EAGLE MOUNTAIN
CITY COUNCIL MEETING

APRIL 21, 2026, 4:00 PM
EAGLE MOUNTAIN CITY COUNCIL CHAMBERS
1650 E STAGECOACH RUN, EAGLE MOUNTAIN, UT 84005

4:00 PM WORK SESSION - CITY COUNCIL CHAMBERS

1. DISCUSSION AND INFORMATION ITEMS

   This is an opportunity to provide information to the City Council. These items are for information only and do not require action by the City Council.

   1.A. DISCUSSION - Quarterly Financial Report - Management Analyst Terrence Dela Peña
   (anticipated time 15 minutes)

   1.B. DISCUSSION - Trails at Hidden Valley Subdivision Concept Plan (formerly "Lower Hidden Valley" Subdivision) - Community Development Director Brandon Larsen
   (anticipated time 20 minutes)

   1.C. DISCUSSION - Brandon Park Rezone - Planner Steven Lehmitz
   (anticipated time 15 minutes)

2. CITY MANAGER INFORMATION ITEMS

   This is an opportunity for the City Manager to provide information to the City Council.

3. AGENDA REVIEW

   The City Council will review items on the Consent Agenda and Policy Session Agenda.

4. ADJOURN TO A CLOSED SESSION

   The City Council will adjourn into a Closed Session for the purpose of discussion of pending or reasonably imminent litigation; the character, professional competence, or physical or mental health of an individual; the purchase, lease, sale, or exchange of real property; a proposed development agreement, project proposal, or financing proposal related to the development of land owned by the state or a political subdivision; and/or the deployment of security personnel, devices, or systems, pursuant to Section 52-4-205(1) of the Utah Code, Annotated.

7:00 PM POLICY SESSION - CITY COUNCIL CHAMBERS

5. CALL TO ORDER

6. PLEDGE OF ALLEGIANCE

7. INFORMATION ITEMS/UPCOMING EVENTS

7.A. RECOGNITION - Graduates of Eagle Mountain Academy Spring 2026

8. PUBLIC COMMENTS

Time has been set aside for the public to express their ideas, concerns, and comments. *(Please limit your comments to three minutes each.)*

9. CITY COUNCIL/MAYOR ITEMS

Time has been set aside for the City Council and Mayor to make comments.

CONSENT AGENDA

10. CHANGE ORDERS

10.A. CHANGE ORDER - Belle Street Booster Power Conduit Replacement and SCADA - Change Orders #2 and #3

11. MINUTES

11.A. April 7, 2026 Minutes - Regular City Council Meeting

11.B. April 14, 2026 Minutes - Budget Work Session

12. RESOLUTIONS

12.A. RESOLUTION – A Resolution of Eagle Mountain City, Establishing Special Revenue Funds Titled the Community Development Block Grant (CDBG) Fund, Recreation, Arts, and Parks (RAP) Tax Fund and Community Development Fund, and Public Art Fund.

12.B. RESOLUTION - A Resolution of Eagle Mountain City, Utah, Declaring Surplus Property - Fleet Vehicles.

12.C. RESOLUTION - A Resolution of Eagle Mountain City, Utah, Awarding the Bid for the EMC Work Authorization GMP 1, Membrane Filtration System (MFS) Equipment Procurement with MGC Contractors, Inc. for the WWTF 6.0 MGD Expansion Project.

12.D. RESOLUTION - A Resolution of Eagle Mountain City, Utah, Approving the 2025 Municipal Wastewater Planning Program Annual Report.

SCHEDULED ITEMS

13. RESOLUTIONS/PUBLIC HEARINGS

13.A. RESOLUTION/PUBLIC HEARING - A Resolution of Eagle Mountain City, Utah, Considering the Disposal of a Portion of Utah County Parcel #46:536:0430, Designated as "Significant Real Property" Pursuant to EMMC 3.30.060 and 3.30.070.

BACKGROUND: *(Presented by City Recorder Lacie A. Messerly)* This item is a request to dispose of a portion of Utah County Parcel #46:536:0430 designated as "Significant Real Property" in accordance with EMMC 3.30.060 and 3.30.070. The application, submitted by Chelsea Lindsay & Chad Vidinhar, pertains to a trail corridor located behind lot 424 in Meadow Ranch, Plat 4.

14. ORDINANCES/PUBLIC HEARINGS

14.A. ORDINANCE/PUBLIC HEARING - An Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code 17.72.040 HVAC Screening for Multi-Family Buildings.

BACKGROUND: (*Presented by Senior Planner, Robert Hobbs*) A proposed amendment to Eagle Mountain Code section 17.72.040 establishing more specific standards for the screening of outdoor HVAC condenser units installed for multi-family buildings.

15. ORDINANCES

15.A. ORDINANCE - An Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code 17.60 and 17.10 regarding Fencing.

BACKGROUND: (*Presented by Planner, Mickie Mills*) Initiated by Eagle Mountain Resident, Katie Elliott, the proposed code amends Eagle Mountain Municipal Code 17.60.120 and 17.10.030 to add "pre-weathered weathering steel (ASTM A606-4/A588 steel)" as an approved material type for residential perimeter fencing and defines "pre-weathered weathering steel fences." This item was tabled by City Council for updates on March 3, 2026. A public hearing has been held on this item.

16. LEGISLATIVE ITEMS

16.A. UPDATE - Legislative Priorities List

17. CITY COUNCIL/MAYOR'S BUSINESS AND LIAISON REPORTS

This time is set aside for the City Council's and Mayor's comments on City business, and for Councilmembers to report on the boards they are assigned to as liaisons to the City Council.

18. COMMUNICATION ITEMS

18.A. Financial Report

18.B. Upcoming Agenda Items

19. ADJOURNMENT

THE PUBLIC IS INVITED TO PARTICIPATE IN PUBLIC MEETINGS FOR ALL AGENDAS.

In accordance with the Americans with Disabilities Act, Eagle Mountain City will make reasonable accommodations for participation in all Public Meetings and Work Sessions. Please call the City Recorder's Office at least 3 working days prior to the meeting at 801-789-6611. This meeting may be held telephonically to allow a member of the public body to participate. This agenda is subject to change with a minimum 24-hour notice.

CERTIFICATE OF POSTING

The undersigned, duly appointed City Recorder, does hereby certify that the above agenda notice was posted on this 16 day of April, 2026, on the Eagle Mountain City bulletin boards, the Eagle Mountain City website www.eaglemountain.gov, posted to the Utah State public notice website http://www.utah.gov/pmn/index.html.

Lacie A. Messerly
City Recorder

To: Mayor and City Council
From: Finance Department
Date: April 21, 2026
Subject 3rd Quarterly Financial Report

FINANCIAL QUARTERLY REPORT

The following financial information represents the period of July 1 through March 31, 2026. These quarterly reports are presented on a budgetary and fund-level basis and are not intended to present results in conformity with the Generally Accepted Accounting Principles (GAAP). Capital outlay, debt service, depreciation, and long-term debt accounting necessary to conform enterprise fund activity to GAAP are recorded as part of the annual year-end closing and audit process. Accordingly, interim results may differ from amounts ultimately reported in the City's Annual Comprehensive Financial Report (ACFR).

For questions regarding this report, please reach out to the Director of Administrative Services, Kimberly Ruesch, at kruesch@eaglemountain.gov.

FUND LEVEL OVERVIEW

This table summarizes the City's current fiscal year budget by fund, showing the approved budget, year-to-date (YTD) actual revenues and expenditures, and the percentage of the budget used so far. Overall, the total revenues represent approximately 60% of the total budget, while total expenditures account for approximately 46% of the annual budget. Most operating funds show revenue and spending levels that are generally in line with expectations for this point in the year, while several impact fee and capital-related funds have higher revenue collections with limited expenditures to date, reflecting the timing of project activity.

% FY Remaining: **75%**

Fund	Current Budget	YTD Estimate	% Budget Used
AA-2013-1			
Revenues	40,025.00	40,115.08	100%
Expenditures	40,025.00	7,557.50	19%
AFFORDABLE HOUSING			
Revenues	1,847,887.00	-	0%
Expenditures	1,847,887.00	921,618.59	50%
CAPITAL PROJECTS			
Revenues	19,805,942.00	1,563,089.53	8%
Expenditures	19,805,942.00	9,624,831.70	49%
CEMETERY			
Revenues	81,523.00	39,310.43	48%
Expenditures	81,523.00	23,734.67	29%
FLEET			
Revenues	3,398,678.00	2,439,874.94	72%
Expenditures	3,398,678.00	3,030,564.94	89%

Fund	Current Budget	YTD Estimate	% Budget Used
GENERAL			
Revenues	36,854,296.00	28,168,786.98	76%
Expenditures	36,854,296.00	20,331,967.03	55%
GIS			
Revenues	517,016.00	425,465.66	82%
Expenditures	517,016.00	381,602.31	74%
PARKS/TRAILS IMPACT			
Revenues	3,424,792.00	2,545,455.31	74%
Expenditures	3,424,792.00	-	0%
PUBLIC SAFETY IMPACT			
Revenues	35,700.00	295,110.35	827%
Expenditures	35,700.00	2,500.00	7%
RDA			
Revenues	8,453,952.00	15,694,171.43	186%
Expenditures	8,453,952.00	34,500.00	0%
SALES TAX BOND			
Revenues	1,813,250.00	65,416.89	4%
Expenditures	1,813,250.00	1,810,750.00	100%
SOLID WASTE			
Revenues	3,040,294.00	2,319,578.81	76%
Expenditures	3,040,294.00	2,108,488.30	69%
STORMWATER			
Revenues	2,130,846.00	1,661,900.05	78%
Expenditures	2,130,846.00	1,389,283.15	65%
STORMWATER IMPACT			
Revenues	410,100.00	504,983.92	123%
Expenditures	410,100.00	-	0%
TRANSPORTATION IMPACT			
Revenues	4,125,050.00	4,038,092.86	98%
Expenditures	4,125,050.00	1,791.25	0%
UTILITY BILLING			
Revenues	742,776.00	563,622.45	76%
Expenditures	742,776.00	545,197.05	73%

Fund	Current Budget	YTD Estimate	% Budget Used
WASTEWATER			
Revenues	17,491,257.00	11,397,956.65	65%
Expenditures	17,491,257.00	9,413,018.02	54%
WASTEWATER IMPACT			
Revenues	8,327,993.00	3,640,486.65	44%
Expenditures	8,327,993.00	2,000,188.50	24%
WATER			
Revenues	24,391,308.00	19,296,994.64	79%
Expenditures	24,391,308.00	16,266,078.46	67%
WATER IMPACT			
Revenues	26,247,177.00	3,023,452.16	12%
Expenditures	26,247,177.00	7,739,210.93	29%
TOTAL BUDGET			
Revenues	163,179,862.00	97,723,864.79	60%
Expenditures	163,179,862.00	75,632,882.40	46%

DEPARTMENT LEVEL OVERVIEW

This table presents the FY 2026 operating budget, excluding capital outlay by department and division, showing the adopted budget, year-to-date (YTD expenditures, pending purchase orders or obligations, and the remaining available balance. As of this reporting period, approximately $50.7 million (about 64%) of the total 78.9 million operational budget has been spent, with an additional $2.1 million encumbered in pending obligations. Overall, most departments are tracking within budget expectations for this point in the fiscal year. Variations in spending levels primarily reflect the timing of contractual services, seasonal operations, and service delivery needs across departments.

Department/Division	FY 2026 Budget	YTD	PENDING Pos	REMAINING BALANCE
Affordable Housing	1,847,887.00	921,618.59	0.00	926,268.41
Building	2,445,286.00	1,392,505.00	126,915.71	925,865.29
Cemetery	81,523.00	23,734.67	542.50	57,245.83
City Attorney	233,650.00	141,881.88	6,930.00	84,838.12
City Recorder	519,180.00	350,896.93	0.00	168,283.07
Communications	314,526.00	169,777.01	19,007.22	125,741.77

Department/Division	FY 2026 Budget	YTD	PENDING Pos	REMAINING BALANCE
Economic Development	5,611,668.00	2,400,015.77	1,600.00	3,210,052.23
Engineering	294,275.00	148,784.39	5,679.92	139,810.69
Executive	967,429.00	899,596.85	0.00	67,832.15
Facilities	450,763.00	346,292.41	30,331.20	74,139.39
Finance	740,195.00	341,766.86	19,559.40	378,868.74
Fleet	3,398,678.00	3,030,564.94	71,659.80	296,453.26
Human Resources	433,044.00	245,829.35	0.00	187,214.65
Information Technology	733,817.00	406,866.38	206,816.19	120,134.43
Legislative Affairs	480,051.00	174,947.28	41,550.27	263,553.45
Library	879,530.00	609,414.73	21,848.40	248,266.87
Neighborhood Improvement	434,563.00	326,502.58	0.00	108,060.42
Open Space	373,576.00	163,989.44	12,164.68	197,421.88
Parks	3,295,056.00	2,454,798.74	327,682.36	512,574.90
Planning	1,098,507.00	719,193.39	37,890.87	341,422.74
Public Safety	8,815,970.00	4,297,245.99	30,144.75	4,488,579.26
Recreation	546,008.00	357,502.21	0.00	188,505.79
Solid Waste	3,040,294.00	2,108,488.30	0.00	931,805.70
Special Events	598,635.00	412,561.58	18,115.41	167,958.01
Stormwater	2,130,846.00	1,388,432.64	32,565.09	709,848.27
Streets	5,612,846.00	3,846,802.59	190,309.66	1,575,733.75
Utility Billing	205,330.00	137,840.99	0.00	67,489.01
Wastewater Collection	8,938,105.00	6,654,801.57	275,674.26	2,007,629.17
Water Distribution	22,023,027.00	14,443,517.95	494,620.28	7,084,888.77
Water Resource	2,368,281.00	1,822,560.51	202,639.14	343,081.35
Grand Total	**78,912,546.00**	**50,738,731.52**	**2,174,247.11**	**25,999,567.37**

TOTAL BUDGET BY ACCOUNT TYPE OVERVIEW

This table presents the FY 2026 total budget summarized by account type, showing the current adopted budget, third-quarter activity, year-to-date expenditures, and the percentage of budget collected or spent. Revenue and expense categories are aggregated across all departments to provide a citywide view of major revenue sources and expenditure classifications. As of the third quarter, approximately 59.9% of total revenues and 46.4% of total expenditures have been recognized year to date. Variances among individual account types primarily reflect the timing of revenue collections, billing cycles, seasonal activity, and scheduling of expenditures throughout the fiscal year.

Account Type	Current Budget	3rd Quarter	YTD	% Collect/Spent
REVENUE				
Property Taxes	3,156,498.00	103,479.43	$ 3,143,021.80	99.57%
Sales & Use Taxes	15,128,921.00	1,144,945.85	$ 11,818,665.62	78.12%
Franchise Taxes	7,846,283.00	714,375.97	$ 4,751,466.61	60.56%
Licenses and Permits	48,935.00	5,849.25	$ 42,696.81	87.25%
Planning Building & Eng Fees	5,082,300.00	413,016.81	$ 4,179,246.30	82.23%
Intergovernmental	12,724,537.00	48,133.90	$ 18,413,292.15	144.71%
Charges for Services	204,700.00	19,692.22	$ 3,038,111.01	1484.18%
Recreation	147,000.00	7,015.00	$ 123,594.00	84.08%
Utility Revenue	30,034,489.00	2,278,024.48	$ 23,640,188.89	78.71%
Other Revenue	762,340.00	49,220.00	$ 581,092.81	76.22%
Cemetery Revenue	53,800.00	3,950.00	$ 30,310.00	56.34%
Fines & Forfeitures	25,200.00	10,672.71	$ 119,292.97	473.38%
Other Revenues	12,741,368.00	616,292.02	$ 10,728,081.63	84.20%
Transfers In	9,058,781.00	263,945.49	$ 3,052,767.33	33.70%
Special Revenues & Resources	13,797,625.00	1,189,748.67	$ 14,062,036.86	101.92%
Other Financing Sources	52,367,085.00	-	$ -	0.00%
Total Revenue	**163,179,862.00**	**6,868,361.80**	**$ 97,723,864.79**	**59.89%**
EXPENSE				
Personnel Services	17,071,670.00	1,250,564.18	$ 12,113,569.99	70.96%
Materials Supplies Services	27,898,853.00	770,575.18	$ 16,527,889.00	59.24%
Utility & Utility Services	2,249,770.00	418,836.11	$ 1,816,933.94	80.76%
General & Contracted Services	18,303,263.00	980,143.85	$ 10,648,837.04	58.18%
Special Departmental Materials	20,000.00	3,686.93	$ 10,140.77	50.70%
Grants	10,868,217.00	164,525.43	$ 1,554,774.22	14.31%
Contractual Agreements	5,185,483.00	10,629.53	$ 2,356,287.05	45.44%
Capital Outlay	66,337,735.00	2,426,587.50	$ 24,407,315.55	36.79%
Interdepartmental Charges	-	-	$ -	0.00%
Debt Service	3,506,892.00	-	$ 3,144,367.50	89.66%
Transfers Out	9,058,781.00	263,945.49	$ 3,052,767.34	33.70%
Contribution to Fund Balance	2,679,198.00	-	$ -	0.00%
Total Expense	**163,179,862.00**	**$ 6,289,494.20**	**$ 75,632,882.40**	**46.35%**

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	DISCUSSION - Trails at Hidden Valley Subdivision Concept Plan
ITEM TYPE:	Discussion Item
FISCAL IMPACT:	
APPLICANT:	Lynsi Neve - Perry Homes

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
See proposed plan.	243

PUBLIC HEARING
No

PREPARED BY
Brandon Larsen, Planning Director

PRESENTED BY
Brandon Larsen

RECOMMENDATION:

BACKGROUND:
Perry Homes would like to review their proposed 243-acre, 850 unit, residential development with the Council. A major point in previous discussions with the Council has been the classification and width of a couple of key streets in the development. The applicant would like to revisit the street discussion.

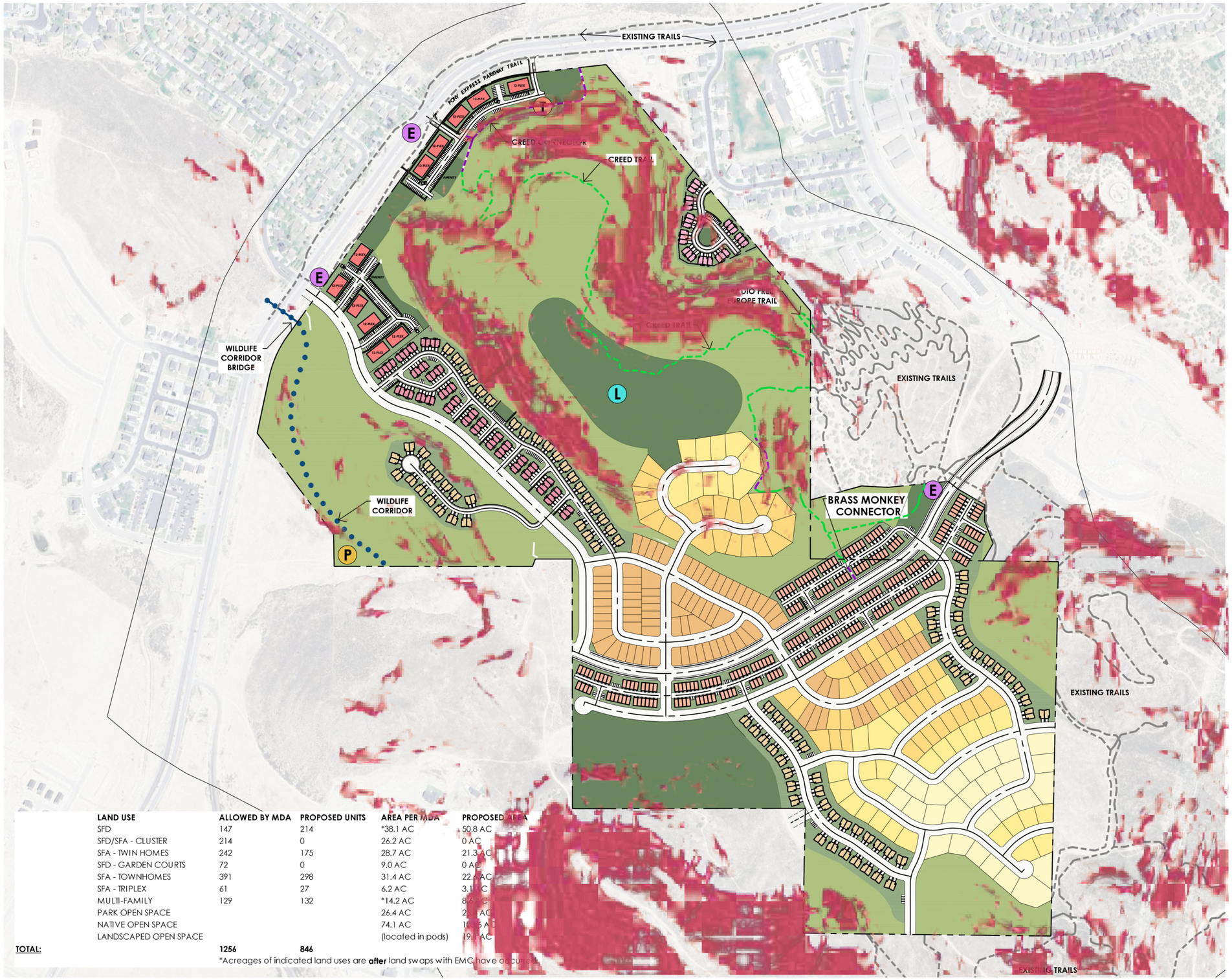
There are two (2) main streets that would run through the proposed development. Both are proposed to be minor collectors. However, the street sometimes referred to Red Pine Rd. would have a reduced ROW width (61 feet from 77 feet). The reduction comes from the elimination of the trail and parkstrip on one side of the ROW. There would be no reduction in pavement width or curb and gutter.

The development POD map proposes 850 units. The applicants claim the approved MDA/P gives them approvals for 1256 units. The proposed development would offer a large increase in open space, as opposed to the originally approved open space (100.5 ac < 139.3 ac).

ITEMS FOR CONSIDERATION:

PLANNING COMMISSION ACTION/RECOMMENDATION:
N/A

ATTACHMENTS:
1. Exhibit - Hidden Valley 25% Slope
2. Exhibit - Hidden Valley Backbone Roads
3. Exhibit - Hidden Valley Pods Comparison



PROJECT AREA = 244.6 ACRES

HOME PRODUCT LEGEND

- MULTIFAMILY UNITS (132)
- SFA TRIPLEX UNITS (27)
- SFA FRONT-LOAD TOWNHOMES (73)
- SFA REAR-LOAD TOWNHOMES (225)
- SFA TWIN HOMES (175)
- SFD 40' LOTS (97)
- SFD 60' LOTS (54)
- SFD 80' LOTS (36)
- SFD 100' LOTS (27)
- TOTAL UNITS: 846

- PARK OPEN SPACE (26.4 AC)
- LANDSCAPED OPEN SPACE (19.1 AC)
- NATIVE OPEN SPACE (103.6 AC)

LEGEND

- E — ENTRY MONUMENT
- T — TRAILHEAD
- L — LOOKOUT TOWER
- P — PETROGLYPHS

- PRESERVED TRAIL CORRIDOR
- PROPOSED TRAIL CORRIDOR
- WILDLIFE CORRIDOR
- EXISTING TRAILS (OUTSIDE BOUNDARY)
- MINIMUM PRESERVED TRAILS: 4,976'

LAND USE	ALLOWED BY MDA	PROPOSED UNITS	AREA PER MDA	PROPOSED AREA
SFD	147	214	*38.1 AC	50.8 AC
SFD/SFA - CLUSTER	214	0	26.2 AC	0 AC
SFA - TWIN HOMES	242	175	28.7 AC	21.3 AC
SFD - GARDEN COURTS	72	0	9.0 AC	0 AC
SFA - TOWNHOMES	391	298	31.4 AC	22.6 AC
SFA - TRIPLEX	61	27	6.2 AC	3.1 AC
MULTI-FAMILY	129	132	*14.2 AC	8.4 AC
PARK OPEN SPACE			26.4 AC	26.4 AC
NATIVE OPEN SPACE			74.1 AC	103.6 AC
LANDSCAPED OPEN SPACE			(located in pods)	19.1 AC
TOTAL:	**1256**	**846**		

*Acreages of indicated land uses are **after** land swaps with EMC have occurred.

N

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GRAPHIC SCALE

250 0 125 250 500 1,000

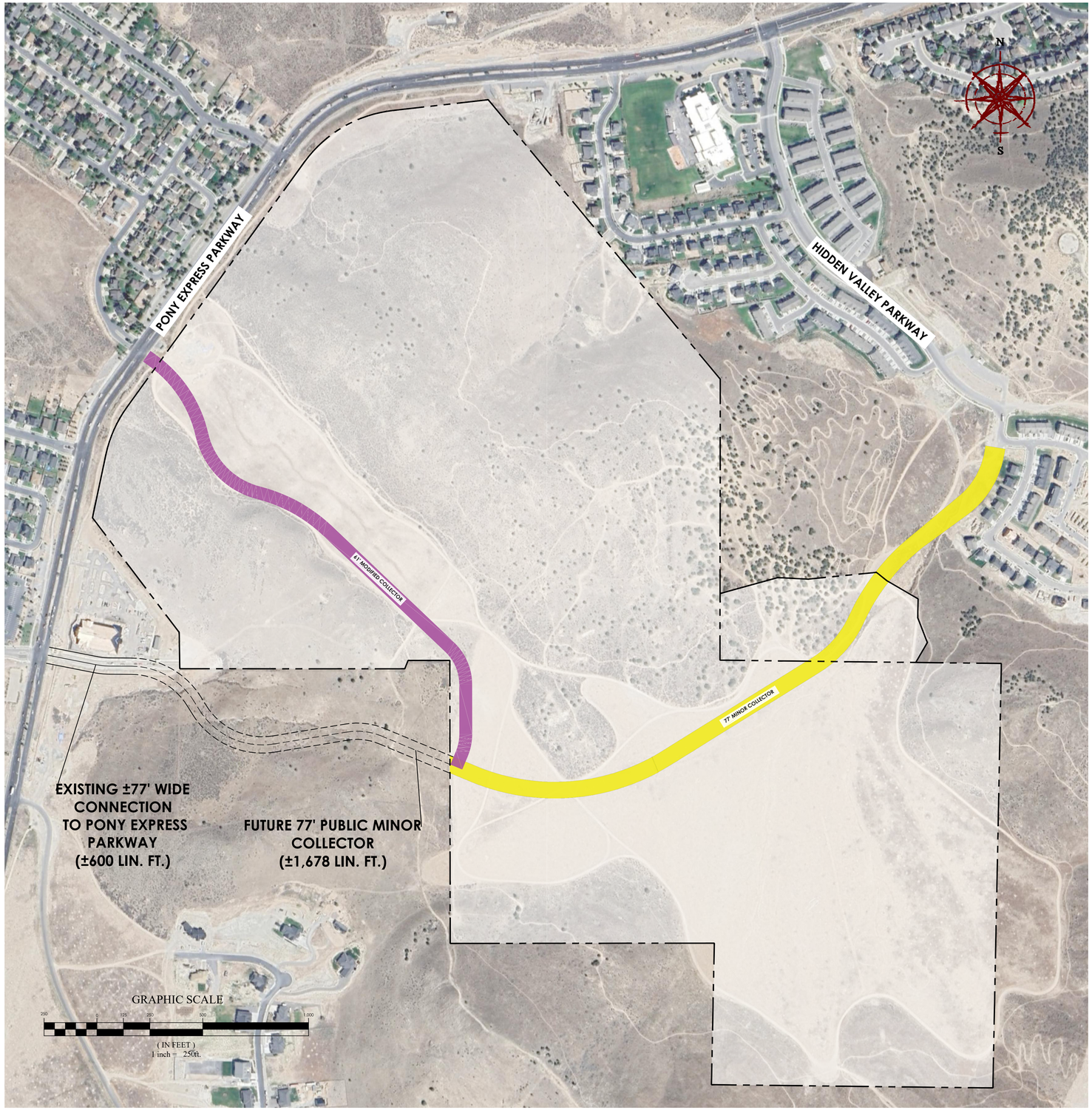
(IN FEET)
1 inch = 250ft.

THE TRAILS AT HIDDEN VALLEY master plan

EAGLE MOUNTAIN CITY, UTAH COUNTY
4/14/2026
23-0134

FOCUS ENGINEERING AND SURVEYING, LLC

Z:_2023\23-0134 Hidden Valley\design\23-0134\dwg\concepts\23-0134 Hidden Valley Master Plan.dwg



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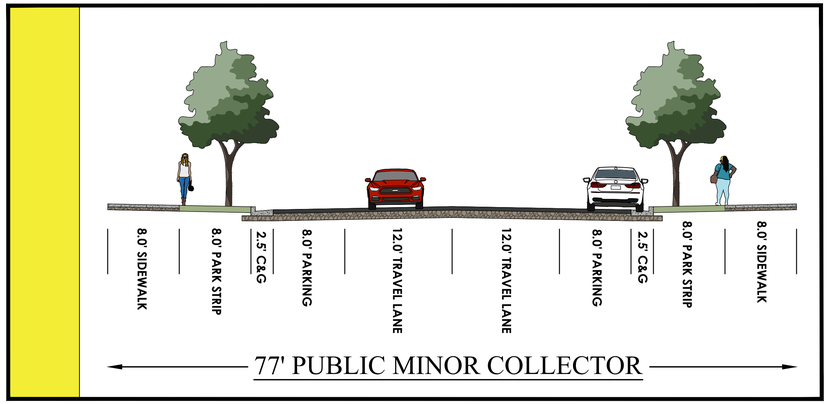
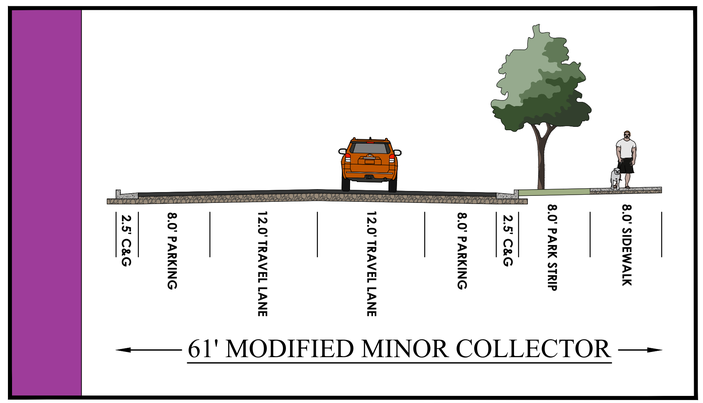




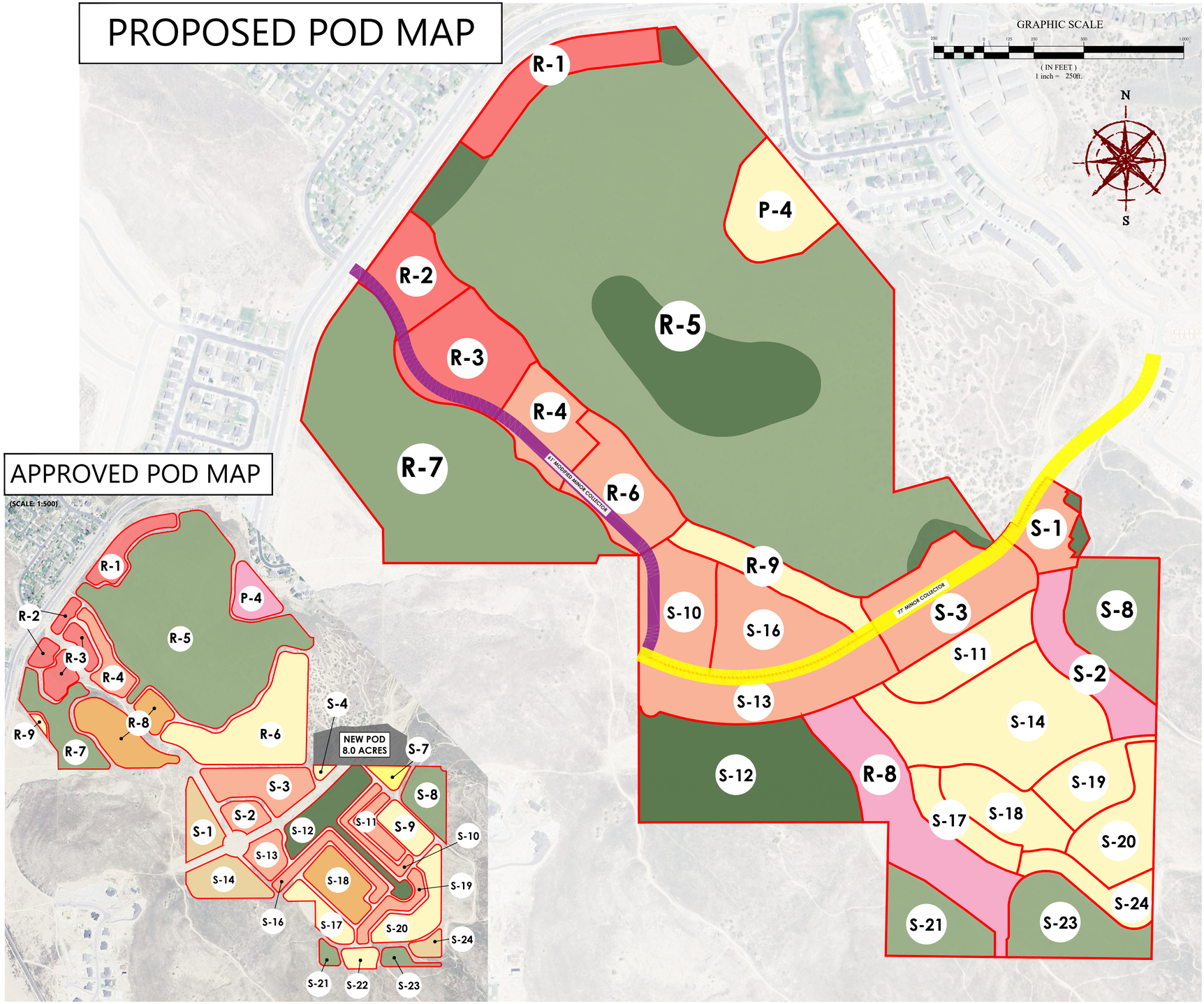
THE TRAILS AT HIDDEN VALLEY *backbone roadways exhibit*

EAGLE MOUNTAIN CITY, UTAH COUNTY
12/8/2025
23-0134

Z:_2023\23-0134 Hidden Valley\design 23-0134\dwg\MDA\23-0134 Hidden Valley Backbone Roads Exhibit with Pods 120525.dwg

FOCUS ENGINEERING AND SURVEYING, LLC

PROPOSED POD MAP



APPROVED POD MAP

(SCALE: 1:500)

LEGEND

- MULTI-FAMILY
- SFA - TOWNHOMES
- SFA - TRIPLEX
- SFA - TWIN HOMES
- SFA - CLUSTER
- POD BOUNDARY
- SFD - CLUSTER
- SFD
- PARKS & OPEN SPACE
- NATIVE OPEN SPACE
- 77' MINOR COLLECTOR
- 61' MODIFIED MINOR COLLECTOR

POD	UNIT COUNT			LAND USE	
	APPROVED	PROPOSED	DIFFERENCE	APPROVED	PROPOSED
P-4*	61	14	(-47)	SFA - TRIPLEX	SFD
R-1*	56	73	(+17)	MULTI-FAMILY/PARKS	MULTI-FAMILY
R-2*	48	60	(+12)	MULTI-FAMILY	MULTI-FAMILY
R-3*	45	72	(+27)	MULTI-FAMILY	MULTI-FAMILY
R-4*	82	47	(-35)	SFA - TOWNHOMES	SFA - TOWNHOMES
R-5*	N/A	N/A		PARK/OPEN SPACE	PARK/OPEN SPACE
R-6*	90	74	(-16)	SFD/PARKS	SFA - TOWNHOMES
R-7*	N/A	N/A		PARKS	PARKS
R-8*	98	48	(-50)	SFA - TWIN HOMES	SFA - TRIPLEX
R-9*	52	25	(-27)	SFD	SFD
S-1*	45	26	(-19)	SFD - CLUSTER	SFA - TOWNHOMES
S-2*	41	18	(-23)	SFA - TOWNS/CHURCH	SFA - TRIPLEX
S-3*	110	85	(-25)	SFA - TOWNS/PARK	SFA - TOWNHOMES
S-4*	2	N/A	(-2)	SFD	N/A
S-7*	15	N/A	(-15)	SFA - CLUSTER	N/A
S-8	N/A	N/A		NATIVE OPEN SPACE	NATIVE OPEN SPACE
S-9*	18	N/A	(-18)	SFD	SFA - TOWNHOMES
S-10*	48	45	(-3)	SFA - TOWNHOMES	SFA - TOWNHOMES
S-11*	33	30	(-3)	SFA - TWIN HOMES	SFD
S-12*	N/A	N/A		PARK	PARK
S-13*	50	48	(-2)	SFA - TOWNHOMES	SFA - TOWNHOMES
S-14*	66	65	(-1)	SFD - CLUSTER	SFD
S-16*	60	48	(-12)	SFA - TOWNHOMES	SFA - TOWNHOMES
S-17*	17	7	(-10)	SFD	SFD
S-18*	75	20	(-55)	SFA - TWIN HOMES	SFD
S-19*	36	15	(-21)	SFA - TWIN HOMES	SFD
S-20*	72	23	(-49)	SFD - GARDEN	SFD
S-21	N/A	N/A		NATIVE OPEN SPACE	NATIVE OPEN SPACE
S-22*	16	N/A	(-16)	SFD - GARDEN	N/A
S-23	N/A	N/A		NATIVE OPEN SPACE	NATIVE OPEN SPACE
S-24*	20	7	(-14)	SFD - CLUSTER	SFD
NEW POD	N/A	N/A		N/A	N/A
TOTAL	1256	850	-406		

* INDICATES A CHANGE IN UNIT COUNT, POD LOCATION, AND/OR LAND USE TYPE

TOTAL PROJECT AREA:	***243.3 ACRES***
APPROVED OVERALL UNITS:	*1256 UNITS*
PROPOSED OVERALL UNITS:	***850 UNITS***
APPROVED DEVELOPABLE AREA:	*148.8 ACRES*
PROPOSED DEVELOPABLE AREA:	***104 ACRES***
TOTAL APPROVED OPEN SPACE:	*100.5 ACRES*
TOTAL PROPOSED OPEN SPACE:	***139.3 ACRES***

THE TRAILS AT HIDDEN VALLEY *pod comparison exhibit*

EAGLE MOUNTAIN CITY, UTAH COUNTY
4/15/2026
23-0134

FOCUS CONSULTING

Z:_2023\23-0134 Hidden Valley\design 23-0134.dwg\MDA\pod comparison\23-0134 Hidden Valley Pod Comparison Exhibit.dwg

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	DISCUSSION - Brandon Park Rezone - Planner Steven Lehmitz *(anticipated time 10 minutes)*
ITEM TYPE:	General Plan Amendment & Rezone
FISCAL IMPACT:	N/A
APPLICANT:	City-initiated

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
General Plan Designations: Neighborhood Residential One Zone: Residential Tier II and Park	Approximately 216 Acres

PUBLIC HEARING	PREPARED BY	PRESENTED BY
No	Steven Lehmitz, Planner	Steven Lehmitz

RECOMMENDATION:
Staff recommends that the City Council discuss the proposed Zoning Map and Future Land Use Map amendments for Brandon Park.

BACKGROUND:
Since the Eagle Mountain City Zoning Map was adopted, some properties have been listed with historic zoning designations. The Eagle Mountain City Council has asked that these properties be assigned updated zoning that coincides with current zoning designations. They also want to make sure the zoning fits with the City's Future Land Use Map, updating that map if needed.

<u>Proposed Zoning</u>
Agriculture: These properties are included within the public rights-of-way and are developed as roads.
Improved Open Space (OS-I): These properties are either improved parks or improved pedestrian pathways.
Residential 2 (R2): These lots are no smaller than 8,000 sq. ft, with many of them being at least 10,000 sq. ft. The R2 zone seems to be the best fit for these lots.
Rural Density 2 (RD2): These lots are around 1/2 acre (21,780 sq. ft.) in size, matching most closely with the RD2 zone.

ITEMS FOR CONSIDERATION:
The criteria for approval of a Rezone are listed in EMMC 17.90.060:

Rezoning of property shall be evaluated using the following criteria, and may be approved if the requirements below are met:

- Compliance with General Plan. The requested zones are consistent with the land uses shown on the General Plan's Future Land Use and Transportation Corridor Map, and comply with the

policies and provisions of the City's General Plan.

- Compatibility Determination. The proposed uses and densities will be reasonably compatible with adjacent land uses and the pattern of proposed uses and densities will appropriately buffer potentially incompatible uses from others based on the assumption that the proposed uses and densities will comply with this title, including the performance standards designed to help ensure land compatibility.
- City Services. The proposed use can be accommodated with public services and will not overburden the city’s service capacity.
- Traffic Generation. Traffic generation by the proposed use is within capabilities of streets serving the property.
- Property Values. The proposed use is not expected to have a significant negative impact on surrounding property values.

PLANNING COMMISSION ACTION/RECOMMENDATION:

At their April 14, 2026, meeting, the Planning Commission forwarded a positive recommendation (5-0) of the proposed Future Land Use Map and Rezone Map amendments.

ATTACHMENTS:

1. Presentation - Brandon Park Rezone
2. Rezone Map - Brandon Park Rezone
3. Rezone Table - Brandon Park Rezone
4. Current Future Land Use Map

Brandon Park

Rezone

LEGEND

Residential Categories:

- Foothill Residential
- Agricultural/Rural Density One
- Agricultural/Rural Density Two
- Neighborhood Residential One
- Neighborhood Residential Two
- Neighborhood Residential Three

Mixed Use/Commercial Categories:

- Community Commercial
- Town Center Mixed Use
- Regional Commercial
- Employment Center/Campus
- Business Park/Light Industry

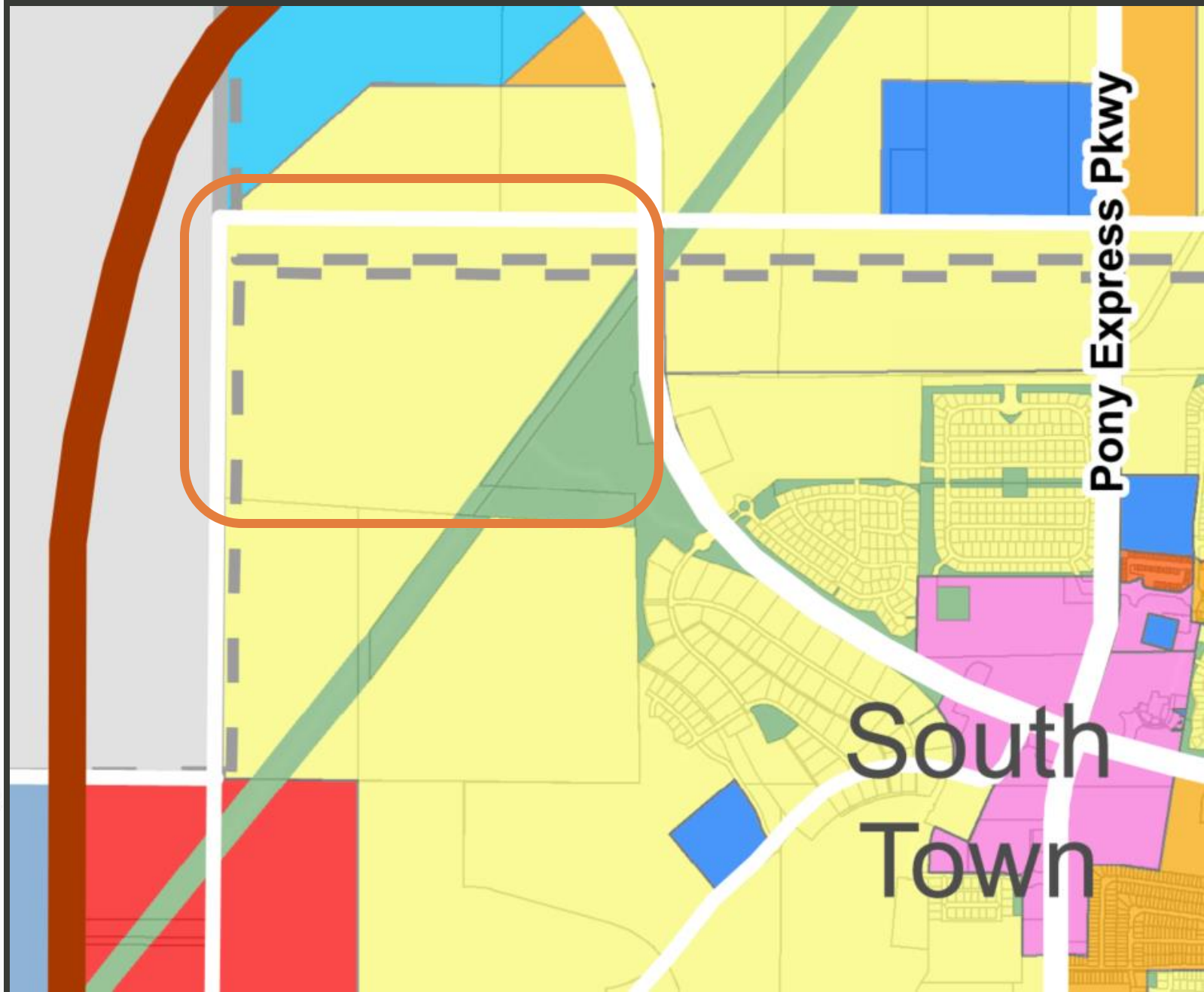
Public/Civic Categories:

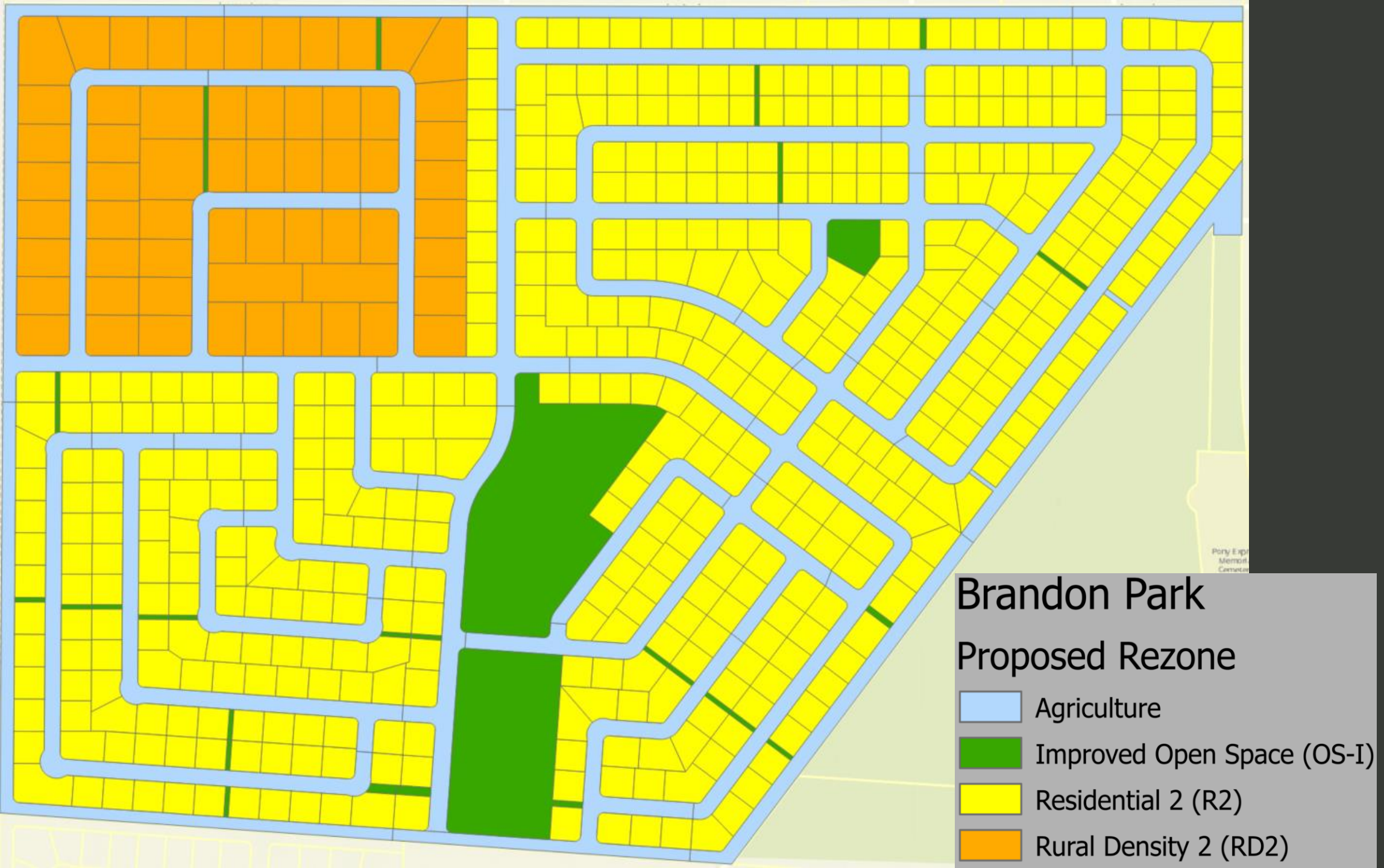
- Civic Uses/Schools
- Parks and Open Space

NEIGHBORHOOD CHARACTER AREA

TRANSPORTATION

- UDOT Highway/Freeway
- City Road Network - Collector & up




Brandon Park
Proposed Rezone
Agriculture
Improved Open Space (OS-I)
Residential 2 (R2)
Rural Density 2 (RD2)

Brandon Park Proposed Rezoning

N

Red Creek Road
Old Cobble Way
Lukes Street
Orange Stone Road
Hudson Creek Way
Quartz Creek Lane
Slate River Road
River Rock Drive
Black Quartz Way
Clear Granite Way
Clear Granite Way
Red Creek Road
Slate River Road
4890 ft
Garden Grove Drive
Hearth Lane
Willow Tree Road
Lintel Road
Damper Drive
Willow Tree Road
Oak Creek Drive
Espalier Drive
Folkstone Drive
Oak Creek Drive
Espalier Drive
Folkstone Drive
Stonebriar Drive
Stonebriar Drive
Eagle Mountain Boulevard
Pony Express Memorial Cemetery
Cemetery Road
Pony Express Park
Eagle Mountain City Trails
4873 ft
Lehi Fairfield Road

Brandon Park

Proposed Rezone

- Agriculture
- Improved Open Space (OS-I)
- Residential 2 (R2)
- Rural Density 2 (RD2)

Sources: Esri, Vantor, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, (c) OpenStreetMap contributors, and the GIS User Community

0 0.07 0.15 0.3 0.45 0.6 Miles

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357941507	4645 N EYRIE PEAK LN LLC	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941535	ACEVEDO - DORA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690827	ACREE - MONTANA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460315	ADAMS - BRIAN & DANA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570640	ADAMSON - BRETT & CASSIDY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931419	ADBULLAH - GARY	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357370147	AIELLO - AUSTIN & NICOLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460332	AKANA - CRAIG K	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470402	ALLEN - DAVID (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931410	ALLEN - JOSHUA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357690804	ALVEY - JACOB BYRON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690845	ANDERSEN - JOHN PAUL & RACHEL LYNN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550523	ANDERSON - CAMERON & ANGELA NELSON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370114	ANDERSON - DAKODA A	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470404	ANDERSON - HUNTER MARK & KATELIND PRATT	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370140	ANDERSON - JEREMIAH JOSEPH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600024	ANDERSON - KAILEE & MATT	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600035	ANTHIAN - JOSHUA PIERRE & SHANEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781124	ANTHONY - ALEXANDER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460319	ARCHER - BODIE & LINDSAY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941520	ARGUELLO - DIEGO ALBERTO	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370148	ARGYLE - JORDON & ANNE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690823	ARGYLE - WYATT & HALIEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600004	ASHINHURST - ADRIAN & HAILEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590704	AUELUA - HOBART ISAIAH & LORA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570620	AVERETT - TAYLER & MORGAN	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357570618	AVERETT - TAYLER RAY (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357801332	AVERY - CRAIG & LIZBETH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357690835	AWASUM - NELSON (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941541	AYLETT - MICHAEL & DANICA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470414	BAILEY - DANIEL KEVIN & LAURALEE MOODY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801329	BAKER - TONYA & DAVID ERIC (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420217	BALANDRAN - AXA E	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801324	BALLARD - KEVIN & MIRANDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590709	BANGON - KHAMLA & MAI CHEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370131	BARCLAY - STEVEN & SHAYANNA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791208	BARGER - CASSANDRA MARIE & JOHN M	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550505	BARKER - TROY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700911	BARNES - PATRICK HAYDEN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420203	BARNETT - STEVE & EMILY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550508	BARNUM - BRAD A & DEANNA M	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690843	BARTLESON - BRETT & BONNIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781126	BEACH - JUSTIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420228	BEAVIN - MARK A & BRITTANY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600013	BEINS - AMOS DELOY & BRENDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791215	BELL - JARIN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570628	BELL - JAROMY JUSTIN & TORI NICHELE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357420242	BELLOWS - JESSICA MAGAAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550513	BELNAP - GREGORY BRENT & JALYNN MARIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931439	BEVINGTON - WESLEY	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357941515	BILLMAN - WESLEY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570623	BJORKMAN - NICK & REBECCA M	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357941532	BLACKMAN - NEIL & AMANDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781107	BLACKWELL - JAMIE & WILLIAM	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590703	BLEA - WILLIAM & KIMBERLY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357370115	BLYTHE - COREY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931425	BODILY - SCOTT & BRITTANY	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357801330	BRADSHAW - NICK L & SHANTEL ELIZABETH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590710	BRADY - ANDREW & CATHERINE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460333	BRADY - ERICA & RANDY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460304	BRAILSFORD - CODY BRAYDEN & HEATHER CHRISTINE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570637	BRANNING - JORDAN REBECCA & MITCHELL THOMAS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570610	BRIGGS - KYLE LAVARRE & BRITTANY NICOLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690816	BRIMHALL - KURTIS & CHEYENNE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801327	BRINKERHOFF - RILEY & ASHLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470421	BROWER - KYLER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570601	BROWN - CASEY DON & CAMILA BEATRIZ	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370121	BROWN - JEFFREY & JULIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931440	BROWN - JOSHUA & MEGNA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357600010	BROWN - TERRY R	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791219	BROWNE - ZACHARY S & KIRSTA ELIZABETH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801322	BRUIN - BRYAN & LINDSAY M	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420249	BRYAN - LINDSEY MARIE & TRAVIS LEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420220	BUHLER - MICHAEL B & MEGAN R (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470409	BULLOCK - RYAN ALEXANDER & KATE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700908	BUNNELL - CRYSTAL & CORY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600011	BURNSIDE - ROBERT J & JANET S	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420206	BURT - KENNETH & LAURA A	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357460310	BUTLER - MICHAEL REED & ANDREA DAVIS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570611	CABRERA - EVELYN (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357781105	CAHOON - TYLER & MEGAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600036	CALLAHAN - CHRISTIAN & EMMA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600019	CAMACHO - J JESUS MORENO (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420240	CAMARGO - MARIO & JENNIFER H	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690805	CAMPBELL - SPENCER & KRISTEN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370112	CAMPOS - BORIS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460341	CAMPOS - BORIS P	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690831	CAMPOS - IVAN & VERONICA ELIZABETH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781127	CAMUSO - BRYAN STEPHEN & FELICIA CHRISTINE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931432	CANELON - JESUS & LILIANA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690837	CARROLL - SHAUNA & ETHAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460305	CARTER - CHERYL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931416	CARTER - MIKE & PAMELA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357931442	CASTILLO - DANIEL CERVANTES	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357700920	CEPEDA - DENISSE S & DENISSE S	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931407	CERVANTES - CHANTELLE ATKINSON & GEORGE JESSE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357781119	CHALK - MARK E & SHELLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470408	CHAMBERLAIN - BRET & TIFFINY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791205	CHAVEZ - CESAR & IRMA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941533	CHEN - CHRISTINE MICHELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600001	CHIRINOS - CARMEN A CHIRINOS & EUKARIS M SANCHEZ (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420241	CHRISTENSEN - BLAKE & YANERY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941524	CHRISTENSEN - SAMUEL SCOTT & MADELINE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357470428	CHRISTIANSEN - CHRISTOPHER & AMANDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801328	CHRISTIANSEN - SEAN LARRY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470422	CLARK - ADAM H & AMY E	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370151	CLARK - DAVID L & TRIXIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420238	CLARK - RILEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931411	CLARK - WESLEY VERN & MICAELA SHENAE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357420208	CLEMENTS - CARL G & KRISTINA M	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590706	COLLIER - MICHAEL JAY & DESIREE MARIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781102	COLLINS - MIKHAIL & STEPHANIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690813	COMPTON - MARY NOREEN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801310	CORDERO - ALEX & NANCY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600045	CORDOVA - FREDDY & ANA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420234	CORONA - NICHELLE & ERIC	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931402	COSTON - KELLY R & KANDYCE M (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357931421	COURAUD - JUSTIN MICHAEL & HILARY	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357460306	COWAN - CRAIG FRANK & ROXANNE MURPHY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420218	COWAN - MELINDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931422	COWART - GRAYSON & MICHELLE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357600006	CRESPO - ISAIAH BENJAMIN & KALA DORIS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550524	CROSSLEY - JUSTIN & DENICE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690815	CROWTHER - TODD J & KAREN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690829	CRUZ - ROLANDO RAMIREZ & MARISOL RAMIEREZ (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941504	CUMMING - JOHN & LINDSAY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550512	CURTIS - SHEILA & DAVID	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357550516	CUSHING - TROY W	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
358601041	DAHL - TYSON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801317	DAVILA - DOMINIC (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781128	DAVIS - JOSHUA & HAYLEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941508	DAVIS - KYLE & MARY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570626	DAVIS - MATTHEW & AMANDA VENABLES	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357570615	DAY - MISTY DEANN	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357470411	DAY - SHAYNE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460338	DEATON - MASON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600047	DELGADO - HECTOR	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460309	DELMAS - LORAN & LACEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570604	DEMING - ROGER & AMY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570639	DEMKE - JEFF & MELISSA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600015	DENNISON - SARA M	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420233	DICKENS - ANDREW & TIFFANY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370118	DIMMICK - JAMES & NATALIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470412	DIMOND - KIRA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931426	DOMNIK - DENNEY & LORRIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370132	DOTY - BREANNA LYNN & JARED LEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791211	DOUANGDARA - PHOUKHOM (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570627	DOW - ERIC BOONE & AMANDA (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357600009	DOYLE - MICHAEL II & JOLENE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570606	DUNCAN - AUSTIN PAUL & MONIQUA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370106	DUPAIX - TANNER T & CASSIDY N	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600007	DYRENG - RODNEY M & TERESA J	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370153	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357370154	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357420253	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357420254	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357460345	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357470431	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357550531	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357570642	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357570643	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357590714	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357600052	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357690851	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357690852	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357700924	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357781131	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357791227	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357791228	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357801338	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357931445	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357941549	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357941550	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Agriculture
357370152	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357420250	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357420251	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357420252	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357460343	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357460344	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357470430	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357550530	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357570641	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357590712	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357590713	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357600050	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357600051	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357670001	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Park	Parks and Open Space	Improved Open Space (OS-I)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357670002	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Park	Parks and Open Space	Improved Open Space (OS-I)
357690850	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357700922	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357700923	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357791225	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357791226	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357801335	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357801336	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357801337	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357931443	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357931444	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357941543	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357941544	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357941545	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357941546	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357941547	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357941548	EAGLE MOUNTAIN CITY	Neighborhood Residential One	Residential Tier II	Parks and Open Space	Improved Open Space (OS-I)
357690803	EAKLE - ALEXANDER COLE & SUSAN LEANN BURNETT	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941513	ELLIOTT - KATIE FAYE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600037	EMPEY - GILE & MCKINZIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600032	EMPEY - TRAVIS & LANCE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420216	EQUITY HOLDING CORP (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700904	EVANS - ALEC & NICOLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941516	EVERETT - TAZZ & JENTRY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801308	EZQUIVEL - LUIS PENALOZA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370144	FABER - BRADY & CASSIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420239	FABRIZIO - ANTHONY & ASHLY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781110	FALEPAPALANGI - SAMASONI & LESIELI	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357931408	FALEPAPALANGI - SAMASONI (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357370104	FARR - ANTHONY LAURENCE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931424	FEATHERHAT - ELI	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357931413	FERREIRA - JORGE (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357420230	FIEDLER - KRISTOPHER & NURY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791203	FIGUEROA - HENRY & TANIA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420227	FITCH - TRAVIS & KIMBERLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600021	FITZGERALD - KODY & IRIDIAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570630	FITZGERALD - SCOTT BARRY	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357460313	FOVAL - EUGENE & ANGELA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370137	FRAUGHTON - COLTON & BRITTNEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370137	FRAUGHTON - COLTON & BRITTNEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590702	FRAZIER - PRESTON & ANGELA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570609	FRYE VENTURES LLC	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801311	FULLER - BRANDON S & RANDI C	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550522	FULLMER - STEPHEN B & KIRSTEN J	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600027	GALICIA - EDGAR (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690830	GARBER - TODD & KARALEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570624	GAST - MICHAEL LAWRENCE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357570602	GEE - LARRY STEPHEN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420205	GIL - CESAR ENRIQUE PALOMINO (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781104	GILES - TREVOR & ELISHA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781108	GILL - COLIN & SAMANTHA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370130	GILMORE - JAAK & AMY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690825	GLINES - BRANDON & ASHLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690814	GOMES-VARELLA - DANIEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370146	GOMEZ - NATHAN & ERIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700919	GONZALEZ - DAVID STEWART & ALISHA NICOLE WEISS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550517	GONZALEZ - FAVIO ENRIQUE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357470415	GONZALEZ - VICTOR MANUEL VALENCIA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690828	GRAHAM - MICHAEL J & SANDEE K	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791218	GREEN - CAROL & JENNIFER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420231	GUERRA - ANGEL ISMAEL & EMILY ROSE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370133	GUNNELL - RACHEL & DANIEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420210	GUNTER - WALTER EUGENE & AMBER JILL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801333	HADLOCK - STEPHEN & SARAH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690809	HAIGHT - BENJAMIN FRANCIS & SHAUNA LAREE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420248	HALL - JUSTIN & SHERRIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690822	HALL - SCOTT & MILISSA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470427	HAMBLIN - JOSEPH JAY & ASHLEY LAUREL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941509	HAMILTON - CHRISTINA L & MASON T	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700916	HANCOCK - NATHAN & NICOLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700909	HANSEN - GRANT MERRILL (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690806	HANSEN - MATIAS JAMES & JENNIFFER AMANDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460321	HANSEN - MATTHEW & MCKENZIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600043	HARLEY - GREGORY & JENNIFER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781129	HARPER - HEATH & SHEREE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690818	HARRIS - AARON & TRYKELL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420246	HASLAM - KERRA & MARK	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690849	HAWKINS - JENSEN JOSEPH & HOLLY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801313	HAWS - MICHELLE & WESLEY JOSEPH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460331	HAYNES - CLARK & LINDSEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570607	HEATON - MICHAEL STEPHEN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357931431	HEFFELFINGER - MATTHEW & KAREN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370150	HERBERT - COLTON S	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570605	HERMANSEN - DANIEL & KENNEDY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690840	HERRERA - ANAHI LIMONES	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931429	HERRERA - PERLA & BENJAMIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600048	HESS - MASON & JACQUELINE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801301	HESSICK - MICHAEL PATRICK	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550509	HEUPEL - LINDSAY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781112	HICKEN - DOUG & JENA (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357570619	HILL - KELLEN	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357420235	HILL - SCOTT & TAYLOR	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690839	HILLEGAS - CONSUELO & JAMES C III	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570636	HOEHNE - JOSEPH BRYANT & EMILY JOY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600038	HOFFE - ROBERT AUSTIN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420224	HOLIDAY - BLAKE & ALYSSA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791209	HOLLADAY - BRAD SCOTT & AUBREY NICOLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801302	HOLTZ - DEREK LEE & RIENA SUENE KALILIMOKU	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420212	HOOGVELDT - GAGE & ASHLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460327	HORLACHER - DAVID SHAWN & AMY ELIZABETH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590705	HOSKIN - ZACHARY PAUL & KINSIE LYNN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941523	HOUSEWRIGHT - JORDAN ZACHARY & CAROLINA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470429	HOWARD - ZACKERY B	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460336	HOWE - CHRISTOPHER J & ARIELA P	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370126	HUGHES - KAREN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357460326	HUNTER - ALANNA KATIE & MATTHEW MICHAEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550518	HUNTSMAN - MATTHEW	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941505	HUTCHINSON - LESLIE B	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600034	INDREBOE - MARTIN J & ARLISS M	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690808	ISAACSON - DALLIN & JADEN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600031	JAAR - JOSE R & ANGELA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370149	JAAR - JOSE RAUL & ANGELA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931409	JACKMAN - JOSHUA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357801314	JAMES - LANCE & JESSICA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550504	JAMES - ROGER & KRISTI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931441	JEFFS - MATTHEW (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357700915	JENSEN - ERIK C & BRIANNA B	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801325	JENSEN - SANDRA & STEVEN R (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370107	JEPSON - MICHAEL D & NICOLE B	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420229	JOHNS - JAYSON & ASHLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460303	JOHNSON - GEORGE A & LORILEE A	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690838	JOHNSON - JUSTIN SMITH & SAMANTHA NICOLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420213	JOHNSON - KEVIN M & SHARLEE C	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941531	JOHNSTON - DRU K & PAUL A	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690821	JOHNSTON - SKIP JORDAN & JENNIFER L	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590707	JOLLEY - STEPHEN & JILLIAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690848	JONES - JON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931414	JONES - PARKER & BROOKE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357470425	JUDSON - PERRY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941501	KALUBA - JOSEPH & BERIHANE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931430	KANYUCK - COLLIN & JACQUELINE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460302	KEATE - KENDALL JAMES (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357570613	KEATE - WINSTON (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357690846	KELLEY - JOHN & SUSAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470416	KELLMAN - TERESA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370111	KEMP - BRYSON & JACKIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370123	KEMP - MICHAEL & SHAUNA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931420	KENDALL - JUSTIN & HEATHER	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357941503	KENISON - CHRISTOPHER & TORRI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370134	KINSMAN - STEVEN & ALI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370142	KIRALY - STEPHEN J & DEBRA K (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370135	KONOLD - BREANN M & TRAVIS R	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460318	LAIRD - KAYLA & ROGER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370125	LAKE - STUART BERT & KRISTEN KAY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931412	LAMBERT - JANEAN & BRANDON	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357600026	LANDEN - MICHAEL ALAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600039	LARSEN - ALLAN SCOTT & MESINA DAWN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570616	LARSEN - MIKE & BROOKE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357460307	LARSEN - NATHAN LEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370138	LARSON - SHAWN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600012	LAVIN - NATHAN & MYKALEEN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801326	LAWRENCE - JEREMY & EMILY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460312	LEAVITT - MALORIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700917	LEE - JUSTIN & CHELSEA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460339	LEFLER - MART WILLIAM (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420244	LIDDLE - TANNER & MALLORY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690847	LIGHT - MATTHEW D & PAULA B	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570634	LINDSAY - RYAN S & MONICA J	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781101	LINDSEY - JESSICA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941522	LITTLE - ELIZA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357570632	LIVAI - SEMISI & NORMA-JEAN (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357370105	LOFTES AND AGGIE TRYK FAMILY TRUST 07-19-2015 THE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550525	LOPSHIRE - BENJAMIN LYN & LAURA LYNN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700903	LOVATO - EMILEE & KEITH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570617	LOWDER - GREGORY & ABIGAIL	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357941512	LOWE - CHRISTOPHER & SAOFAI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781111	LOWE - CURTIS M & ANNA JADE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357931435	LOWE - ELDEN & EARL RAY (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357801304	LOYA - CARLOS SOLIS (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420243	LUCKAU - BRIAN & AMY JO	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690817	LUKE - WILLIAM	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931438	LYDOLPH - KIRSTEN ELISA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357941518	MACKINTOSH, WILLIAM & JORDAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931436	MADSEN - JEFFREY (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357570622	MADSEN - SHERRI TANYA CLARK & RICHARD GOULD	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357781116	MAKIN - SHAYLA JOLENE & HEATH SCOTT	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690836	MARSHALL - PATRICIA & MATTHEW	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941527	MARTINEZ - DANIEL ANTONIO BERMUDEZ (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781121	MARTINEZ - DAVID J	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600046	MASCARO - WESTON & SARAH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690801	MASTRACOLA - MICHELLE & ROBERT KEITH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690802	MASTRACOLA - NICHOLAS & MICHELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931406	MATAAFA - HARRIS & MIRANDA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357690811	MAXSON - CORY & RHONDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357801305	MAY - JACKLYN RILEY & ALEXANDER MITCHELL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570633	MAYER - DYLON A (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801315	MAYER - SIGURD PAUL & APRIL ASHLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470420	MCDONALD - ANDREW & STEPHANIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931417	MCGEE - BENJAMIN	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357370122	MCGEE - PATRICK & DEBRA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470403	MCGINNIS - DANIEL RAWSON & KALEIGH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801316	MCLAUGHLIN - MICHAEL P & ALYSSA E	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550502	MCTEE - JUSTIN ANTHONY KEONI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941526	MEADE - KYLE & MEGAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550506	MERRITT - TYLER JORDAN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370145	MILLER - ALEXCIA & BRIAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370113	MIRANDA - ALEJANDRO H LEON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420209	MOLI - ALO & ASHLEY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941521	MOON - JOSHUA J & EMILY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941534	MORENO - NANCY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781109	MORTENSEN - DANIEL C & CASEY L	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791212	MOSES - SAMUEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791204	MOSQUEDA - JOSE ADRIAN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420247	MOULTON - CODY J & CHELSEA M	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370117	MUNOZ - MICHAEL & APRIL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791222	MYERS - CHRIS & CHRISTINA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700905	NAPOLEON - TITUS KN III	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590711	NASH - NATHAN & KARYN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781130	NAVARRETE - EDWARD & YESENIA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470413	NAVARRO - LUIS F & LUIS ENRIQUE JR	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600005	NAY - JONATHAN MATTHEW & SHANNON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357570638	NELSON - ALEXANDER J	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550526	NENNIG - ANDREAS KONRAD & TAMIRA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931418	NEUMANN - TIMOTHY R	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357700907	NEWMAN - RICHELLE & CHRISTOPHER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700918	NIELSEN - BREANNA & AUSTIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791214	NIKOLAEV - IRINA & ARTHUR	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931405	NOGUEZ - EMILIANO (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357690812	NORRIS - AARON MICHAEL & JENNIFER STJARSTEN OLSEN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370116	NOTT - ADAM & JAMIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931423	NSEREKO - BUSULWA (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357931401	O'DONNELL - PAUL & TAUNI	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357550527	OLDROYD - TREVOR & MAX	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690807	OLSEN - MICHAEL & DEBORAH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600017	OLSON - DONALD REED & JANE ANNETTE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370128	OLSON - TAD L & ANNETTE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460328	OLZACK - DUSTIN ROBERT & TERRI BUHLER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460301	ORTEZ - DAN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570621	ORWIN - CHASE & REBECCA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357791220	OSBORNE - DALLAS & S ELYSE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791201	OTANEZ - ANNE MARIE MICHELLE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941502	PACK - SCHUYLER B (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801331	PAEZ - JUAN & BRITTANY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460308	PALMER - ALEX & SAMANTHA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420221	PALMER - MATTHEW & ASHTON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941540	PARADISE INVESTMENT LLC	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357801323	PAREDES - MARCO ANTONIO & DICIFREDO	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801309	PATCHETT - MELISSA & DUSTIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570614	PAUL - LOUIS W & TAMERA	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357791213	PEARCY - ALISHA & MATTHEW	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370109	PEARSON - DANIEL & KYLEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420245	PENA - MIGUEL (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460323	PERKINS - DANIEL LEVI & HEIDI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420214	PETERSON - BENJAMIN H	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420226	PETERSON - MICHAEL & KAITLIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420237	PETERSON - TIMMY & TERRIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600029	PHILLIPS - ANDREW	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460316	PIERSON - GARRETT & TASHINA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941525	PINEDA - CARLOS ENRIQUE URIBE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941511	POLLARD - DAVID & ASHLEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781122	PORRAS - CARMEN CASIMIRO	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791223	PORTER - ANDREW & JESSA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781114	PORTER - JENNIFER ANN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781115	POWELL - JESSICA & TYLER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791224	PRINCE - JOSHUA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370143	PROFFIT - STEVEN E & RHONDA L	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600003	PUGH - BRYAN & CRYSTAL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470418	QUINN - JORDAN & MELISA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570629	R & C ASSET PROTECTION TRUST 10-23-2018 THE (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357600020	RACKLIFFE - ISAAC & ROCHELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700902	RASMUSON - CHARLES HENRY & CORREY BETH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470417	RASMUSSEN - GARY & COLETTE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357460337	REID - DUSTIN DOUGLAS & SYDNEY MCCALL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801334	REYNA - DANIEL AGUILERA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700910	RICH - JEFF & KRISTI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570635	RICH - MATT TYLER & DESIREE JANAE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550511	RIDEOUT - ZACHARY DAVID & MICHELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550515	RIGGS - ELIZABETH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931415	RINKER - JEFFREY WILLIAM	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357600033	ROBERTS - MICHAEL & JESSICA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470423	ROBINSON - DAVID K	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700921	ROBINSON - HOWARD	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470410	RODGERS - JEREMY LAWRENCE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931404	RODRIGUEZ - ANA M (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357370108	ROEBUCK - DAVID MARK & DEBORAH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460330	ROJAS - ERICK (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690819	ROTHEY - RILEY & SUNNIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370110	ROWE - PAUL & SHARON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941537	ROZO - LEIDY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600049	RUESCH - CHRISTOPHER & KARLIE BRE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420225	RUIZ - DACHELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801318	RUSSELL - RYLEE & DAVID SCOTT (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690841	RUWODO - CHRISTINE L (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791217	SAINT FELIX - GERARD S & MARIE C (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941506	SALAZAR - GUILLERMO P CHICO (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941538	SALAZAR-SORIA - SAMUEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941517	SALDIVAR - HUGO E PEREZ (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357370120	SALISBURY - WHITNEY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570612	SANCHEZ - OMAR ALBERTO	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357690844	SANTIAGO - ELISA GONZALEZ	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791216	SARMIENTO - FERNANDO & ELAINE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470419	SARMIENTO - HEBER & ALISA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941514	SCHAFER - CHRISTOPHER DOUGLAS & ASHLEY RAND (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600008	SCHAUERHAMER - JACOB & KALI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550501	SCOVILLE - BRENT HARMON & DEANNA LENE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460342	SCOVILLE - JACOB & ALEXIS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941542	SEEGRIST - BRANDON TAYLOR (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570625	SELF - JARED & KATHERINE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357420215	SHAW - CHRISTIAN W & AMBER LEIGH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420236	SHAY - DAVID & BRANDY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931427	SHEIKH - JEREMY SALIM	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700912	SHOWALTER - MATTHEW & JULIA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420204	SHUTT - NATHANEAL HARRIS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781106	SILVA - MANOEL & PAOLA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690833	SIMMONS - GARY JEROME & IRYNA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370119	SINGLETON - MARK (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550529	SIPE - MARTIN A II & SHANNON C (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570631	SIPPLE - CARRIE LAWTON & WADE AARON	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357791206	SISOUPHANH - ADAM & MONICA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460335	SIVONGSA - SATI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420207	SLADE - ERNEST S & KOSHEILA T	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801306	SMITH - CRYSTAL & JENS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801312	SMITH - MAJOR & KELSIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781123	SMITH - ROGER & BARBARA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

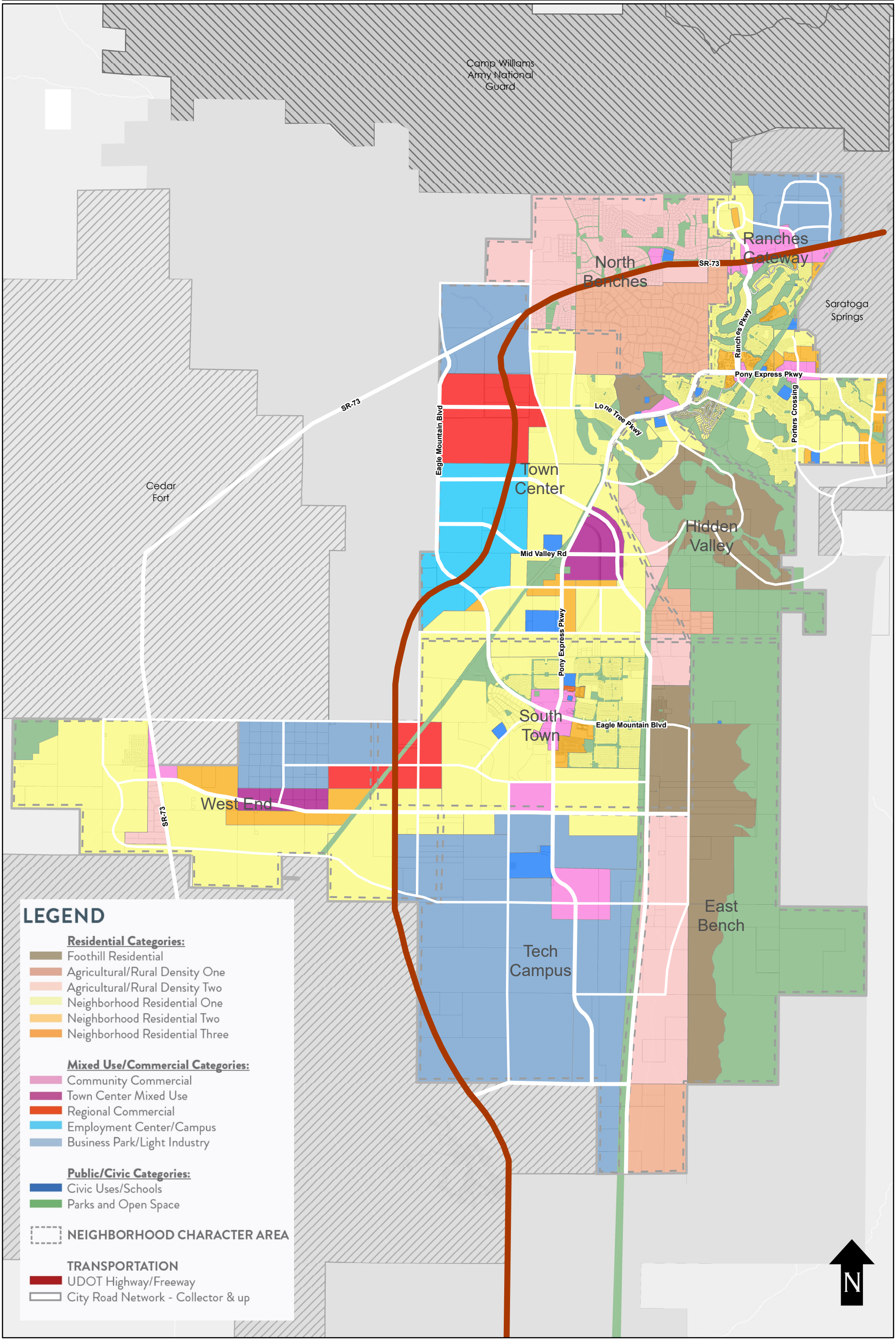
Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357570608	SNAPE - JUSTIN & ARIANNA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690820	SOLORIO - RAMON & ERIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370129	SOLORZANO - YLZE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470406	SORENSON - ROYAL JOHN & COLLEEN THOMAS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370102	SOTELO - JULIE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600030	SPENCE - BRADEN & PAMELA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550514	STANGER - BRADY R & SHAE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460322	STARR - JARED & ATHENA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700901	STEELE - LORETTA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600028	STEVENS - JONATHAN DAVID	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801303	STEWART - BLAINE FRANKLIN & TERRY LYN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420219	STIRLAND - CRAIG & STACI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931428	STOPPEL - ROSA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357570603	STOWELL - PETER VINCE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941529	SUMBOT - HEIDI WILCOX & JUDSON HOWARD	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931437	SUMMERS - DAVID J & STACY JO	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357941530	SUMMERS - ZACHARY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791207	SUMNER - DAVID C & KYLEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931434	SUMNER - VANESSA R & VINCENT J (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357791202	TALBOT - DALE WARREN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460317	TANNER - JOSPEH V & NICHELLE SHAW	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600002	TAPIA - GLORIA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941539	TATE - JARED WILLES & JAMEE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781117	TAYLOR - DUANE ALLEN & TIFFANY DIANE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460320	TE'O - LEVI & PAIGE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357600042	THACKER - DAVID BRADLEY & AMANDA LOUISE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470426	THOMAS - BRYCE JAMES & KIMBERLY SUE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420211	THOMAS - JARED & VALYSSA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470401	THOMAS - PRESTON R & AMANDA J	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370136	THOMPSON - CRAIG & MICHELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370136	THOMPSON - CRAIG & MICHELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460314	THOMPSON - DARRELL & LORI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460325	THOMPSON - JOSEPH LYMAN & HALEIGH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781125	THORN - JIMMY & GLADYS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550519	TIMOTHY - STEVEN MATTHEW & MEGAN SARAH	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781118	TINNEY - J R & JESSICA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690832	TOLBERT - RUFUS FREDRICK JR & MANDOLYNN THAMAR	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470407	TOLTON - DEVIN JOHNNY & BAILIE LYNN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420202	TORRES - WILLIAM RICARDO	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460334	TUALAU - TEVITA PALEIONO (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550507	TURNER - ANDREW & BRITTANY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931403	TURNER - CLIFFORD L & JAMIE	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357700914	TURNER - CLINTON & MANDY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700913	TURNER - DONALD B	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370103	TURNER - JULIE ANNA & JONATHAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801320	URE - CAMERON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420223	VALENTINE - JULIA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600016	VAN ORMAN - ERIK R & STEPHANIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420201	VARGAS - MONICA (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941536	VARGAS - XIMENA J	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357420222	VEENENDAAL - GABRIEL L & MALLORY A	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590701	VIDAL - SAMUEL JAMES & MELANIE BIENER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357931433	VILORIO - MARLON (ET AL)	Neighborhood Residential One	Residential Tier II	Agricultural/Rural Density Two	Rural Density 2 (RD2)
357941519	VOELLER - BRITTNEY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781120	VOGEL ENT LLC	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801321	WAITE - GRACE & MICHAEL RICHARD	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370139	WALKER - CAMERON & ANNALI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460340	WALTON - TREVOR J & JENNIFER L	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781103	WANG - ZHIGUANG	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600044	WARENSKI - BEAU & AMBER ELAINE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690826	WARLIN - NATHAN JOHN & DANIELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370127	WARREN - JAKE (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550503	WAY - WILLIAM W & SHELLY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690834	WEATHERS - GREGORY SCOTT & MORGAN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600023	WEBB - JILL & NATHAN AARON	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460329	WEBB - MICHAEL & LISA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600022	WEBB - SHAWN D & JESSICA MARIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690842	WEBSTER - MARK MASON & KELLY LEWIS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550520	WENERSTROM - JOEL & ARIELLE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370141	WENTZ - TONY & RHONDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600040	WEST - JESSICA & DUSTIN	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791210	WHITE - BRIAN M & SANDRA S (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357690810	WHITE - EDWARD II	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550521	WHITFORD - AMANDA NICOLE & JOSEPH KALAEOKUMUKAHI IV	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550510	WHITING - TREVER A & JESSICA L	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

Parcel	Owner	Current Future Land Use Designation	Current Zoning	Proposed Future Land Use Designation	Proposed Rezone
357690824	WIDMER - ROBERT GREGORY & LILIANE WINDMULLER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600014	WILDER - JACOB A & SHANNON (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357700906	WILLIAMS - LOGAN RICHARD & NATASHA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801307	WILSON - JASON NICHOLAS & EMILY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460324	WILSON - RYAN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600018	WINSOR - SCOTT & HEIDI	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357550528	WINTERS - LARRY & JOY	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357600025	WINWARD - ROB TERRY JR & SHELLI S	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941510	WINZELBERG - JULIEN (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470424	WITTMAAK - ROBERT T & ISABEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357791221	WOERNER - RACHEL & ALEX	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370124	WOLFGRAMM - TONY N & DORIS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357420232	WOOD - BLAINE & JOANNA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357801319	WOODHEAD - STACI & MICHAEL	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357590708	WOODHEAD - ZACH & KIRSTIE	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357370101	YMCMP SERIES 667	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357781113	YOURSTON - ERIC & YOLANDA	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357941528	ZARAGOZA - MARIA & MARCOS	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357470405	ZDUNICH - BRADY (ET AL)	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)
357460311	ZITTING - BRADLEY & JENNIFER	Neighborhood Residential One	Residential Tier II	No Change	Residential 2 (R2)

FUTURE LAND USE & TRANSPORTATION MAP



	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	CHANGE ORDER - Belle Street Booster Power Conduit Replacement and SCADA - Change Orders #2 and #3.
ITEM TYPE:	Change Order
FISCAL IMPACT:	$38,619.01 to be added to the project for Condie Construction. $33,900.00 to be added to the project for SKM for SCADA.
APPLICANT:	Eagle Mountain City

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	N/A

PUBLIC HEARING
No

PREPARED BY
Bryce Mcrae, Engineer in Training

PRESENTED BY
Bryce Mcrae

RECOMMENDATION:
Staff recommends City Council approve Belle Street Booster Power Conduit Replacement and SCADA Change Orders #2 and #3.

BACKGROUND:

The proposed change orders pertain to the same project but involve two different contractors: Change Order #2 is related to Condie Construction, and Change Order #3 is related to SKM.

There is an existing power conduit installed by the development to the north that was intended to allow installation of power cable to the south side of Harmony Way. We were planning to use this conduit to run power to the newly constructed Belle Street Booster Station. It was discovered that the existing conduit has been damaged and cannot be used to run the planned power cable to the booster station. Because of this damage, a new conduit will need to be installed from the power box on Belle Street next to the Middle School south along Belle Street to the Booster Station site. With full landscaping being complete along this route and with two road crossings, the best way to install this conduit is to bore from the power box to the Booster Station site. Change Order 2 is the full cost to bore the conduit as described.

SCADA is the telemetry that allows remote monitoring and control of the Booster Station by our Public Works personnel. This system is used throughout the city and all water facilities have this equipment installed. SKM is the company that installs and maintains all of the telemetry equipment for the city. Change Order 3 is to add the purchase and installation of this equipment to the project.

ITEMS FOR CONSIDERATION:

N/A

PLANNING COMMISSION ACTION/RECOMMENDATION:
N/A

ATTACHMENTS:

1. Change Order #2 - Condie Construction
2. Change Order #3 - SKM

Eagle Mountain City

1650 E Stagecoach Run Eagle Mountain Utah 84005
801-789-6600

Change Order # 2

Date:	4/14/2026	**Change Order Amount:**	$38,619.01
Project Title:	Belle St Booster	**PO #**	84872
Project Manager:	Bryce McRae	**GL #**	11-81-51000-7000
Contractor:	Condie Construction	**Task Code #**	
Contr. Contact:	Christian Wagner 801-602-0241		

The Contract Documents will be modified as follows upon execution of this Change Order:

Description:
Attached PDF is for change order on Belle St Booster. This include work to bore power conduit from the site to existing transformer on the northwest of the middle school.

Attachments (List documents supporting this change order, attach to this form, upload to Springbrook):

1. Apex Electric - (6" bore from south side of road up to sectionalizer (~420 LF)) and supervision
2. ($38,619.01)
3.
4.
5.

Contract Pricing:		**Contract Time:**	
Original Contract Amount:	$ 534,357.00	Original Completion Date:	December 31st, 2025
Previously Approved CO's:	$ 107,826.42	Previously approved days:	
Present Contract Price:	$ 642,183.42	Increased by:	
Change Order Amount:	$ 38,619.01	Decreased by:	
New Contract Amount:	$ 680,802.43	New Completion Date:	

City Council Budget Approval?	✔	YES		NO	Admin Assistant Reviewed?		YES	✔	NO

City Council approval required if funds are not budgeted and for change orders over $75,000.00 or 10% of cost; whichever is greater. Also, for purchases over 15,000.00 for auditing, attorneys, architectural services for city facilities, branding, government relations and consulting for master plans and general plans.

Signatures (approval):

Purchasing:	Melissa Yates	Project Accountant:	Chris Waldron Chris Waldron (Apr 15, 2026 15:57:33 MDT)
Project Manager:	Bryce McRae Bryce McRae (Apr 15, 2026 15:58:46 MDT)	Department Head/Director:	Vince Hogge Vince Hogge (Apr 15, 2026 15:59:41 MDT)
City Manager:	Benjamin A. Reeves Benjamin A. Reeves (Apr 15, 2026 17:18:46 MDT)	City Council:	

Condie Construction Company, Inc.
325 North 900 West
Springville, UT 84663
(801) 489-3070

PCO #08 - Offsite electrical extension - 6" bore to bypass existing pipe from south side of road up to sectionalizer

PROJECT NAME & NUMBER: Belle Street Booster Station

OWNER: Eagle Mountain City

SUBMITTED TO: Bryce McRae

DATE: 4/13/2026

CHANGE PROPOSAL NUMBER: 8

CHANGES TO BE MADE TO ORIGINAL CONTRACT: Y

Item	Description	Quantity	Units	Price	Total
1	Apex Electric - (6" bore from south side of road up to sectionalizer (~420 LF))	1.00	LS	$31,612.75	$31,612.75
2	Supervision, project management, coordination, design	20	Hrs	$98.45	$1,969.00

Subtotal	**$33,581.75**
Markup (15%)	**$5,037.26**
TOTAL	**$38,619.01**

Original contract:	
Previous change orders:	**$0.00**
Total this change order:	**$38,619.01**
Adjusted contract:	**$38,619.01**

Added contract time: **310 Days** (Takes us to August 31st as to when generator should be here and installed)

Requested and Approved by Owner /Engineer:

Name: Title: Signature:

Accepted and Approved by Condie Construction Company, Inc.

Name: Christian Wagner Title: Project Manager Signature:

APEX ELECTRICAL

Change Order Breakdown: #CO4

Date:	2/9/26	**Job Name:**	Belle Street Booster	**Job #:**	151-003
Company Name:		Condie Const. Com.	**Contact Name:**		Christian W.
Phone #:			**PO#**		
Scope of Work:		Provide a 6" bore from the existing sectionalizer to tie in to newly placed conduits, bypassing all existing conduits. Bore length ~420'.			
T&M Work Requested By:				**Date:**	

In signing the line below, I declare that I am an authorized representative for the Company listed above, and have directed and approve of the Scope of Changes detailed above.

Pre-Authorization Signature:				**Date:**
Time:				
Base Project				
2	@	$135.00	PM/GF -Dan Leseberg Labor Total:	$270.00
2	@	$110.00	JW - Labor Total:	$220.00
			Total Labor:	**$490.00**
Equipment, Subcontractors				
1	ea @	$25,470.00	Boring Subcontractor	$25,470.00
1	ea @	$1,500.00	Landscaping Allocation	$1,500.00
0	ea @	$2,500.00	Hydrovac- Potholing to find Conduit	$0.00
			Total Equipment, Subcontractors:	**$26,970.00**
			Subtotal Equipment, Subcontractors + Markup (15%):	**$31,015.50**
Travel, Equipment, Trucks				
1	ea @	$95.00	Trip Charge, Vehicle Expenses	$95.00
2.5%	ea @	$490.00	Tools & Materials - 2.5% of Labor Cost	$12.25
			Subtotal Travel, Equipment, Trucks:	**$107.25**
			Total Invoice:	***$31,612.75***

BORE PIT, TIE IN TO VAULT
BORE PIT, TIE TO NEW CONDUIT

CO 2 Belle St Booster Condie Construction

Final Audit Report 2026-04-15

Created:	2026-04-15
By:	Melissa Yates (myates@emcity.org)
Status:	Signed
Transaction ID:	CBJCHBCAABAAsjrUshlYFDqCnTq3kwWBnJQDzGeo38EB

"CO 2 Belle St Booster Condie Construction" History

Document created by Melissa Yates (myates@emcity.org)
2026-04-15 - 8:42:24 PM GMT

Document emailed to Christopher Waldron (cwaldron@eaglemountain.gov) for signature
2026-04-15 - 8:45:37 PM GMT

Email viewed by Christopher Waldron (cwaldron@eaglemountain.gov)
2026-04-15 - 9:50:51 PM GMT

Signer Christopher Waldron (cwaldron@eaglemountain.gov) entered name at signing as Chris Waldron
2026-04-15 - 9:57:31 PM GMT

Document e-signed by Chris Waldron (cwaldron@eaglemountain.gov)
Signature Date: 2026-04-15 - 9:57:33 PM GMT - Time Source: server

Document emailed to Bryce McRae (bmcrae@eaglemountain.gov) for signature
2026-04-15 - 9:57:35 PM GMT

Email viewed by Bryce McRae (bmcrae@eaglemountain.gov)
2026-04-15 - 9:58:14 PM GMT

Document e-signed by Bryce McRae (bmcrae@eaglemountain.gov)
Signature Date: 2026-04-15 - 9:58:46 PM GMT - Time Source: server

Document emailed to Vince Hogge (vhogge@eaglemountain.gov) for signature
2026-04-15 - 9:58:48 PM GMT

Email viewed by Vince Hogge (vhogge@eaglemountain.gov)
2026-04-15 - 9:59:16 PM GMT

Document e-signed by Vince Hogge (vhogge@eaglemountain.gov)
Signature Date: 2026-04-15 - 9:59:41 PM GMT - Time Source: server

Document emailed to Benjamin Reeves (breeves@eaglemountain.gov) for signature

2026-04-15 - 9:59:43 PM GMT

Email viewed by Benjamin Reeves (breeves@eaglemountain.gov)

2026-04-15 - 11:18:21 PM GMT

Signer Benjamin Reeves (breeves@eaglemountain.gov) entered name at signing as Benjamin A. Reeves

2026-04-15 - 11:18:44 PM GMT

Document e-signed by Benjamin A. Reeves (breeves@eaglemountain.gov)

Signature Date: 2026-04-15 - 11:18:46 PM GMT - Time Source: server

Agreement completed.

2026-04-15 - 11:18:46 PM GMT

Adobe Acrobat Sign

Eagle Mountain City

1650 E Stagecoach Run Eagle Mountain Utah 84005
801-789-6600

Change Order # 3

Date:	4/15/26	**Change Order Amount:**	$33,900
Project Title:	Belle St Booster	**PO #**	85256
Project Manager:	Bryce McRae	**GL #**	11-81-51000-7000
Contractor:	SKM	**Task Code #**	
Contr. Contact:	Allen Rogers		

The Contract Documents will be modified as follows upon execution of this Change Order:

Description:
Attached PDF is for change order on Belle St Booster. This include work for the PLC Panel and Programming

Attachments (List documents supporting this change order, attach to this form, upload to Springbrook):

1. PLC Panel
2. a. Qty 1 30” x 36” Painted Steel Nema 12 Box, b. As-built drawings for PLC, c. Switch for communications with
3. DirectCom system
4. Programming
5. a. PLC Programming for the booster, b. Touchscreen programming, c. Integration programming with existing HMI

Contract Pricing:		**Contract Time:**	
Original Contract Amount:	$ 534,357.00	Original Completion Date:	December 31st, 2025
Previously Approved CO's:	$ 107,826.42	Previously approved days:	
Present Contract Price:	$ 642,183.42	Increased by:	
Change Order Amount:	$ 33,900	Decreased by:	
New Contract Amount:	$ 714,702.43	New Completion Date:	

City Council Budget Approval?	✔	YES		NO	Admin Assistant Reviewed?		YES	✔	NO

City Council approval required if funds are not budgeted and for change orders over $75,000.00 or 10% of cost; whichever is greater. Also, for purchases over 15,000.00 for auditing, attorneys, architectural services for city facilities, branding, government relations and consulting for master plans and general plans.

Signatures (approval):

Purchasing:	Melissa Gates	Project Accountant:	Chris Waldron Chris Waldron (Apr 15, 2026 17:06:58 MDT)
Project Manager:	Bryce McRae Bryce McRae (Apr 15, 2026 17:08:13 MDT)	Department Head/Director:	Vince Hogge Vince Hogge (Apr 15, 2026 17:45:17 MDT)
City Manager:	Benjamin A. Reeves (Apr 15, 2026 18:53:57 MDT)	City Council:	

skm
SAVE TIME • SAVE ENERGY • SAVE MONEY
533 W 2600 S, Suite 25, Bountiful, UT 84010
(801)677-0011 www.skmeng.com

Confidential Proposal

December 12, 2025

To Mack Straw
Eagle Mountain City

Re: Bell Street Booster PLC Panel

SKM is pleased to provide the quotation for the PLC for the new Bell Street Booster vault.

Project Scope of Supply

1. **PLC Panel**
    a. Qty 1 30” x 36” Painted Steel Nema 12 Box
        i. Modicon M340 family of processor
            1. 32 Discrete Inputs
            2. 16 Discrete Outputs
            3. 8 Analog Inputs
            4. 4 Analog Outputs
        ii. Phoenix Contact Quint Line with DC UPS
        iii. 10.4” Magelis touchscreen for station control
        iv. Networking hardware
    b. As-built drawings for PLC
    c. Switch for communications with DirectCom system
2. Programming
    a. PLC Programming for the booster
    b. Touchscreen programming
    c. Integration programming with existing HMI

Costs

Total: $33,900

Exclusions and Exceptions

1. Installation of panel provided by others.

Confidentiality

The Client agrees that the technical methods, techniques and pricing information contained in any proposal submitted by SKM pertaining to this project or in this Agreement or any addendum thereto, are to be considered confidential and proprietary, and shall not be released or otherwise made available to any third party without the express written consent of SKM.

Standard Rates

Any work performed outside of the listed scope of items will be billed time and materials at our standard rates at time of work.

Closing,

Allen Rogers
SKM Engineering, LLC

Accepted by

Signature	Printed Name
Title	Date

Attached: Articles of Terms and Conditions

SKM Engineering, LLC
Articles of Terms and Conditions

I. SCOPE
SKM, Engineering LLC.(SKM) agrees to perform the services described in the proposal attached hereto which incorporates these terms and conditions. Unless modified in writing by the parties hereto, the duties of SKM shall not be construed to exceed those services specifically set forth in the proposal. These terms and conditions and the proposal, when executed by Client, shall constitute a binding agreement on both parties (hereinafter the "Agreement').

II. COMPENSATION
Client agrees to pay for the services in Article I in accordance with the compensation provisions in the proposal. Payment to SKM will be made within 30 days after the date of billing. Interest on the unpaid balance will accrue beginning on the 31st day at the maximum interest rate permitted by law.

Time-related charges will be made in accordance with the billing rate referenced in the proposal or Agreement. Direct expenses and Subcontractor services shall be billed in accordance with the proposal or compensation exhibit attached to this Agreement. Otherwise, SKM's standard billing rates shall apply.

Ill. RESPONSIBILITY
SKM is employed to render a professional service only, and any payments made by Client are compensation solely for such services rendered and recommendations made in carrying out the Work. SKM shall perform the services in accordance with generally accepted engineering practices and standards in effect when the services are rendered. SKM does not expressly or impliedly warrant or guarantee its services.

In performing construction management services, SKM shall act as agent of Client. SKM's review or supervision of work prepared or performed by other individuals or firms employed by Client shall not relieve those individuals or firms of complete responsibility for the adequacy of their work.

The presence of SKM's personnel at a construction site, whether as on-site representative, resident engineer or construction manager, shall be for the sole purpose of determining that the work is generally proceeding in conformance with the intent of the project specifications and contract documents and does not constitute any form of guarantee or assurance with respect to contractor's performance. No other express or implied warranty with respect to the Work is provided and all such other warranties are expressly disclaimed.

IV. INDEMNIFICATION
SKM agrees to indemnify, defend, and hold Client harmless from and against any liability to the extent arising out of the negligent acts, errors or omissions of SKM, its agents, employees, or representatives, in the performance of duties under the Agreement. Regardless of any other term of this Agreement, in no event shall SKM be responsible or liable to the other for any incidental, consequential, or other indirect damages.

V. ATTORNEYS' FEES
In the event of any litigation arising from or related to this Agreement or the services provided under this Agreement, the prevailing party shall be entitled to recover from the nonprevailing party all reasonable costs incurred, including staff time, court costs, attorneys' fees and all other related expenses in such litigation.

VI. INSURANCE
SKM shall maintain during the life of the Agreement the following minimum insurance:

1. **Comprehensive general liability** insurance, including personal injury liability, blanket contractual liability, and broad form property damage liability. The combined single limit for bodily injury and property damage shall be not less than $1,000,000.
2. **Automobile bodily injury and property damage liability** insurance covering owned, non-owned, rented, and hired cars. The combined single limit for bodily injury and property damage shall be not less than $1,000,000
3. **Statutory Worker's compensation and employers' liability** insurance as required by state law.
4. **Professional liability** insurance with limits of not less than $1,000,000.

VII. SUBCONTRACTS
SKM shall be entitled, to the extent determined to be appropriate by SKM, to subcontract any portion of the Work to be performed under this Agreement.

VIII. ASSIGNMENT
This Agreement is binding on the heirs, successors, and assigns of the parties hereto. The Agreement is not to be assigned by either Client or SKM without the prior written consent of the other.

IX. INTEGRATION
These terms and conditions and the proposal to which they are attached represent the entire understanding of Client and SKM as to those matters contained herein. No prior oral or written understanding shall be of any force or effect with respect to those matters covered herein. The Agreement may not be modified or altered except in writing signed by both parties, provided further that any terms and conditions in any Task Order or purchase order issued in connection or under the Agreement which are inconsistent with the Agreement are deemed null and void.

X. CHOICE OF LAW/JURISDICTION
This Agreement shall be administered and interpreted under the laws of the State of Utah. Jurisdiction and venue of any litigation arising from the Agreement shall also be in Idaho.

XI. SEVERABILITY
If any part of the Agreement is found unenforceable under applicable laws, such part shall be inoperative, null and void insofar as it is in conflict with said laws, but the remainder of the Agreement shall be in full force and effect.

XII. NO BENEFIT FOR THIRD PARTIES
The services to be performed by SKM hereunder are intended solely for the benefit of Client, and no right or benefit is conferred on, nor any contractual relationship intended or established with any person or entity not a party to this Agreement No such person or entity shall be entitled to rely on SKM's performance of its services hereunder.

XIII. WORK PRODUCT
SKM and Client recognize that SKM's work product submitted in performance of this Agreement is intended only for the Client's benefit and use. Change, alteration, or reuse on another project by Client shall be at Clients sole risk, and Client shall hold harmless and indemnify SKM against all losses, damages, costs and expense, including attorneys' fees, arising out of or related to any such unauthorized change, alteration or reuse.

Any signed, stamped and dated Construction Documents prepared by the Consultant are the Work Product. CADD files are furnished for convenience only. The transfer of the CADD files for use by the Client shall not be deemed a sale and the Consultant makes no warranty, either express or implied, of merchantability or fitness for any particular purpose.

XIV. SUSPENSION OF WORK
Work under this Agreement may be suspended as follows:

1. **BY Client**. By written notice to SKM, Client may suspend all or a portion of the Work under this Agreement if unforeseen circumstances beyond Client's control make normal progress of the Work impracticable. SKM shall be compensated for its reasonable expenses resulting from such suspension including mobilization and de-mobilization. If suspension is greater than 30 days, then SKM shall have the right to terminate this Agreement in accordance with Article XIV, Termination of Work.
2. **By SKM.** By written notice to Client, SKM may suspend the Work if SKM reasonably determines that working conditions at the Site (outside SKM's control) are unsafe, or in violation of applicable laws, or for other circumstances not caused by SKM that are interfering with the normal progress of the Work. SKM's suspension of Work hereunder shall be without prejudice to any other remedy of SKM at law or equity.

XV. TERMINATION OF WORK
This Agreement may be terminated as follows

1. **Client** (a) for its convenience on 30 days' notice to SKM, or (b) for materially breaches this Agreement through no fault of Client and SKM neither cures such material breach nor makes reasonable progress toward cure within 15 days after Client has given written notice of the alleged breach to SKM.
2. **By SKM** (a) for cause, if Client materially breaches this Agreement through no fault of SKM and Client neither cures such material breach nor makes reasonable progress toward cure within 15 days after SKM has given written notice of the alleged breach to Client, or (b) upon five days' notice if Work under this Agreement has been suspended by either Client or SKM in the aggregate for more than 30 days.
3. **Payment upon Termination.** In the event of termination, SKM shall perform such additional work as is reasonably necessary for the orderly closing of the Work. SKM shall be compensated for all work performed prior to the effective date of termination, plus work required for the orderly closing of the Work. Except for termination of SKM by Client for cause, SKM shall also receive a termination fee equal to 15 percent of the total compensation yet to be earned under existing authorizations at the time of termination.

XVI. NOTICES
All notices required under this Agreement shall be by personal delivery, facsimile or mail to the SKM Project Manager and to the person signing the proposal on behalf of the Client, and shall be effective upon delivery to the addressed stated in the proposal

CO 3 Belle St Booster SKM

Final Audit Report 2026-04-16

Created:	2026-04-15
By:	Melissa Yates (myates@emcity.org)
Status:	Signed
Transaction ID:	CBJCHBCAABAAI8PWKvulo6437gmsgfCIyg_tD0En2HiZ

"CO 3 Belle St Booster SKM" History

Document created by Melissa Yates (myates@emcity.org)
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2026-04-16 - 0:52:00 AM GMT

Signer Benjamin Reeves (breeves@eaglemountain.gov) entered name at signing as Benjamin A. Reeves
2026-04-16 - 0:53:55 AM GMT

Document e-signed by Benjamin A. Reeves (breeves@eaglemountain.gov)
Signature Date: 2026-04-16 - 0:53:57 AM GMT - Time Source: server

Agreement completed.
2026-04-16 - 0:53:57 AM GMT

Adobe Acrobat Sign

EAGLE MOUNTAIN
CITY COUNCIL MEETING MINUTES

APRIL 7, 2026, 4:00 PM
EAGLE MOUNTAIN CITY COUNCIL CHAMBERS
1650 E STAGECOACH RUN, EAGLE MOUNTAIN, UT 84005

ELECTED OFFICIALS PRESENT: Mayor Jared R. Gray; Melissa Clark, Rich Wood, Brett Wright and Zachory Huish.

ELECTED OFFICIALS PRESENT ELECTRONICALLY: Councilmember Craig Whiting.

CITY STAFF PRESENT: Benjamin Reeves, City Manager; Steve Mumford, Deputy City Manager; Carson Stapley, Information Systems Manager; John Magness, Legislative and Policy Analyst; Evan Berrett, Director of Legislative and Strategic Services; Marcus Draper, City Attorney; Lacie Messerly, City Recorder; Kimberly Ruesch, Director of Administrative Services; Stephanie Allred, Deputy Recorder; Kyle Ireland, Communications Manager; Natalie Winterton, Assistant to the City Manager; Elizabeth Fewkes, Planner; Terrence Dela Pena, Finance and Management Analyst; Vince Hogge, City Engineer; Zac Hilton, Assistant Public Works Director; David Salazar, Assistant City Engineer; Sariah Farmer, Digital Communications Specialist and Embret Fossum, UFA Battalion Chief.

CITY STAFF PRESENT ELECTRONICALLY: Brad Hickman, Public Works Director, Mack Straw, Assistant Public Works Director and Michele Graves, Library Director.

4:00 PM WORK SESSION – CITY COUNCIL CHAMBERS

Mayor Gray called the meeting to order at 4:00 PM, after which the City Council immediately entered a Closed Session.

1. ADJOURN TO A CLOSED SESSION

MOTION: *Councilmember Wright moved to adjourn to a Closed Session for the purpose of discussion of pending or reasonably imminent litigation; the character, professional competence, or physical or mental health of an individual; the purchase, lease, sale, or exchange of real property; a proposed development agreement, project proposal, or financing proposal related to the development of land owned by the state or a political subdivision; and/or the deployment of security personnel, devices, or systems, pursuant to Section 52-4-205(1) of the Utah Code, Annotated. Councilmember Wood seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes

Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

The recording of the motion can be found here at 00:02:38.

2. AGENDA REVIEW

No discussion.

3. CITY MANAGER INFORMATION ITEMS

No discussion.

4. DISCUSSION AND INFORMATION ITEMS

No discussion.

7:00 PM POLICY SESSION – CITY COUNCIL CHAMBERS

5. CALL TO ORDER

Mayor Gray called the meeting to order at 7:06 PM.

The recording of the discussion can be found here at 00:07:16.

6. PLEDGE OF ALLEGIANCE

Unified Fire Authority led the Pledge of Allegiance.

7. INFORMATION ITEMS/UPCOMING EVENTS

City Manager Ben Reeves provided information and updates.

Mayor Gray recognized Economic Development Director Abby Ivory as a recipient of the 2026 Robert M. Ady Professional Scholarship through the Site Selectors Guild.

8. APPOINTMENTS

8.A. Community Services Board Appointments

1. Elizabeth Evans – One Year Term, April 2026 through March 2027

MOTION: *Councilmember Huish moved to approve the appointment of Elizabeth Evans as a Community Services Board Member from April 1, 2026 through March 31, 2027. Councilmember Clark seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

The recording of the motion can be found online here at 00:12:29.

2. Marian Burningham – Three Year Term, April 2026 through March 2029

MOTION: *Councilmember Clark moved to approve the appointment of Marian Burningham as a Community Services Board Member from April 1, 2026 through March 31, 2029. Councilmember Wright seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

The recording of the motion can be found online here at 00:13:04.

City Recorder Lacie Messerly administered the Oath of Office to Marian Burningham as Community Service Board Members. Elizabeth Evans will have the Oath of Office administered at a later date.

9. PROCLAMATION

Community Forester Alec Boydston read the Arbor Day Proclamation.

The recording of the discussion can be found online here at 00:17:42.

10. PUBLIC COMMENTS

Mayor Gray opened the public comment period at 7:21 PM.

The following individuals spoke during the Public Comment period:

- Kesslynn Winn – Spoke in favor of a community center/recreation center.

Mayor Gray closed the public comment period at 7:23 PM.

The recording of the discussion can be found online here at 00:20:23.

11. CITY COUNCIL/MAYOR ITEMS

The Mayor and Councilmembers offered comments to the public.

The recording of the discussion can be found online here at 00:24:14.

CONSENT AGENDA

12. BOND RELEASES

12.A. Oquirrh Mountain Ranch & EM Central Stake LDS Building - Into Warranty

13. MINUTES

13.A. March 25, 2026 Minutes – Special City Council Meeting

14. RESOLUTIONS

14.A. RESOLUTION – A Resolution of Eagle Mountain City, Utah, Approving a Land Exchange Agreement with SITLA for the Exchange of Properties in the Overland Area.

14.B. RESOLUTION – A Resolution of Eagle Mountain City, Utah, Approving a Memorandum of Agreement Concerning Overland.

14.C. RESOLUTION – A Resolution of Eagle Mountain City, Utah, Amending the Employee Policies and Procedures Manual to add Section 4.31.

14.D. RESOLUTION – A Resolution of Eagle Mountain City, Utah, Approving a Separation Agreement and General Release.

MOTION: *Councilmember Clark moved to approve the Consent Agenda removing items 14.A. and 14.B. and moving them to Scheduled Items. Councilmember Wright seconded the motion.*

Melissa Clark Yes

Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Abstain
Brett Wright	Yes

The motion passed by a vote of 4:0, with one abstention.

The recording of the discussion can be found online here at 00:34:56.

Councilmember Rich Wood abstained from the Consent Agenda vote because he was not in attendance at the March 25, 2026 meeting and therefore did not participate in approving the minutes.

SCHEDULED ITEMS

Item 14.A. was removed from Consent Agenda for further discussion.

14.A. RESOLUTION – A Resolution of Eagle Mountain City, Utah, Approving a Land Exchange Agreement with SITLA for the Exchange of Properties in the Overland Area.

The recording of the discussion can be found online here at 00:37:32.

Brad Mackay with Ivory Homes and City Attorney Marcus Draper responded to questions from the City Council.

MOTION: *Councilmember Whiting moved to approve a Resolution of Eagle Mountain City, Utah, Approving a Land Exchange Agreement with SITLA for the Exchange of Properties in the Overland Area conditioned upon:*

1. *Reciprocal language be added to Section 8 of the agreement; and*
2. *SITLA guarantees clean title of warranty.*

Councilmember Wright seconded the motion.

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

Item 14.B. was removed from Consent Agenda for further discussion.

14.B. RESOLUTION – A Resolution of Eagle Mountain City, Utah, Approving a Memorandum of Agreement Concerning Overland.

The recording of the discussion can be found online here at 00:49:56.

City Attorney Marcus Draper responded to questions from the City Council.

MOTION: *Councilmember Wood moved to approve a Resolution of Eagle Mountain City, Utah, Approving a Memorandum of Agreement Concerning Overland. Councilmember Huish seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

15. PUBLIC HEARING/NO ACTION TAKEN

15.A. PUBLIC HEARING ONLY/NO ACTION TAKEN – Community Development Block Grant (CDBG).

The recording of the discussion can be found online here at 00:50:37.

Representative from MAG, Taylor Draney provided an overview of the item, including the requirement to review proposed projects and obtain City Council and public input prior to final project selection and submission. Ms. Draney responded to questions from the City Council.

Tabithas Way Representative Josh Osborne presented information regarding the organization's request for CDBG funding and outlined the program's qualifications. Mr. Osborne also responded to questions from the City Council.

Saved by Grace Foundation President, June Barr and Vice President Mindy Muller presented their application for CDBG funding, outlining the organization's qualifications and need for grant funds. They also responded to questions from the City Council.

My Story Matters Representative Joshua Heslop provided background of the organization, outlined qualifications for CDBG funding, and responded to questions from the City Council.

Mayor Gray opened the Public Hearing period at 8:40 PM. Seeing no one wished to speak Mayor Gray closed the Public Hearing at 8:40 PM.

16. RESOLUTIONS/PUBLIC HEARING

16.A. RESOLUTION/PUBLIC HEARING – A Resolution of Eagle Mountain City, Utah, Approving a Portion of Utah County Parcel #46:489:0159 of Designated "Significant Real Property" Pursuant to EMMC 3.30.060 and 3.30.070, and Establishing Terms of the Disposal.

The recording of the discussion can be found online here at 01:42:10.

City Recorder Lacie Messerly presented the item and responded to questions from the City Council.

Mayor Gray opened the Public Hearing period at 8:45 PM. Seeing no one wished to speak Mayor Gray closed the Public Hearing at 8:45 PM.

MOTION: *Councilmember Wood moved to adopt a Resolution of Eagle Mountain City, Utah, Approving a Portion of Utah County Parcel #46:489:0159 of Designated "Significant Real Property" Pursuant to EMMC 3.30.060 and 3.30.070, and Establishing Terms of the Disposal:*

1. *The purchase price for the property is established at $2.07 per square foot, with the total amount determined by the final surveyed areas; and*
2. *All existing utility easements on the property shall be maintained.*

Councilmember Clark seconded the motion.

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

The recording of the motion can be found online here at 01:46:34.

17. ORDINANCES/PUBLIC HEARING

17.A. ORDINANCE/PUBLIC HEARING – An Ordinance of Eagle Mountain City, Utah, Approving the Parks, Trails, and Open Space Master Plan.

The recording of the discussion can be found online here at 01:48:25.

Director of Landscape Architecture Vince Olcott and Planner Emily Seang with MHTN Architects presented an overview of the Parks, Trails, and Open Space Master Plan. They

highlighted updates and summarized community feedback gathered through online surveys and local events, identifying common themes and key trends. They also outlined next steps in the process and presented proposed recommendations.

Mr. Olcott and Ms. Seang responded to questions from the City Council. The City Council provided direction and requested that the item return at a future work session for further discussion.

Mayor Gray opened the Public Hearing period at 9:50 PM.

The following individuals spoke during the public hearing period:

- Wendy Warren – shared concerns about inconsistencies in the maps presented in the proposed master plan and requested that they be updated to reflect current information.

- Adam Clark - requested that the City develop a clear vision for the community and plan outlining future direction.

Mayor Gray closed the Public Hearing at 9:57 PM.

MOTION: *Councilmember Clark moved to table an Ordinance of Eagle Mountain City Utah, Approving the Parks, Trails and Open Space Master Plan, directing consultant to take feedback presented and return with revisions at a future work session, along with an agenda item for potential approval at the same meeting. Councilmember Huish seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	No
Brett Wright	Yes

The motion passed with a 4:1 vote.

The recording of the motion can be found online here at 03:15:32.

17.B. ORDINANCE/PUBLIC HEARING – An Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code Section 8.15 regarding Noise to Modify Maximum Decibel Levels During Hours of Restriction.

The recording of the discussion can be found online here at 03:16:25.

Long Range Planner Elizabeth Fewkes provided a background of the item and presented a proposed code amendment to clarify existing noise standards, allowing sound levels up to 75 decibels in the Industrial and Light Manufacturing/Distribution zones during restricted hours. Ms. Fewkes responded to questions from the City Council, which provided direction for moving forward.

Mayor Gray opened the Public Hearing period at 10:32 PM. Seeing no one wished to speak Mayor Gray closed the Public Hearing at 10:32 PM.

MOTION: *Councilmember Whiting moved to adopt an Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code Section 8.15 regarding Noise to Modify Maximum Decibel Levels During Hours of Restriction as presented by staff, with the change that morning hours be adjusted from 9:00 a.m. to 7:00 a.m., seven day a week. Councilmember Huish seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	No

The motion passed with a 4:1 vote.

The recording of the motion can be found online here at 03:33:18.

17.C. ORDINANCE/PUBLIC HEARING – An Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code 2.35 (Public Library) and Eagle Mountain Municipal Code 17.15 (Roles and Duties) to modify the Timing of Appointments form January 1 – December 31 to April 1 – March 31.

The recording of the discussion can be found online here at 03:36:57.

Assistant to the City Manager Natalie Winterton presented the item, explaining that the amendment would align the timing of appointments for the Public Library Board and Planning Commission with those of the already approved Community Service Board.

Mayor Gray opened the Public Hearing period at 10:37 PM. Seeing no one wished to speak Mayor Gray closed the Public Hearing at 10:37 PM.

MOTION: *Councilmember Wood moved to adopt an Ordinance of Eagle Mountain City Utah, Amending the Eagle Mountain Municipal Code 2.35 (Public Library) and Eagle Mountain Municipal Code 17.15 (Roles and Duties) to*

Modify the Timing of Appointments from January 1 – December 31 to April 1 – March 31. Councilmember Wright seconded the motion.

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

The recording of the motion can be found online here at 03:38:24.

18. LEGISLATIVE ITEMS

18.A. DISCUSSION/PRESENTATION – Strategic Plan Vision and Mission Updates – Director of Legislative Affairs, Evan Berrett

The recording of the discussion can be found online here at 03:39:08.

Director of Legislative Affairs Evan Berrett presented the item, emphasizing the purpose of a successful strategic plan, vision, and mission statement for Eagle Mountain City. Mr. Berrett responded to questions and requested feedback from the City Council,

18.B. UPDATE – Legislative Priorities List

The recording of the discussion can be found online here at 03:52:39.

Mayor Gray excused Councilmember Rich Wood for the remainder of the evening.

Management and Policy Analyst John Magness requested feedback from the City Council regarding a justice court and guidance moving the process forward.

MOTION: *Councilmember Wright moved to add pursuing a Justice Court with Utah County be added to the Legislative Priorities List. Councilmember Clark seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Excused
Brett Wright	Yes

The motion passed with a 4:0 vote.

The recording of the motion can be found online here at 03:56:36.

MOTION: *Councilmember Clark moved to add a temporary business signage provision to the Legislative Priorities List, with direction for staff to return with a proposal to the City Council. Councilmember Wright seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Excused
Brett Wright	Yes

The motion passed with a 4:0 vote.

The recording of the motion can be found online here at 04:01:28.

19. DISCUSSION ITEM ONLY/NO ACTION TAKEN

19.A. DISCUSSION – Alternative Energy Overlay Zone – Director of Legislative Affairs, Evan Berrett

The recording of the discussion can be found online here at 04:02:44.

Director of Legislative Affairs Evan Berrett presented the item, reviewed the changes to the Alternative Energy Overlay Zone, requested feedback, and responded to questions from the City Council.

19.B. DISCUSSION – FY 2026-2027 City Budget Update – Director of Administrative Services, Kimberly Ruesch

The recording of the discussion can be found online here at 04:17:06.

Director of Administrative Services Kimberly Ruesch provided an update on future presentation dates for discussion of the FY 2026-2027 City Budget.

20. CITY COUNCIL/MAYOR'S BUSINESS AND LIAISON REPORTS

Mayor Gray and the City Councilmembers offered comments and reports on committees to which they are assigned as liaisons.

The recording of the discussion can be found online here at 04:18:58.

21. COMMUNICATION ITEMS

22. ADJOURNMENT

MOTION: *Councilmember Clark moved to adjourn the meeting at 11:19 PM. Councilmember Huish seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Excused
Brett Wright	Yes

The motion passed with a 4:0 vote.

The recording of the motion can be found online here at 04:20:02.

The meeting was adjourned at 11:19PM.

Approved by the City Council on April 21, 2026.

_____

Lacie Messerly
City Recorder

EAGLE MOUNTAIN
SPECIAL SESSON – BUDGET WORK SESSION

APRIL 14, 2026, 3:00 PM
EAGLE MOUNTAIN CITY COUNCIL CHAMBERS
1650 E STAGECOACH RUN, EAGLE MOUNTAIN, UT 84005

ELECTED OFFICIALS PRESENT: Mayor Jared Gray; Councilmembers Craig Whiting, Melissa Clark, Rich Wood, Brett Wright and Zachory Huish.

CITY STAFF PRESENT: Benjamin Reeves, City Manager; Steve Mumford, Deputy City Manager; Fionnuala Kofoed, Assistant City Manager; Carson Stapley, Information Systems Manager; John Magness, Legislative and Policy Analyst; Evan Berrett, Director of Legislative and Strategic Services; Lacie Messerly, City Recorder; Kimberly Ruesch, Director of Administrative Services; Christopher Waldron, Project Accountant; Jeret Shaffer, Finance Manager; Terrence Dela Pena, Finance and Management Analyst; Vince Hogge, City Engineer; Zac Hilton, Assistant Public Works Director; Mack Straw, Assistant Public Works Director; David Salazar, Assistant City Engineer; David Ulibarri, Public Safety Director; Brad Hickman, Public Works Director, Erik Knutzen, Chief Deputy Sheriff; Jeff Robinson, Sheriff's Office Lieutenant.

CITY STAFF PREENT ELETRONICALLY: Michele Graves, Library Director.

3:00 PM BUDGET WORK SESSION - CITY COUNCIL CHAMBERS

1. CALL TO ORDER

Mayor Gray called the meeting to order at 4:06 PM.

2. DISCUSSION OF PROPOSED BUDGET

2.A. BUDGET DISCUSSION ITEM

Chief Deputy Sheriff Erik Knutzen provided a presentation on the proposed budget and discussed available options for consideration during the upcoming budget season, including the potential addition of new deputy positions for Eagle Mountain City.

Assistant City Engineer David Salazar proposed SR-73 Improvements and High "T" Intersection, Trailhead and Pony Express Parkway Signal, Silverlake and Woodhaven Turn Lanes, Ranches Parkway Median Removal, Pole Canyon and Pony Express Parkway, Mt.

DRAFT

Airey Widening, South City Connectivity Study, future concerns and proposed solutions to City Council.

The recording of the discussions can be found online here at 00:04:22.

3. ADJOURNMENT

MOTION: *Councilmember Wood moved to adjourn the meeting at 5:04 PM. Councilmember Whiting seconded the motion.*

Melissa Clark	Yes
Zachory Huish	Yes
Craig Whiting	Yes
Rich Wood	Yes
Brett Wright	Yes

The motion passed with a unanimous vote.

The recording of the discussion can be found online here at 02:01:25.

The meeting was adjourned at 5:04 PM.

Approved by the City Council on April 21, 2026.

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Lacie A. Messerly
City Recorder

DRAFT

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	RESOLUTION – A Resolution of Eagle Mountain City, Establishing Special Revenue Funds Titled the Community Development Block Grant (CDBG) Fund, Recreation, Arts, and Parks (RAP) Tax Fund and Community Development Fund, and Public Art Fund.
ITEM TYPE:	Resolution
FISCAL IMPACT:	None to the General Fund. Revenues and expenditures will be restricted within the respective Special Revenue Funds.
APPLICANT:	City-Initiated

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	N/A

PUBLIC HEARING
No

PREPARED BY
Kimberly Ruesch, Finance Director
Terrence Dela Peña, Finance Analyst

PRESENTED BY
Kimberly Ruesch, Terrence Dela Peña

RECOMMENDATION:
Staff recommends the City Council approve a Resolution establishing Special Revenue Funds titled the Community Development Block Grant (CDBG) Fund, the Recreation, Arts, and Parks (RAP) Tax Fund, and the Community Development Fund, and the Public Art Fund.

BACKGROUND:

Eagle Mountain City receives and administers various revenues that are legally restricted for specific purposes. These include federal Community Development Block Grant (CDBG) funds, locally generated Recreation, Arts, and Parks (RAP) Tax revenues, and development-related revenues such as building permit fees, plan review fees, and other charges associated with community development activities, as well as revenues designated for public art purposes.

CDBG funds are provided through federal programs and must be used for eligible activities that benefit low- to moderate-income populations and comply with federal regulations and reporting requirements. RAP Tax revenues are generated through a voter-approved local option sales tax and are restricted for use on recreation, arts, and parks programs and capital improvements. Development-related revenues are intended to support the City’s planning, zoning, permitting, and inspection services, ensuring that the costs of these services are funded by the associated user fees. Public art revenues are generated through the City's Percent-for-Art Program and other authorized sources and are restricted to public art purposes in accordance with Eagle Mountain City Code 12.35.

As these funding sources continue to grow and require increased tracking and reporting, establishing separate Special Revenue Funds for CDBG, RAP Tax, Community Development, and Public Art is considered a best practice in governmental accounting and financial management. This approach promotes transparency, ensures proper segregation of restricted revenues, and aligns the use of funds with their intended purposes.

ITEMS FOR CONSIDERATION:
It is proposed to establish three Special Revenue Funds:

- **CDBG Fund** – for the receipt and expenditure of federal grant funds and any associated program income, in compliance with applicable federal regulations
- **RAP Tax Fund** – for the receipt and expenditure of RAP Tax revenues, restricted to recreation, arts, and parks purposes as authorized by the City Council
- **Community Development Fund** – for the receipt and expenditure of building permit fees, plan review fees, and other development-related revenues, to be used for the operations and costs associated with providing planning, zoning, permitting, and inspection services
- **Public Art Fund** — for the receipt and expenditure of revenues generated through the City's Percent-for-Art Program and other authorized sources, restricted for public art purposes in accordance with Eagle Mountain City Code Chapter 12.35

Establishing these funds will:

- Ensure compliance with federal, state, and local requirements
- Improve transparency and accountability in financial reporting
- Provide clear segregation of restricted revenues and expenditures
- Support audit and budget processes

Appropriations from these funds will be reviewed and approved by the City Council through the annual budget process or as otherwise directed.

PLANNING COMMISSION ACTION/RECOMMENDATION:
N/A

ATTACHMENTS:
1. Resolution

RESOLUTION NO. R- -2026

A RESOLUTION OF EAGLE MOUNTAIN CITY, UTAH, ESTABLISHING SPECIAL REVENUE FUNDS TITLED THE COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG) FUND, RECREATION, ARTS, AND PARKS (RAP) TAX FUND, COMMUNITY DEVELOPMENT FUND, AND PUBLIC ART FUND

PREAMBLE

WHEREAS, Eagle Mountain City desires to properly account for certain restricted revenues and expenditures; and

WHEREAS, establishing special revenue funds promotes compliance with applicable federal, state, and local requirements, improves transparency and accountability in financial reporting, provides clear segregation of restricted revenues and expenditures, and supports audit and budget processes;

NOW THEREFORE, BE IT RESOLVED by the City Council of Eagle Mountain City, Utah as follows:

1. The following Special Revenue Funds are hereby established:
   - Community Development Block Grant (CDBG) Fund
   - Recreation, Arts, and Parks (RAP) Tax Fund
   - Community Development Fund
   - Public Art Fund

2. The purpose of each fund is as follows:
   - CDBG Fund: For the receipt and expenditure of federal grant funds and any associated program income, in compliance with applicable federal regulations.
   - RAP Tax Fund: For the receipt and expenditure of RAP Tax revenues, restricted to recreation, arts, and parks purposes as authorized by the City Council.
   - Community Development Fund: For the receipt and expenditure of building permit fees, plan review fees, and other development-related revenues, to be used for the operations and costs associated with planning, zoning, permitting, and inspection services.
   - Public Art Fund: For the receipt and expenditure of revenues generated through the City's Percent-for-Art Program and other authorized sources, restricted for public art purposes in accordance with Eagle City Coded Chapter 12.35.

3. Appropriations from these funds shall be reviewed and approved by the City Council through the annual budget process or as otherwise directed by the City Council.

4. These funds shall be administered in accordance with applicable laws and standard governmental accounting practices.

5. This Resolution shall take effect upon adoption.

ADOPTED by the City Council of Eagle Mountain City, Utah, this 21st day of April, 2026.

EAGLE MOUNTAIN CITY, UTAH

_____
Jared Gray, Mayor

ATTEST:

_____
Lacie A. Messerly
City Recorder

CERTIFICATION

The above Resolution was adopted by the City Council of Eagle Mountain City, Utah on the 21st day of April, 2026.

Those voting yes:	Those voting no:	Those excused:	Those abstaining:
☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark
☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish
☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting
☐ Rich Wood	☐ Rich Wood	☐ Rich Wood	☐ Rich Wood
☐ Brett Wright	☐ Brett Wright	☐ Brett Wright	☐ Brett Wright

_____

Lacie A. Messerly
City Recorder

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	RESOLUTION - A Resolution of Eagle Mountain City, Utah, Declaring Surplus Property - Fleet Vehicles.
ITEM TYPE:	Resolution
FISCAL IMPACT:	
APPLICANT:	City Staff

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	N/A

PUBLIC HEARING
No

PREPARED BY
Jeff Weber, Fleet & Facilities Operations Director

PRESENTED BY
Jeff Weber

RECOMMENDATION:
Staff recommends the City Council approve a Resolution of Eagle Mountain City, Utah, Declaring Surplus Property - Fleet Vehicles.

BACKGROUND:
The list of fleet vehicles recommended for surplus are part of the 5-year and 10-year replacement program. Fifteen replacement vehicles were purchased during FY25-26.

ITEMS FOR CONSIDERATION:
Staff recommends Council's consideration for amending Chapter 3.25 of the Eagle Mountain City Code to:

- Retain City Council approval requirements for disposal of real property, and
- Revise the code to allow disposal of personal property through administrative policy and best practices, rather than detailed requirements in City Code.

This change would preserve Council oversight of the disposal of real property while reducing routine agenda items, and improving operational efficiency for routine disposal of personal property. For example, existing administrative policy already designates the useful life of vehicles and establishes criteria for replacement. Vehicle replacements are reviewed annually and incorporated into the budget approval process for vehicle and equipment purchases.

PLANNING COMMISSION ACTION/RECOMMENDATION:
N/A

ATTACHMENTS:

1. Resolution
2. Fleet Surplus - FY25-26

RESOLUTION NO. R- -2026

A RESOLUTION OF EAGLE MOUNTAIN CITY, UTAH, DECLARING SURPLUS PROPERTY

PREAMBLE

WHEREAS, Section 3.25.010 of the Eagle Mountain Municipal Code describes the requirement for disposal of surplus property; and

WHEREAS, in accordance with the Eagle Mountain Municipal Code, the City Manager has determined that the vehicles described in Exhibit A are surplus and no longer needed by City departments; and

WHEREAS, Eagle Mountain City desires to dispose of the vehicles.

NOW THEREFORE, BE IT RESOLVED by the City Council of Eagle Mountain City, Utah as follows:

1. The vehicles more specifically described in Exhibit A are hereby declared surplus property.

2. The value of the vehicles may be determined by one or more of the following methods to determine the highest and best economic return to the City:

    a. Advertised competitive bid;
    b. Evaluation by a qualified and disinterested appraiser;
    c. Other professional publication and valuation service; or
    d. An informal market survey by the City Manager or designee.

3. Any monetary proceeds from the sale will be credited to the General Fund.

ADOPTED by the City Council of Eagle Mountain City, Utah, this 21st day of April, 2026.

EAGLE MOUNTAIN CITY, UTAH

_____
Jared Gray, Mayor

ATTEST:

_____
Lacie A. Messerly
City Recorder

CERTIFICATION

The above Resolution was adopted by the City Council of Eagle Mountain City, Utah on the 21st day of April, 2026.

Those voting yes:	Those voting no:	Those excused:	Those abstaining:
☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark
☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish
☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting
☐ Rich Wood	☐ Rich Wood	☐ Rich Wood	☐ Rich Wood
☐ Brett Wright	☐ Brett Wright	☐ Brett Wright	☐ Brett Wright

_____

Lacie A. Messerly
City Recorder

Exhibit A

Vehicle Number	Department	Year	Make	Model
70	STORM DRAIN	2014	Freightliner	114SD
110	STORM DRAIN	2019	Freightliner	M2 106
107	SEWER	2017	Ford	F-350
112	WATER	2018	Ford	F-150
113	STORM DRAIN	2018	Ford	F-150
116	FLEET	2018	Ford	F-150
118	PARKS	2018	Ford	F-150
122	FACILITIES	2019	Ford	F-150
123	NEIGHBORHOOD IMPROVEMENT	2019	Ford	F-150
124	SWPPP	2019	Ford	F-150
125	ENGINEERING	2019	Ford	F-150
126	WATER	2019	Ford	F-150
127	WATER	2019	Ford	F-150
128	SEWER	2019	Ford	F-150
129	WATER	2019	Ford	F-150

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	RESOLUTION - A Resolution of Eagle Mountain City, Utah, Awarding the Bid for the EMC Work Authorization GMP 1, Membrane Filtration System (MFS) Equipment Procurement with MGC Contractors, Inc. for the WWTF 6.0 MGD Expansion Project.
ITEM TYPE:	Bid Award
FISCAL IMPACT:	$8,290,119.36
APPLICANT:	Eagle Mountain City- Initiated

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	N/A

PUBLIC HEARING
No

PREPARED BY
Mack Straw, Public Utilities Manager

PRESENTED BY
Mack Straw

RECOMMENDATION:
Staff recommends that the City Council approve a Resolution of Eagle Mountain City, Utah, Awarding the Bid for the EMC Work Authorization GMP 1, Membrane Filtration System (MFS) Equipment Procurement with MGC Contractors, Inc. for the WWTF 6.0 MGD Expansion Project.

BACKGROUND:

GMP 1: MFS (Membrane Filtration System) Equipment Procurement

Eagle Mountain City requests Council approval to award and execute Work Authorization GMP 1 under the CMGC 6 MGC MBR Wastewater Expansion Pre-Construction contract with MGC Contractors, Inc. This authorization covers the procurement of the Membrane Filtration System (MFS) equipment for the WWTF 6.0 MGD Expansion project. The scope includes drafting and executing a purchase order with Veolia Environmental S.A. (or its authorized subsidiaries), potholing, procurement and installation of the effluent flow control valve and manhole, and associated contingency items (including potential selection of a temporary IMLR pump, valves, and air compressor for the MFS equipment package). The total lump sum compensation for this Work Authorization is $8,290,119.36. This critical early procurement step is necessary to maintain the overall project schedule and support timely delivery of the membrane filtration system equipment required for the new 6.0 MGD MBR wastewater treatment facility. The substantial completion milestone is delivery of equipment to site, which is expected to be by January 2028. The design of the upgraded site is centered around this equipment, and specifically this manufacturer. Design would be delayed significantly if this authorization were delayed.

ITEMS FOR CONSIDERATION:

PLANNING COMMISSION ACTION/RECOMMENDATION:
N/A

ATTACHMENTS:

1. Resolution
2. Recommendation of Award
3. Work Authorization - GMP 1 - MFS Equipment Procurement

RESOLUTION NO. R- -2026

A RESOLUTION OF EAGLE MOUNTAIN CITY, UTAH, AWADING THE BID FOR THE EMC WORK AUTHORIZATION GMP 1, MEMBRANE FILTRATION SYSTEM (MFS) EQUIPMENT PROCUREMENT WITH MGC CONTRACTORS, INC. FOR THE WWTF 6.0 MGD EXPANSION PROJECT AND APPROVING THE CONTRACT

PREAMBLE

WHEREAS, the City Council of Eagle Mountain City, Utah, finds that it is in the public interest to award the bid for the EMC Work Authorization GMP 1, Membrane Filtration System (MFS) Equipment Procurement with MGC Contractors, Inc. for the WWTF 6.0 MGD Expansion Project and approve the contract, as set forth herein.

NOW THEREFORE, BE IT RESOLVED by the City Council of Eagle Mountain City, Utah as follows:

1. The City Council finds that all required notices have been completed as required by law to consider and approve the bid award as set forth in Exhibit A.

2. The bid award and contract are hereby approved as set forth more specifically in Exhibit A.

3. The Mayor is authorized to execute the contract as set forth more specifically in Exhibit A.

4. This Resolution shall be effective upon passage.

ADOPTED by the City Council of Eagle Mountain City, Utah, this 21st day of April, 2026.

EAGLE MOUNTAIN CITY, UTAH

_____
Jared Gray, Mayor

ATTEST:

_____
Lacie A. Messerly
City Recorder

CERTIFICATION

The above Resolution was adopted by the City Council of Eagle Mountain City, Utah on the 21st day of April, 2026.

Those voting yes:	Those voting no:	Those excused:	Those abstaining:
☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark
☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish
☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting
☐ Rich Wood	☐ Rich Wood	☐ Rich Wood	☐ Rich Wood
☐ Brett Wright	☐ Brett Wright	☐ Brett Wright	☐ Brett Wright

_____

Lacie A. Messerly
City Recorder

Exhibit A

www.ae2s.com

April 14th, 2026

Eagle Mountain City
Attn: Mack Straw, Public Utilities Manager
1650 E Stagecoach Run
Eagle Mountain, UT 84005

RE: Recommendation of Award for EMC 6.0 MGD Wastewater Treatment Facility Expansion – GMP-1 MFS Equipment Procurement

Dear Mr. Straw:

Recommendation:
AE2S recommends that Eagle Mountain City award the Contract for **EMC 6.0 MGD Wastewater Treatment Facility Expansion – GMP-1 MFS Equipment Procurement Contract** to MGC Contractors, Inc. MGC Contractors, Inc.'s Lump Sum Compensation for the GMP1 MFS Equipment Procurement is $8,290,119.36. We are confident that MGC Contractors, Inc. meets the qualifications required to supply the goods and scope of work requested for the EMC 6.0 MGD Wastewater Treatment Facility Expansion.

WORK AUTHORIZATION NO. 1 – GMP-1: MFS Equipment Procurement:
MGC Contractors, Inc. will perform the following scope of work:

- Draft and Execute Purchase Order with Veolia Environmental S.A., or it's authorized subsidiaries, for the procurement of the Membrane Filtration System equipment.
- Potholing
- Effluent Flow Control Valve and Manhole
- **Contingency:** It is anticipated that contingency will be used to select a temporary IMLR pump as well as valve and air compressor type for the MFS Equipment Package.

Substantial completion for this work is within 954 days of authorization. Substantial completion will be met following completion of:

Milestone: Executed PO with Veolia, potholing, procurement of flow control valve, electric actuator, and manhole

PROPOSAL & WORK AUTHORIZATION EVALUATION:
MGC Contractors, Inc.'s project proposal was found to be responsive and complete. MGC Contractors, Inc. was selected as the CM/GC for the for EMC 6.0 MGD Wastewater Treatment Facility Expansion and is currently contracted for Preconstruction Services. Award will lead to successful completion of the initial project scope of work and keep the project on track.

AE2S also recommends awarding the **EMC 6.0 MGD Wastewater Treatment Facility Expansion – Membrane Filtration System Equipment Procurement Contract** to Veolia WTS Systems USA, Inc. in the amount of $6,283,335.00 on a Lump Sum basis (included in the GMP1 MFS Equipment Procurement award

to MGC Contractors, Inc.). The bid from Veolia WTS Systems USA, Inc. was found to be the most responsive, highest scoring, and lowest capital and overall life cycle costs during detailed bid evaluation. The overall 20-year NPV of recurring O&M costs showed Veolia had a total cost savings of $317,167 compared to the runner-up.

REQUESTED EAGLE MOUNTAIN CITY COUNCIL ACTION:
AE2S recommends moving to approve the Work Authorization No. 1 – GMP-1 MFS Equipment Procurement.

AE2S appreciates the opportunity to provide the Eagle Mountain City with professional engineering services for this important project. If you wish to discuss any of this information or have questions prior to issuing the Notice of Award, please do not hesitate to contact me.

Sincerely,

AE2S

Russell Sprague, PE
Project Manager

Encl.: MGC Contractors Inc. GMP 1 – MFS Equipment Procurement
Work Authorization Agreement Between Owner and Contractor for MFS Equipment Procurement
Contract | Unexecuted

SECTION 00 54 50

WORK AUTHORIZATION: GMP 1 – MFS EQUIPMENT PROCUREMENT

		Project No.
Owner:	Eagle Mountain City	EMC_FY26-04
Owner's Advisor:	AE2S, LLC	P13139-2023-002
Engineer:	AE2S, LLC	P13139-2023-002
CM/GC:	MGC Contractors, Inc.	
Project:	EMWWTF 6.0 MGD MBR Expansion	
Contract Name:	CMGC 6 MGC MBR Wastewater Expansion Pre-Construction	
Work Authorization:	GMP 1 – MFS Equipment Procurement	
Date Issued: 4-21-2026	Effective Date of Work Authorization:	

Terms used in this Work Authorization have the meanings stated in the General Conditions and the Supplementary Conditions.

The Contract is modified as follows upon execution of this Work Authorization:

ARTICLE 1—AUTHORIZED WORK

1.01 CM/GC shall complete all Work that is specified or indicated in this Work Authorization. The authorized Work is generally described as follows:

A. **GMP1 – Membrane Filtration System (MFS) Equipment Procurement**

1. Draft and Execute Purchase Order with Veolia Environmental S.A., or its authorized subsidiaries, for the procurement of the Membrane Filtration System equipment.
2. Potholing
3. Effluent Flow Control Valve and Manhole
4. **Contingency:** It is anticipated that contingency will be used to select a temporary IMLR pump, valve and air compressor type for the MFS Equipment Package, potholing, and effluent flow control valve and manhole.

1.02 The authorized Work Package is more fully defined in Exhibit A.

ARTICLE 2—COMPENSATION

2.01 Owner shall pay CM/GC for the completion of the Work Package described in this Work Authorization in accordance with the provisions set forth in the Agreement.

2.02 Lump Sum Work

A. Compensation for all Work is a lump sum amount of **$8,290,119.36.**

For all Unit Price Work, an amount equal to the sum of the extended prices established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item. Unit Price Work is itemized in Exhibit B. The extended prices for Unit Price Work set forth as of the Effective Date of the Work Authorization are based on estimated

quantities. As provided in Paragraph 13.02 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Owner's Advisor.

ARTICLE 3—CONTRACT TIMES

3.01 CM/GC agrees to perform the Work set forth in this Work Authorization pursuant to the schedule in Exhibit B. CM/GC will complete the Work covered in this Work Authorization in a timely manner that will (a) allow CM/GC to meet the Substantial Completion and final completion requirements of the Contract, and (b) avoid any adverse impact on the completion of other Work Authorizations for which a Milestone has been established.

3.02 Milestones and Associated Damages

A. Work included in this Work Authorization is a Milestone and must be substantially completed on or before the number of days from the effective date of this Work Authorization shown in Exhibit B.

1. The Milestone 1 will be considered substantially complete when the following requirements have been met:

Executed PO with Veolia, potholing, design submittals of flow control valve, electric actuator, and manhole

ARTICLE 4—CONTRACT DOCUMENTS

4.01 Contract Documents for Work Authorization

A. The Contract Documents are identified in the Agreement, Article 16. The following provisions do not limit or modify the Contract Documents.

B. The Contract Documents with specific applicability to this Work Authorization consist of the following:

1. This Work Authorization, including any exhibits identified as Contract Documents.
2. Bonds
    a. Performance bond, together with power of attorney.
    b. Payment bond, together with power of attorney.
3. The following which may be delivered or issued on or after the Effective Date of the Work Authorization and are not attached hereto:
    a. Contract Amendments pertaining to this Work Authorization
    b. Change Orders, Work Change Directives, and Field Orders that modify this Work Authorization.
4. Drawings and Specifications shown in Exhibit A as included parts of the Work Package (or Work Packages) authorized in this Work Authorization.

C. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 5—EXECUTION

Issued by Owner's Advisor

By:	Russell Sprague, P.E.
Title:	Project Manager
Date:	4-21-2025

Accepted by CM/GC

By:	Dan Taylor
Title:	Project Manager
Date:	4/14/26
By *(signature)*:	

Authorized by Owner

By:	Jared Gray
Title:	Mayor
Date:	
By *(signature)*:	

EXHIBIT A—DESIGN DOCUMENTS

ARTICLE 1—SPECIFICATIONS

1.01 Specifications entitled **Eagle Mountain Membrane Filtration System (MFS) Equipment Procurement Attachment C – Technical Specifications** dated **December 4, 2025.**

1.02 Specifications listed in the table of contents.

1.03 New Specifications as listed in the following table:

Section No.	Specification Title

1.04 Specifications from previous Work Authorizations (WA) as listed in the following table:

Section No.	Specification Title	WA No.	Errata No.

1.05 Errata as listed in the following table:

Errata No.	Description	Section No.	Paragraph No.	Date of Issue

ARTICLE 2—DRAWINGS

2.01 No Drawings associated with this Work Authorization

2.02 Drawings listed on the sheet index in the Drawings.

2.03 New Drawings as listed in the following table:

Sequence No.	Drawing No.	Drawing Title

2.04 Drawings from previous Work Authorizations (WA) as listed in the following table:

Sequence No.	Drawing No.	Drawing Title	WA No.	Revision No.

2.05 Revisions for this Work Authorization as listed in the following table:

Sequence No.	Drawing No.	Revision No.	Description	Date of Issue

ARTICLE 3—APPENDICES

3.01 The following appendices to this Work Authorization are hereby identified as Contract Documents:

A. **none**

3.02 Other appendices to this Work Authorization, enumerated as follows; are not Contract Documents:

A. **none**

Exhibit B - Work Authorization Compensation

Work Authorization N 1 **Work Authorization:** GMP1 - MFS Equipment Procurement

Project Number:	**EMC_FY26-04**			**Date:**	**April 9, 2026**
Project Title:	**2025 CMGC RFP 6 MGD MBR Wastewater Expansion**				
CONSTRUCTION SERVICES					**AMOUNT**
Direct Cost					
1	Membrane System Procurement				$ 6,283,335.00
2					$ -
3					$ -
4					
A.			**SUBTOTAL DIRECT COSTS**		**$ 6,283,335.00**
				CALCULATED RATE:	
B.	General Conditions (Excluding Bonds and Insurance)				$ 399,512.49
C.			**SUBTOTAL DIRECT COST & GENERAL CONDITIONS**		**$ 6,682,847.49**
D.	CMGC Fee - Overhead & Profit			5.50%	$ 367,556.61
E.			**SUBTOTAL INCLUDING FEE**		**$ 7,050,404.10**
F.	Contigency (Does Not Include Construction Fee)			10.00%	$ 668,284.75
G.					
H.					
I.			**SUBTOTAL INCLUDING CONTIGENCY**		**$ 7,718,688.85**
J.	Sales Tax	Cost of Material	$ 6,283,335.00	7.35%	$ 461,825.12
K.	Payment and Performance Bonds			0.75%	$ 57,890.17
L.	Insurance Including Builders Risk			0.67%	$ 51,715.22
M.	**Total GMP 1**			**$**	**8,290,119.36**

Contract Times

CM/GC agrees it will reach Substantial Completion for this Work Authorization within 954 days

CM/GC agrees it will reach Substantial Completion for Milestone 1 within 90 days

BID FORM FOR PROCUREMENT CONTRACT

ARTICLE 1—BUYER AND BIDDER

1.01 This Bid is submitted to:

Eagle Mountain City

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Procurement Contract with Buyer in the form included in the Procurement Bidding and Contract Documents, and to furnish the Goods and Special Services as specified or indicated in the Procurement Bidding and Contract Documents, for the prices and within the times indicated in this Bid, and in accordance with the other terms and conditions of the Procurement Bidding and Contract Documents.

ARTICLE 2—BIDDER'S ACKNOWLEDGMENTS

2.01 Bidder accepts all terms and conditions of the Instructions to Bidders. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period that Bidder may agree to in writing upon request of Buyer.

2.02 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Procurement Bidding and Contract Documents, the related data identified in the Procurement Bidding and Contract Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date
ADDENDUM NO. 1	December 19, 2025
ADDENDUM NO. 2	January 21, 2026
ADDENDUM NO. 3	January 30, 2026

B. If required by the Instructions to Bidders to visit the Point of Destination and the site where the Goods are to be installed or Special Services will be provided, or if, in Bidder's judgment, any observable local or site conditions may affect the delivery, cost, progress, or furnishing of the Goods and Special Services, then Bidder has visited the Point of Destination and site where the Goods are to be installed or Special Services will be provided (as applicable) and become familiar with and is satisfied as to the observable local and site conditions that may affect delivery, cost, progress, and furnishing of the Goods and Special Services.

C. Bidder is familiar with and is satisfied as to all Laws and Regulations that may affect the cost, progress, and performance of Seller's obligations under the Procurement Contract.

D. Bidder has carefully studied, considered, and correlated the information known to Bidder with respect to the effect of such information on the cost, progress, and performance of Seller's obligations under the Procurement Contract.

E. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Procurement Contract Documents, and the written resolution (if any) thereof by Engineer is acceptable to Bidder.

F. The Procurement Bidding and Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance of Seller's obligations under the Procurement Contract.

G. The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of the Bidding Requirements, that without exception the Bid (including all Bid prices) is premised upon furnishing the Goods and Special Services as required by the Procurement Bidding and Contract Documents.

H. Bidder acknowledges that estimated quantities are not guaranteed and are solely for the purpose of comparison of Bids. Final payment for all unit price items will be based on actual quantities, determined as provided in the Procurement Bidding and Contract Documents. Bidder also acknowledges that each unit price includes an amount considered by Bidder to be adequate to cover Bidder's overhead and profit for each separately identified item.

ARTICLE 3—BID

3.01 Bid items are not intended to be comprehensive scope descriptions. Bidder shall be responsible for providing a complete and operational system. Note that instruments should be included in the Bid Form.

3.02 Bidder shall enter the unit price Bid for each unit price line item on the Bid Form and enter the product of the unit price times the estimated quantity for that line item. Bidder shall enter the total of products of unit price and estimated quantity for each unit price line item in the space provided to the total on the Bid Form.

3.02 Discrepancies between the indicated figures and the arithmetically correct sum will be resolved in favor of the arithmetically correct sum.

3.03 The "Base Bid" is the sum stated in the Bid for which the Bidder offers to furnish the Goods and Special Services described in the Procurement Bidding and Contract Documents as the base, to which work may be added for sums stated in Additive Bids. An "Additive Bid" (or Additive) is an amount stated in the Bid to be [added to] [deducted from] the amount of the Base Bid if the corresponding change in the Goods and Special Services, as described in the Procurement Bidding and Contract Documents, is accepted.

3.04 Bidder will furnish the Goods and Special Services in accordance with the Procurement Contract Documents for the following Unit Price(s).

Item No.	Description	Unit	Estimated Quantity	Base Bid Amount
1	Design Phase Services	LS	1	$
2	Engineering Shop Drawings	LS	1	$

The Bid Price is provided in the files attached after the original forms

Item No.	Description	Unit	Estimated Quantity	Base Bid Amount
3	Membrane Filtration System (MFS) Membranes, Frames, and In-Tank Supporting Equipment (including supports to fully equip in-tank spare space)	LS	1	$
4	Membrane Thickening System (MTH) Membranes, Frames, and In-Tank Supporting Equipment (including supports to fully equip in-tank spare space)	LS	1	$
5	MFS Above Tank Permeate and Air Headers, Header Supports, and other fabricated components	LS	1	$
6	MTH Above Tank Permeate and Air Headers, Header Supports, and other fabricated components	LS	1	$
7	MFS Valves Assemblies, Ejectors, and Appurtenances	LS	1	$
8	MTH Valves Assemblies, Ejectors, and Appurtenances	LS	1	$
9	MFS Air Scour Blower System including train dedicated blowers and one standby unit	LS	1	$
10	MTH Air Scour Blower System including train dedicated blowers and one standby unit	LS	1	$
11	MFS Permeate Pump System including train dedicated pumps and one shelf spare unit	LS	1	$
12	MTH Filtrate Pump System including train dedicated pumps and one shelf spare unit	LS	1	$
13	RAS Pump System	LS	1	$
14	WAS Pump System	LS	1	$
15	Thickened WAS (TWAS) Pump System	LS	1	$
16	Chemical Feed Systems	LS	1	$
17	Compressed Air System	LS	1	$
18	MFS Instrumentation & Controls	LS	1	$
19	MTH Instrumentation & Controls	LS	1	$
20	Spare Parts and Special Tools	LS	1	$
21	Construction Drawings	LS	1	$
22	Integration, Startup, Commissioning, and Training Services	LS	1	$

Item No.	Description	Unit	Estimated Quantity	Base Bid Amount
23	Post Commissioning Services	LS	1	$
Total of All Unit Price Bid Items (Base Bid)				**$**

3.07 The following items of work are Bid Additives. They shall only be furnished and installed by the Seller and paid for by the Buyer, if so directed in writing by the Engineer. It is not included in the Base Bid Price. Unreasonable additive (high and/or low) values will result in a nonresponsive bid.

3.08 Indicate deductive amounts in parenthesis in the Bid Amount column.

3.09 If included in base bid, insert $0 for additive bid amount.

Item No.	Description	Unit	Estimated Quantity	Bid Amount
1	Technical Support and Process Monitoring Monthly Fee	Monthly Fee	1	$
2	Alternate Design Flux Rate	LS	1	$
3	Additive for 12-Year Full Replacement Warranty	LS	1	$
4	Additive for 8-Year Pro-Rated Warranty after 12-Year Full Replacement Period Ends for a total 20-Year Warranty	LS	1	$
5	Additive for Rotary Screw Type Blowers (similar acceptable manufacturers, minimum quality, and warranty as Rotary Lobe Blowers)	LS	1	$
6	**[Additive Proposed by Supplier]**	LS	1	$
7	**[Additive Proposed by Supplier]**	LS	1	$
8	**[Additive Proposed by Supplier]**	LS	1	$
9	**[Additive Proposed by Supplier]**	LS	1	$
10	**[Additive Proposed by Supplier]**	LS	1	$

ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the furnishing of Goods and Special Services will be completed and ready for final payment in accordance with Paragraph 10.06 of the General Conditions, modified by the Supplementary Conditions, and conform to the schedule of Procurement Contract Times set forth in Article 2 of the Procurement Agreement.

4.02 Bidder accepts the provisions of the Procurement Agreement as to liquidated damages.

ARTICLE 5—ATTACHMENTS TO THIS BID

5.01 The following documents are attached to and made a condition of this Bid:

A. Required Bid security in the form prescribed in the Instructions to Bidders.

Item No.	Description	Unit	Estimated Quantity	Base Bid Amount
1	Design Phase Services	LS	1	**250,000**
2	Engineering Shop Drawings	LS	1	80,000
3	Membrane Filtration System (MFS) Membranes, Frames, and In-Tank Supporting Equipment (including supports to fully equip in-tank spare space)	LS	1	2,167,560
4	Membrane Thickening System (MTH) Membranes, Frames, and In-Tank Supporting Equipment (including supports to fully equip in-tank spare space)	LS	1	490,275
5	MFS Above Tank Permeate and Air Headers, Header Supports, and other fabricated components	LS	1	195,000
6	MTH Above Tank Permeate and Air Headers, Header Supports, and other fabricated components	LS	1	85,000
7	MFS Valves Assemblies, Ejectors, and Appurtenances	LS	1	166,500
8	MTH Valves Assemblies, Ejectors, and Appurtenances	LS	1	80,000
9	MFS Air Scour Blower System including train dedicated blowers and one standby unit	LS	1	329,000
10	MTH Air Scour Blower System including train dedicated blowers and one standby unit	LS	1	115,000
11	MFS Permeate Pump System including train dedicated pumps and one shelf spare unit	LS	1	532,000
12	MTH Filtrate Pump System including train dedicated pumps and one shelf spare unit	LS	1	135,000
13	RAS Pump System	LS	1	625,000
14	WAS Pump System	LS	1	0
15	Thickened WAS (TWAS) Pump System	LS	1	135,000
16	Chemical Feed Systems	LS	1	92,000
17	Compressed Air System	LS	1	75,000
18	MFS Instrumentation & Controls	LS	1	235,000
19	MTH Instrumentation & Controls	LS	1	105,000
20	Spare Parts and Special Tools	LS	1	167,500
21	Construction Drawings	LS	1	0
22	Integration, Startup, Commissioning, and Training Services	LS	1	147,000
23	Post Commissioning Services	LS	1	76,500
	Total of All Unit Price Bid Items (Base Bid)			**6,283,335**

Item No.	Description	Unit	Estimated Quantity	Bid Amount
1	Technical Support and Process Monitoring Monthly Fee	Monthly Fee	1	0
2	Alternate Design Flux Rate	LS	1	0
3	Additive for 12-Year Full Replacement Warranty	LS	1	0
4	Additive for 8-Year Pro-Rated Warranty after 12-Year Full Replacement Period Ends for a total 20-Year Warranty	LS	1	0
5	Additive for Rotary Screw Type Blowers (similar acceptable manufacturers, minimum quality, and warranty as Rotary Lobe Blowers)-MFS system	LS	1	375,000
6	Additive for Rotary Screw Type Blowers (similar acceptable manufacturers, minimum quality, and warranty as Rotary Lobe Blowers)-MTH System	LS	1	170,000
7	[Additive Proposed by Supplier]	LS	1	
8	[Additive Proposed by Supplier]	LS	1	
9	[Additive Proposed by Supplier]	LS	1	
10	[Additive Proposed by Supplier]	LS	1	

Notes:
- Technical support and Process Monitoring is included in the Post Commissioning Services
- All prices are in USD

B. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids.

C. Technical Information Submittal (included in the Bid Evaluation Criteria in Instructions to Bidders)

1. Technical Information Submittal shall be prepared and be in sufficient detail so that the Buyer can conduct a comparative evaluation process. The Bidder shall submit information on each of the following topics, in the format identified below.
   a. Qualifications
      1) Resumes of following project team members (minimum)
      2) Project Manager
      3) Design Engineer(s)
      4) Start-Up Representative(s)
      5) Other team members as applicable
      6) Statement of Bidder's Qualifications
      7) Location of manufacturer and service centers
   b. References
      1) An installation list of at least five (5) installations of at least 3.0 MGD average daily capacity in operation for five years with at least three trains with similar equipment in the United States.
      2) Reference projects shall meet the criteria defined in Section 46 53 49.
      3) Provide the following information for each reference project:
         a) Project Engineer
         b) Contact Information for Project Owner
         c) Plant Location
         d) Design treatment capacity (peak, maximum month, and average annual).
   c. Comprehensiveness of Bid
      1) Complete Scope of Supply
         a) A detailed list of all equipment, valves, actuators, instrumentation and control devices, control panels, and all other ancillary equipment for a complete operating system.
         b) Level of technical support and remote support services offered and included.
         c) Indicate the equipment and requirements expected by Bidder to be "Supplied by Others."
      2) General Layout Drawings:
         a) Tank dimensions for basin volume required, location of valves, actuators, influent and effluent structures and/or wall penetrations, and piping
         b) Elevations relative to membrane basin floor for major project components including estimated head losses through membrane system.
         c) Clearly differentiate from equipment included in the Scope of Supply and components "provided by others."
         d) Dimensional drawings of the membrane bioreactor equipment including plan drawings with equipment and piping layout, membrane tank plan and sections, membrane cassette/rack plan and sections, and equipment standard details.
      3) Electrical Drawings:
         a) One-line Diagram

4) Process and Instrumentation Diagram (P&ID)
5) Summary Tabulation of connected electrical loads (HP)
   a) Voltage, phase, current draw.
   b) Horsepower (HP) and voltage requirements for all equipment.
   c) Test data for blowers and pumps.
6) Complete list and description of accessory or optional equipment.
   a) Include prices for Bid Additives for Additions or Deductions in Bid Form. Provide sufficient detail for Engineer's consideration.
   b) Include scope of supply associated with each Bid item for which a price was included. Include scope of supply of any proposed Bid Additive. Clearly label the scope of supply as "Scope of Supply for Bid Additive X," where X is the variable on the Bid form associated with the price for said optional scope.
7) Product data sheets for all equipment proposed, including, but not limited to, the following: membranes, valves, actuators, air scour blowers, pumps, air compressors, PLC's, etc.
8) Detailed explanation of membrane integrity testing capabilities.

d. Process Design Calculations:
   1) Complete Bid Form Attachment A – Design Parameters, Assumptions, & Results with the values and results utilized and obtained by design.
   2) Calculations supporting those values Bidder provided in Attachment A. Calculations should contain sufficient detail for Engineer to reproduce and verify Bidder's design.

e. Process Equipment:
   1) List summarizing all major equipment, including manufacturer name, series name, model number and location of manufacture.
      a) Equipment manufacturers specified will be considered the benchmark of performance and quality.

f. Process Control System:
   1) Operational Description
   2) Describe the programming and automation system controlling the membrane treatment process, including:
      a) Overview of the membrane system operations, air scour operations, permeate pump operations, RAS pumping operations, chemical cleaning operations, valve control methodology.
      b) Identify process of Operator control and the interface(s) through which the Operator can control the membrane system.
      c) Identify the amount of manual operation action expected for daily operation.
      d) Provide list of I/O points, both input for control of membrane system components, and output, but control of other WWTF processes.
   3) Membrane Filtration System Supplier (MFSS) shall provide system design direction on if there should be a dedicated master control panel associated with the Membrane Thickening System (MTH) or if control of the MTH will be included in the master control panel supplied for the Membrane Filtration System (MFS). Factors in making this determination shall contain redundancy, intersystem dependencies, complexity, cost, and other applicable factors of this nature.
   4) MFSS shall provide system design direction on which hardwired I/O shall be terminated to which MFSS provided control panels to maximize

redundancy and allow the system to continue operation in the event any single process train control panel is taken offline. A process train control panel is defined as any control panel other than the master control panel for the system.

g. Annual Operation and Maintenance Costs
   1) Complete Bid Form Attachment B – Membrane System Operations with the values and results utilized and obtained by design
   2) A schedule of prices for parts commonly requiring replacement and/or maintenance services (i.e., membrane components including each membrane module, cassette/rack, and remaining hardware for one complete cassette/rack installation consisting of supports, air and permeate headers, valves, fittings, and other in tank components; controls services; operational assistance; etc.). Scoring for this criterion will account for O&M costs, including replacement and operational costs.
   3) Operations and Maintenance costs shall be based on design net flux rates and not alternate design net flux rates.
   4) Manufacturer's recommended schedule for Operation and Maintenance. Schedule should detail frequency with which operators can expect to perform maintenance on equipment.
   5) Summary tabulation of electrical loads (provided above) blower curves, and duration of blower operation at design average annual influent flow (provided in 10, below) will be used to calculate average annual operating costs @ $0.11/kW-hr.
   6) Summary tabulation of electrical loads (provided above) pump curves, and duration of pump operation at design average annual influent flow (provided in 10, below) will be used to calculate average annual operating costs @ $0.11/kW-hr.

h. Capital Cost and Net Present Value
   1) Capital Cost for equipment is identified in Bid Form.
   2) Complete Bid Form Attachment C – Membrane System Costs with the values and results utilized and obtained by design.
   3) Capital cost of concrete will be evaluated for each individual membrane system basin design.
      a) Sufficient space around membrane assemblies for good hydraulic movement and plugging prevention shall also be considered.

i. Warranty and Ongoing Support
   1) Provide a copy of Manufacturer's Standard Warranty.
   2) Describe technical support, maintenance support/assistance, and service support offered to Bidder – if ongoing service and support requires additional service agreements, include pricing as Bid Alternate Bid Item if required - See Comprehensiveness of Proposal.
   3) Identify hours of operation of technical support staff.

j. Efficiency
   1) Blower (for both rotary lobe and rotary screw type) and pump curves.
      a) Individual blower curves of each blower and model. Efficiency curves shall be depicted on blower curves.
      b) Comprehensive blower curves shall depict the following:
         (1) Volumetric flow versus gauge pressure.
         (2) Total-efficiency trend lines
         (3) Total-power ratio

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(4) Design Operating Points @ design flow rates for the following conditions:
(a) Annual Average
(b) Maximum Month
(c) Peak Day
(d) Maximum Month with one Membrane Tank Offline

2) Indicate the duration of time each blower and pump will be required to operate per day at design annual average daily flow. (hrs. of operation/day/blower).
3) All motor sizing shall include considerations for site elevation.

k. List of Exceptions
1) A detailed list of any exceptions, functional differences, or discrepancies between the Bidder's proposed system and the Bidding and Contract Document requirements. It is assumed that a lack of any statement of exceptions from the Bidder indicates the Bidder takes no exception to Bidding Documents as presented.

l. List of Manufacturers
1) Complete Bid Form Attachment D – List of Manufacturers

ARTICLE 6—BIDDER'S CERTIFICATIONS

6.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

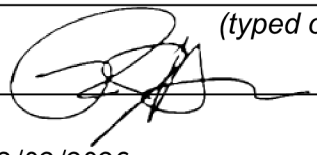
B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Procurement Contract. For the purposes of this Paragraph 6.01.D:
1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;
2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Buyer, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Buyer of the benefits of free and open competition;
3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Buyer, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process.

This Bid is offered by:

Bidder: Veolia WTS Systems USA, Inc.
(typed or printed name of organization)

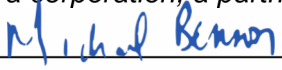
By: 
(individual's signature)

Date: 2/02/2026
(date signed)

Name: Ryan Hess
(typed or printed)

Title: Director - EPP NORAM Applications
(typed or printed)

(If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to

Attest: 
(individual's signature)

Title: Michael Benson - Commercial Contracts Manager
(typed or printed)

Address for giving notices:
3600 Horizon Blvd
Trevose, PA, 19053

Designated Representative:

Name: Grant MacInnis
(typed or printed)

Title: Regional Director
(typed or printed)

Address:
2913 Quitman St., Denver CO 80212

Phone: 303-396-9532
Email: grant.macInnis@veolia.com
License No.:
Classification:
Limitation:

Docusign Envelope ID: E459A2F0-5592-4AFE-94EA-BEFA4491C733

DELEGATION OF SIGNATURE AUTHORITY BY OFFICER

BY THIS DELEGATION OF SIGNATURE AUTHORITY, I as, respectively Vice President of Veolia WTS Analytical Instruments, Inc.; Veolia WTS International USA, Inc.; Veolia WTS Systems USA, Inc.; and Veolia WTS Solutions USA, Inc (hereinafter collectively referred to as "Veolia WTS"), with the delegable authority to sign contracts in the name of Veolia WTS, hereby delegate to the following individuals effective January 1, 2025:

Ryan Hess
Christopher Jansen
Paul Josephson

A. the authority to exercise my approval authority with regard to commercial operations under the Annual Actions Board Resolutions and subject to the prior approvals obtained via the VEOLIA Delegation of Authority Policy;

B. the authority to sign on behalf of Veolia WTS those certain agreements within my authority as Vice President, subject to the prior approvals obtained via the VEOLIA Delegation of Authority Policy; and

C. the authority to sell goods and/or services to Veolia WTS customers on standard terms and conditions.

Such delegation includes but is not limited to the delegated authority to sign all contractual instruments, certificates, documents, acknowledgments, consents, and other agreements as may be necessary or convenient in order to carry out the intent and purpose of the foregoing authority.

EXCEPT THAT THIS DELEGATION DOES NOT INCLUDE THE AUTHORITY TO:

1. Modify corporate insurance policies
2. Transfer intellectual property to a customer
3. Enter into joint ventures or partnerships
4. Provide advance payments to customers
5. Provide commissions to agents other than approved distributors
6. Provide deferred revenue
7. Buy back inventory
8. Engage in a Tiering arrangement

Nothing in this Delegation of Signature Authority alters any applicable Corporation review and approval requirements for the above-listed documents. The Delegation of Signature Authority conferred hereby shall NOT be further delegable.

This Delegation of Authority is valid until 31 December 2025.

This Delegation of Authority is immediately revoked in the event any of the listed Authorized Signatories cease to be employed by Veolia WTS or any of its affiliates.

This Delegation of Authority may at any time be amended and replaced by Veolia WTS.

This Delegation of Signature Authority supersedes all previously issued delegations.

IN WITNESS, WHEREOF, I, as Vice President of Veolia WTS, have caused my signature to be hereunto placed.

Signed by:
Richard Gray
4A14E2AE243246E...

Name: Richard Gray
Title: Vice President

Docusign Envelope ID: E459A2F0-5592-4AFE-94EA-BEFA4491C733

Acknowledged by Legal Dept.:

DocuSigned by:
Krystina Hamilton
895B6DFCBA4C420...

Acknowledged by Delegee:

DocuSigned by:
Ryan Hess
3963BE34017649A...

Acknowledged by Delegee:

Signed by:
714BE7F176B0405...

Acknowledged by Delegee:

Signed by:
Paul Josephson
80E55E1C3BDA4D3...

Bond No. 82733-Allianz-26-01

SECTION 00 43 00

BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name: Veolia WTS Systems USA, Inc. Address *(principal place of business)*: 3600 Horizon Blvd. Trevose, PA 19053	Name: Euler Hermes North America Insurance Company Address *(principal place of business)*: 100 International Drive, 22nd Floor Baltimore, MD 21202
Owner Name: **Eagle Mountain City** Address *(principal place of business)*: **Eagle Mountain City** **1650 E Stagecoach Run** **Eagle Mountain City, Utah 84005**	**Bid** Project *(name and location)*: **EMWWTF MFS Equipment Procurement** Bid Due Date: February 4, 2026

Bond

Penal Sum: Five Percent (5%) of Attached Bid

Date of Bond: January 28, 2026

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
Veolia WTS Systems USA, Inc. *(Full formal name of Bidder)*	Euler Hermes North America Insurance Company *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: Ryan Hess *(Printed or typed)*	Name: Julie Denman *(Printed or typed)*
Title: Director EPP NORAM Applications	Title: Attorney-in-Fact
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: Michael Benson *(Printed or typed)*	Name: Marta Baker *(Printed or typed)*
Title: Commercial Contracts Mgr.	Title: Witness

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
   3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
   3.2. All Bids are rejected by Owner, or
   3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 15 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 15 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one (1) year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

Allianz

Allianz Trade

EULER HERMES NORTH AMERICA INSURANCE COMPANY
100 International Drive, 22nd Floor • Baltimore, Maryland 21202

The number of persons authorized by this Power of Attorney is not more than: 1

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That EULER HERMES NORTH AMERICA INSURANCE COMPANY (EULER HERMES), a corporation organized and existing under the laws of the state of Maryland, does hereby nominate, constitute, and appoint the person or persons named below, each individually if more than one is named, its true and lawful attorney-in-fact, for and in its name, place, and stead to execute on behalf of EULER HERMES, as surety, any and all bonds, undertakings, and contracts of suretyship, or other written obligations in the nature thereof; provided that the liability of EULER HERMES on any such bond, undertaking, or contract of suretyship executed under this authority shall not exceed the limit stated below.

NAME	ADDRESS	LIMIT OF POWER
Julie Denman	125 Ottawa Avenue NW Suite 400 Grand Rapids, MI 49503	Unlimited

This Power of Attorney revokes all previous powers issued on behalf of the attorney(s)-in-fact named above.

IN WITNESS WHEREOF, EULER HERMES has caused these presents to be signed and attested by its appropriate officers and its corporate seal hereunder affixed this 1st day of December, 20 23.

James Daly, President and CEO-The Americas

Nicholas P. Verna II, Senior Vice President and Regional Head of Surety and Guarantee, Americas

State of Maryland, County of Baltimore

On this 1st day of December, 20 23, before me personally appeared Nicholas P. Verna II, to me known, being duly sworn, deposes and says that he resides in Southeastern, PA; that he is Senior Vice President and Regional Head of Surety and Guarantee, Americas of Euler Hermes North America Insurance Company, the Company described herein and which executed the above instrument; that he know the seal of EULER HERMES; that the seal affixed to said instrument is such corporate seal; that it was so affixed by authority of the Board of Directors of EULER HERMES; and that he signed his name thereto by like authority.

Notary Public

Notarial Seal

This Commission Expires February 2, 2026

This Power of Attorney is granted by authority of the following resolutions adopted by the Board of Directors of EULER HERMES NORTH AMERICA INSURANCE COMPANY (Company) by unanimous consent on October 1, 2015.

RESOLVED: That the President, Executive Vice President, Senior Vice President, Vice President, Secretary, and Assistant Vice Secretary, be and hereby are authorized from time to time to appoint one or more Attorneys-in-Fact to execute on behalf of the company, as surety, and any and all bonds, undertakings and contracts of suretyship, or other written obligation in the nature thereof; to proscribe their respective duties and all respective limits of their authority; and to revoke any such appointment at any time.

RESOLVED FURTHER: That the Company seal and signature of the aforesaid officers and may be affixed by facsimile to any Power of Attorney given for the execution of any bond, undertaking, contract of suretyship, or other written obligations in the nature thereof, such signature and seal when so used being hereby adopted by the Company as the original signature of such officer and the original seal of the Company, to be valid and binding upon the Company with the same force and effect as thought manually affixed.

CERTIFICATION

I, Nicholas P. Verna II, Senior Vice President and Regional Head of Surety & Guarantee, Americas of EULER HERMES NORTH AMERICA INSURANCE COMPANY, do hereby certify that the foregoing Power of Attorney and the Resolutions of the Board of Directors of October 1, 2015, have not been revoked and are now in full force and effect.

Signed and sealed this 28th day of January, 20 26.

Nicholas P. Verna II, Senior Vice President and Regional Head of Surety and Guarantee, Americas

Euler Hermes North America Insurance Company and its affiliated debt collection company are part of the Allianz group and market their products and services using the 'Allianz Trade' trademark.

Eagle Mountain Wastewater Treatment Facility (EMWWTF) 6.0 MGD MBR Expansion Project.

Submitted To:

Eagle Mountain City
E-mail: Myates@EagleMountain.gov
Attention: Melissa Yates
Telephone Number: 801-789-6641

Veolia Proposal Number: 639082
Date: February 4th, 2026

Submitted By:

Veolia WTS Systems USA, Inc.
3600 Horizon Blvd.
Trevose, PA 19053

Grant MacInnis
Regional Director
Telephone: 303-396-9532
E-mail: grant.macInnis@veolia.com

Local Representation By:

Coombs Hopkins
8706 South 700 East, Suite 201
Sandy, UT 84070

James Goldhardt
TelePhone:801- 674-217
Email : james@chcwater.com

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Cover Letter

2913 Quitman St.
Denver, CO 80212

Date: February 4th, 2026

Attn:
Melissa Yates, Purchasing Agent
1650 E Stagecoach Run
Eagle Mountain, Utah 84005

Re: EMC Membrane Filtration System (MFS) Equipment Supplier
REQUEST FOR PROPOSAL (RFP) NO. EMC-FY26-05

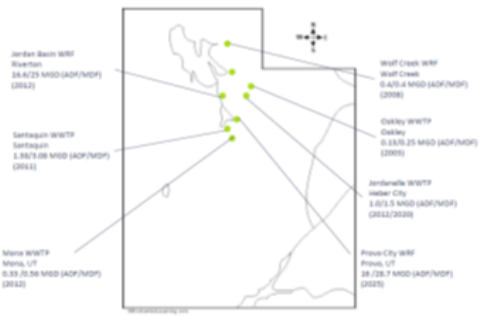
Dear Ms. Yates:

Veolia Water Technologies & Solutions is pleased to present our proposal for the supply of a ZeeWeed MBR system. We are proud to present what we believe to be the greatest value MBR in the industry – the MBR that has proven to be the lowest maintenance, the most reliable and the MBR requiring the least operator maintenance.

Experience in Your Application

The ZeeWeed-500 MBR represents the accumulated expertise of the largest installation base in the world, delivering proven performance backed by industry-leading recognition across Utah and nationwide. Its reinforced membrane fiber is engineered to withstand the demanding conditions high-solids applications without fiber breakage. This durability is validated by Utah's operational track record: ZeeWeed powers both the state's oldest MBRs (Oakley and Wolf Creek) and its largest (Jordan Basin). The same robust design that excels in membrane thickening provides the pathogen removal capabilities essential for potable reuse applications. Notably, Jordan Basin stands as Utah's only MBR integrated into a permitted Direct Potable Reuse facility, demonstrating ZeeWeed's versatility across the most stringent water quality requirements.

ZeeWeed MBR Utah Experience



- Seven operating municipal MBRs in Utah
- Hundreds of operating municipal MBRs
- 12 of the 13 largest operating MBRs in the USA
- Every MBR in the USA in a potable reuse application uses ZeeWeed

Thickening Experience

Traditional MBR focuses on water purification at moderate solids concentrations, while membrane thickening operates at significantly higher solids levels under far more demanding conditions. The elevated air scour rates and recirculation required to prevent solids accumulation create intense mechanical stress on membranes from both the concentrated solids and increased turbulence. In

this harsh environment, superior membrane mechanical strength and proven operating protocols are essential—not optional.

Veolia's ZeeWeed technology delivers both. Our reinforced membranes are purpose-built for thickening applications, and our decades of operational experience provide the critical knowledge to optimize performance and avoid costly failures. While other manufacturers are still experimenting with membrane thickening, Veolia offers proven technology backed by extensive field experience. When selecting a membrane thickening system, you need a partner with both a battle-tested product and the operational expertise to ensure long-term success—advantages that only come from years of real-world application, not laboratory trials.

project	technology	start up date	ADF/MDF (MGD)
Canton, OH	Kubota	2016-18	42 / 88
Euclid, OH	ZeeWeed	2020	22 / 66
Riverside, CA	ZeeWeed	2016	33.5 / 50
Brightwater, WA	ZeeWeed	2011	31 / 45
Visalia, CA	ZeeWeed	2016	22 / 44
North Las Vegas, NV	ZeeWeed	2011	25 / 35
Ballenger McKinney, MD	ZeeWeed	2014	15 / 34.8
Cox Creek, MD	ZeeWeed	2017	15 / 30
Yellow River, GA	ZeeWeed	2011	18 / 29.3
Abilene, TX	ZeeWeed	2015	18.7 / 26.7
Johns Creek, GA	ZeeWeed	2009	10.9 / 24.7
Jordin Basin WRF, UT	ZeeWeed	2010	13.9 / 20.9
Broad Run WRF, VA	ZeeWeed	2008	10 / 18.8

Membrane Life and Simplicity

Only ZeeWeed can demonstrate decades of long and reliable membrane life. The same factors that contribute to long membrane life provide the tools that guarantee simple, reliable operation.

1. **Robust, Unbreakable Membrane**
    a. ZeeWeed MBRs eliminate membrane breakage concerns. Unlike non-reinforced, monofilament fiber systems that are prone to breakage, ZeeWeed's robust design prevents the cascade of problems associated with fiber failure: solids passage, compromised effluent quality in potable reuse, increased maintenance requirements, frequent alarms, and costly fiber replacement procedures.

Monofilament fibers allowing turbidity spikes from broken fibers The reinforced fiber maintains turb < 0.03 NTU

2. **Easy and Reliable Solids Scouring**
    a. ZeeWeed's patented, large-bubble LEAP aeration system, combined with the flexibility of reinforced hollow fiber membranes, provides superior solids removal from fiber bundles. Fiber fragility limits the ability of monofilament fibers to withstand violent air scour, thereby adding to their tendency to plug with solids.

Our confidence in the ZeeWeed system is what allows us to include our industry-leading 20-year membrane warranty at no additional charge.

Service Excellence

Your membrane bioreactor represents both a substantial capital investment and a critical component of your secondary treatment process. While Veolia MBRs deliver industry-leading reliability, even the most dependable systems benefit from responsive, expert support when needed.

Our Utah Service Center in Salt Lake City provides that assurance—keeping essential parts, experienced technicians, and rapid response capabilities close at hand. When your operation depends on continuous performance, local support isn't just convenient—it's essential to protecting your investment and maintaining operational continuity

Chris Jackson
Veolia SLC Service Center Leader

Bri Braach
Utah Field Service Manager

We appreciate the opportunity to partner with you on this critical infrastructure investment and look forward to bringing decades of proven MBR excellence to your facility. Thank you for considering Veolia—where experience meets reliability, backed by unmatched local support.

Yours Truly,

Grant MacInnis, P.Eng.
Regional Business Leader
Veolia Water Technologies & Solutions
grant.macinnis@veolia.com
303-396-9532

1. Bid Forms

Attachments A, B, C and D, which are the required Bid forms, are supplied separately, along with the price. All necessary details are included within these forms.

2. Bidder's Certifications

The signed Bidder certification and the authority to sign the bid is included along with the price forms .

3. Bid Security

Bid security can be found in the price proposal.

4. Evidence of authority to do business in the state of the Project

The subsequent page contains proof of the authority to conduct business within the Project's state.

SPENCER J. COX
Governor

DEIDRE M. HENDERSON
Lieutenant Governor

UTAH DEPARTMENT OF COMMERCE
Division of Corporations and Commercial Code

MARGARET W. BUSSE
Executive Director

G. SCOTT WHITTAKER
Division Director

January 16, 2026

CERTIFICATE OF EXISTENCE

Registration Number:	5049000-0143
Business Name:	VEOLIA WTS SYSTEMS USA, INC.
Principal Office Address:	4636 SOMERTON ROAD, BLDG 8, TREVOSE, PA 19053
Registered Date:	01/15/2002
Entity Type:	FOREIGN BUSINESS CORPORATION
Current Status:	ACTIVE - CURRENT

The Division of Corporations and Commercial Code of the State of Utah, custodian of the records of business registrations, certifies that the business entity on this certificate is authorized to transact business and was duly registered under the laws of the State of Utah. The Division also certifies that this entity has paid all fees and penalties owed to this state; its most recent annual report has been filed by the Division unless the status above is delinquent; and, that Articles of Dissolution have not been filed.

Scott Whittaker

G. Scott Whittaker
Director
Division of Corporations and Commercial Code

Certificate Number: 202601160910958
Enter the certificate number at https://businessregistration.utah.gov/ to verify this certification.

5. Qualifications

5.1. Veolia's Project Execution Model

Veolia believes that successful projects are built on quality teams and communication. Our proven approach is to provide a dedicated engineering and project management team with extensive wastewater treatment plant design experience for each project. The goal of the team is to ensure on-time delivery and overall project success through:

- Frequent communication which allows Veolia to better understand the needs of the Owner
- Comprehensive technical and commercial understanding and knowledge of the project including budget, schedule, as well as regulatory, technical, and political issues – ensuring milestones are met
- Partnerships and communication protocols that will remain in place for the duration of the project
- Continuity of key disciplines through all phases of the project so those involved in the Design phase can be called upon during the startup and commissioning phase if needed

This clear and defined project approach guarantees that the project team will receive the best possible support from Veolia and therefore the best value for all stakeholders.

5.2. Proposed Project Team Experience

During the review and assembly of this bid, our project team identified below was engaged in the process in order to provide a comprehensive response and thorough understanding of the project requirements.

A summary of Veolia's design team members proposed for the Eagle Mountain Wastewater Treatment Facility (EMWWTF) is provided below and all team members are currently available to commence work on this project. Veolia has proposed our most experienced staff to work on this project to ensure it is a successful project for all parties.

All engineering, design, and commissioning support staff listed below are all based out of Veolia's Global UF/MBR Center of Excellence located in Oakville, Ontario.

Table 5-1: Proposed Project Team

Project Team	Team Member	Industry Experience (Years)
Project Manager	Rob Williams	27
Senior Process Engineer	Juliane Kirby	23
Mechanical / Project Engineer	John Seigner	36
Electrical Engineer	Jason Dreyer	13
Field Service Representative	Yurij Drozdowsky	21
Training Supervisor/Trainer	Paolo Forno	21
Technical Support	Dhananjay Bhatt	21
Regional Sales Manager	Grant MacInnis	26
Regional Life Cycle Manager	Jason Diamond	29

A brief description of the roles of the project team members are provided below. Veolia has the most extensive expertise and depth of resources dedicated to UF/MBR in the industry. This will guarantee the successful delivery and implementation of the Eagle Mountain Wastewater Treatment Facility (EMWWTF)

Regional Sales Manager – Grant MacInnis will be the primary contact for the project during the bidding stages and through the transfer to the project team. He is heavily involved with sales and marketing, product delivery and execution on water and wastewater projects within the region.

Veolia Project Manager – As the project manager for this project, Rob Williams will be the primary contact for the project from award through facility start-up. He will be responsible for overall schedule control, communications and Veolia team coordination and will be the single point of contact for the County, Engineer, and General Contractor.

Process Engineer – Juliane Kirby will be responsible for the membrane process design of the wastewater system, equipment specification and selection. Juliane was directly involved in the development of the ZW500EV product and the full-scale validation testing. It is the role of the process engineer to ensure that the proposed design is optimized with the best practices for the membrane and biological treatment processes. For continuity, the same process engineer will also assist with plant start-up support and on-going process support following commissioning.

Field Service Representative – Yurij Drozdowsky will be responsible for assisting the Contractor with on-site plant start up, commissioning and testing activities. He will also be involved in testing of instrumentation and the software FAT with the SCADA Integrator and assisting Paolo Forno with training.

Training Supervisor/Trainer – Paolo Forno will lead the training program for the County's operations and maintenance staff, which will include the development of the site-specific training requirements.

Technical Support/Post-Commissioning Operational Assistance – Dhananjay Bhatt will be responsible for assisting the County's operations staff with the Operational Support Services requested, including on-site service visits.

Regional Lifecycle Manager – Once the facility has been commissioned, Jason Diamond will continue to engage the County's Staff in frequent communication, assist with scheduling of any follow-up service visits associated with the provisional Long-Term Operation and Maintenance Services, ensuring timely access to all the technical resources provided by Veolia.

5.3. Project Team Resumes

The following pages detail Veolia's Project Team for the Eagle Mountain Wastewater Treatment Facility (EMWWTF)

Rob Williams
Lead Project Manager

Rob has served the water industry for the last 29 years working with a broad range of products including pre-treatment equipment, RO, E-CELL, and UFMBR. Rob has held roles of increased responsibility in Production, Service, Commissioning, Water & Wastewater plant operations, Quality, and Project Management.

In his current role as Project Manager, Rob manages a portfolio of primarily Municipal Wastewater projects ranging in scope, design, and complexity.

Employment Record

Water Technologies & Solutions

Project Management

2011 - Present

Quality Manager

2004 - 2011

Warranty Specialist

2000 - 2002

Field Service Technician

1992 - 2000

Job Specific Experience – Project Manager

Project Manager, Municipal WW CF&E

Walnut Creek, GA – 6.0 mgd

Fort Mill WPCP, SC – 7.2 mgd

Little River MBR, GA – 2.1 mgd

Cranberry Township MBR, PA – 7.5 mgd

Ballenger MBR, MD – 15 mgd

Cox Creek MBR MD – 15 mgd

City of Visalia MBR, CA – 20 mgd

Lathrop MBR, CA – 1.05 mgd

IQ Project Manager, Quality & Reliability

ZENON Environmental (now GE) – Oakville, ON (Jan 2004 – 2011)

- Lead a global team to manage and resolve large warranty projects and systemic issue project.
- Responsible for the International Product and Maintenance Bulletin process; update policies/procedures, perform risk assessments, write & approve bulletins, manage distribution, tracking, and compliance.

Warranty Specialist (Services 2000-2002):

- Provided customers with on-line and telephone technical support 24/7.
- Responsible for the management and tracking of global and substantial site specific issues

Field Service Technician: Zenon & Glegg Water (now GE) - Guelph, ON (1992 – 2000)

- Responsible for performing field service and system commissioning for commercial and industrial water systems internationally.
- Managed an inventory of parts, consumables, tools, etc.
- Provided customers with on-site and telephone technical support 24/7.

Juliane Kirby

Senior Wastewater Process Engineer

Juliane Kirby has over 23 years of experience in MBR and MABR product manufacturing, research and development, testing and validation, and process design for municipal wastewater applications.

Academic Credentials

Wayne State University, B.S. Chemical Engineering

University of Windsor, B. Sc.

Biology

Employment Record

Water Technologies & Solutions

Senior Process Engineer NAM Municipal WW, 2022 – Present

Advanced Lead Researcher (Technology), 2013 – 2022

Testing and Validation Lead (Technology), 2008 – 2013

Six Sigma Lead, 2006 – 2008

Manufacturing Process Engineering (Supply Chain), 2001 – 2006

Roles and Responsibilities:

MABR and MBR process design for municipal wastewater applications, including biological process calculations, O&M estimation, and system control.

- Process equipment sizing
- Development of PFD, P&ID, General Arrangement and Plot Plan drawing.
- Design co-ordination with consulting engineers
- Process support for start-up, operation, and optimization of wastewater treatment plants

Job Specific Expertise

- Design, execution and commissioning of municipal MBR and MABR wastewater treatment plants
- Process validation lead for ZeeWeed Technology pilot systems

Job Specific Experience:

- *Oxford WWTP, London, ON*- ZW500EV MBR pilot installation

  Process Lead and Researcher
- *Babcock Ranch WRF, Babcock Ranch, FL*- 0.75 MGD MBR facility treating municipal wastewater

  Process Engineering
- *City of Republic WWTP, Republic, MO*– 5 MGD MBR expansion of facility treating municipal wastewater

  Process Engineering
- *Caesars Lane WWTF, Windsor, NY*- 5 MGD MBR expansion of facility treating municipal wastewater

  Process Engineering

John Siegner, MBA, P.Eng.
Project Engineer

John Siegner has 36 years engineering experience working in the Water / Wastewater Industry, currently with Veolia WTS. He is engaged by the Project Engineering department in the delivery of the detailed design of municipal drinking water, industrial pure water, and municipal/industrial wastewater systems.

John coordinates a multi-disciplined team comprised of professional engineers and technologists to achieve project execution. His major focus is on design, equipment specification and selection for the mechanical, instrumentation and hydraulic systems of the plant.

Roles and Responsibilities:

Responsible for mechanical and process design of municipal and industrial water treatment systems, utilizing UF and RO membranes, ion exchange and conventional water treatment technologies.

Job Specific Experience:

- City of Barrie WWTP MBR Upgrade 20.5 MGD
  Barrie, ON
  Project Engineer
- City of Euclid WWTP, 22 /66 MGD MBR
  Euclid, Ohio
  Project Engineer
- City of Riverside RWQCP, 32 MGD MBR
  Riverside, California
  Project Engineer
- Council Bluffs Drinking Water Plant, 4 MGD UF/RO
  Council Bluffs, Iowa
  Project Engineer
- Dahab Desalination Water Plant , 2.6 MGD RO
  Dahab, Egypt
  Project Engineer
- Thornton Water Treatment Plant, 15 MGD UF/RO (Design)
  Thornton, Colorado
  Project Engineer

Employment Record

Water Technologies & Solutions

Senior Project Engineer

2017 - Present

Project Engineering

2000 - 2017

Technical Manual Development

1999 - 2000

Mechanical Engineer / Product Development

1988 - 2000

Jason Dreyer
EI&C Team Leader

Jason Dreyer has over 13 years of experience with Veolia in numerous roles. He has worked on various types and sizes of projects across the Veolia portfolio including UF/MBR facilities. In addition to his experiences with Veolia.
In his time with Veolia Mr. Dreyer has held roles with increasing responsibility with duties including commissioning, electrical design, automation design, commissioning/engineering management and project management. These roles have provided experience in projects across several continents, many industries and technologies including semiconductor, municipal water and waste, oil and gas, desalination, incineration and food and beverage.

Education & Certifications

B. Tech – McMaster University

Employment Record

Water Technologies & Solutions

EI&C Team Leader

2024 - Present

Project Manager

2019 - 2024

Commissioning Manager

2016 - 2019

Process Controls Specialist

2013 - 2016

Commissioning Representative

2011 - 2013

Key Qualities Include:

- Diverse technical background in automation, field service and construction
- Effective communication skills
- Strong leadership skills of both direct and indirect reports
- Vendor and stakeholder management

Selected Projects:

- Owatonna, MN – ZW500D MBR, 7.0 MGD
- Jordan Basin, UT – ZW500D MBR, 16.6 MGD
- Sanibel Island, FL – ZW500D MBR. 2.0 MGD
- Port Rowan, ON – ZW500D MBR, 0.4 MGD
- Samsung ATC, ROK – ZW500D MBR, 4.4 MGD

Yurij Drozdowsky
Field Service Representative

35 years of water treatment and engineering experience including commissioning / start-up and Site management in municipal and industrial water treatment systems.

Academic Credentials

B. Sc, Biochemistry – University of Toronto, 1981

B.A.Sc, Chemical Engineering – University of Toronto, 1984

Employment Record

Water Technologies & Solutions

Field Service Representative

2004 - Present

Responsibilities

- Currently responsible for the commissioning of the Veolia WTS products and systems in various locations in NAM.

Commissioning Experience

- Visalia, CA WWTP 15 mgd MBR
- Bush Brothers TN WRP MBR
- Cranberry Township, PA WWTP 25 mgd MBR
- Marathon Refinery MI WWTP MBR
- Lakeview ON WTP 100 mgd
- Lorne Park ON WTP 380 MLD
- Rapid City SD WTP 8 mgd
- Table Mountain Casino, CA WTP
- Chateau Lake Louise , AB WTP
- Buford, GA WTP
- Babcock Ranch FL WWTP
- Leoni Township, MI WWTP
- Fort Mill, SC WWTP
- Plumsted, NJ WW

Paolo Forno

Commissioning Support Training Specialist

Mr. Paolo Forno is a highly skilled professional with 20+ years combined experience in developing course curriculum and delivering training for various water purification systems.

Academic Credentials

Electrical Engineering Technology, Georgian College of Applied Arts and Technology, Barrie, ON

Employment Record

Water Technologies & Solutions

Commissioning Support Training Specialist

2023 - Present

Responsibilities

- Responsible for the development and delivery of training material associated with Veolia Water Technologies & Solutions products and systems.
- Interacts with North American and international customers and end users
- Experienced in the following equipment / technologies:
    - Ion exchange
    - Media filtration
    - Reverse Osmosis
    - Immersed Membranes - ZeeWeed 500
    - Pressurized Membranes - ZeeWeed 1500

Certifications

- Operator-in-training (OIT) Certification, Ontario Water Wastewater Certification Office
    - Water Treatment
    - Water Distribution and Supply
    - Wastewater Management
    - Wastewater Collection
- Certified Technician, OACETT (Ontario Association Certified Engineering Technologies and Technicians)

Project Experience

- 3M Cottage Grove, Wastewater Treatment
- Berens River Water Treatment Plant, Berens River, MB
- Chisasibi Drinking Water Treatment Plant, Chisasibi
- Pooler Wastewater Expansion, Pooler, GA
- LNG Canada

Dhananjay Bhatt, P.Eng.

Technical Support Team Leader

20+ years of engineering experience in the field of Water and Wastewater Plant Engineering providing Customer service support with the Veolia business from commissioning and servicing of the technologies personally to remotely working with operators of Veolia supplied plant and equipment and Veolia operating team. In his current role, Dhananjay is responsible for ensuring that customers are supported through the entire lifecycle of their facility from hand over, through warranty to equipment renewal and upgrades both day to day & after hours.

Employment Record

Water Technologies & Solutions

Team Leader Technical Support UF MBR

Jan 2023 - Present

Technical Support Specialist

July 2007 - Dec 2022

Technical Support Representative

April 2007 - July 2007

Field Service Representative

July 2004 - April-2007

Responsibilities

- Interact directly with Plant Operation and Maintenance team, contractor, vendor and provide technical support & warranty support to resolve day to day small and large issues
- As subject matter expert in direct customer support, troubleshooting through phone support, remote access to system controls PLC, review controls and advise operators in operating plant optimally
- Support and provide feedback to product and project team for resolving large and escalated issues, provide feedback on control deficiencies, system design deficiencies and recommend corrective action that provides better project delivery system. Working with various engineering team in the field of process, Instrument, control, Mechanical and Electrical

Grant MacInnis, P. Eng.

Senior Sales Manager – Central USA

Education & Certifications

Bachelor of Science in Mechanical Engineering

Queen's University at Kingston - Canada

Registered Professional Engineer

Employment Record

Water Technologies & Solutions

Regional director, Central USA

Dec. 2006 – present

Western USA process manager

Oct. 2003 – Dec. 2006

Project engineer

June 1999 – Oct 2003

Grant MacInnis - business development - central USA and Rocky Mountain region.

Mr. MacInnis is responsible for process flow development and design, technical sales support, bid preparation and contract document review for the sale of SUEZ water and wastewater treatment equipment and systems. This includes conceptual design of complete water and wastewater treatment systems, development of PFD, P&IDs & GAs.

- Extensive experience in; process flow sheet development, unit process equipment sizing, preparation of budgetary and detailed firm pricing proposals, and equipment design.
- Coordination of field test work, equipment commissioning, process trouble shooting, and technical presentations.
- Coordination with North American and international consultants and end users.
- Expertise developed in process equipment used for; water treatment, solids-liquid separation, and biological wastewater treatment

Jason Diamond, P.Eng.
Regional Lifecycle Manager

Jason Diamond has over 20 years of experience in the field of water and wastewater treatment, with responsibility for the support of SUEZ municipal customer water and wastewater plants in the Western US of various sizes, including separation equipment.

Education & Certifications

B.A.Sc., University of Waterloo, Ontario, Canada

Chemical Engineering (Co-op)

Employment Record

Water Technologies & Solutions

Regional Lifecycle Manager – Western US

March 2014 – Present

Wastewater Process Manager

March 2005 – March 2014

Wastewater Process Engineer

August 2000 – March 2005

Project Engineer - Municipal Systems

May 1997 – July 2000

Responsibilities include:

- Product support for the lifecycle of the plant providing a main point of contact assisting with:
- Technical Support
- Product Upgrades
- Insight Process Support
- Scheduled Service Visits
- Plant Audits
- Unscheduled Service Visits
- Operator Training
- Spare Parts and related product

Project Experience

- Traverse City, Michigan (Wastewater)
- Cauley Creek, Georgia (Wastewater)
- Rapid City, South Dakota (Drinking Water)
- Woodstock, Georgia (Wastewater)
- Tempe Kyrene, Arizona (Wastewater)
- Bedok, Singapore (Wastewater – Tertiary Treatment)
- Gwinnett County, Georgia (Wastewater – Tertiary Treatment)

5.4. Statement of Bidder's Qualification

Veolia meets or exceeds all the required qualifications of the RFP and expertly qualified to deliver commissioning services, technical support, and maintenance activities through all phases of the plant's life from engineering design services and commissioning through to long term plant operation. Should your treatment plant require service, we are prepared to provide the support you need with our dedicated service team.

Veolia Water Technologies & Solutions has a history defined by expertise and innovation. Throughout the years, Veolia Merged with ZENON Environmental and GE Water & Process Technologies and SUEZ Water Technologies & Solutions to develop and expand our portfolio and expertise in membrane bioreactor systems and ultrafiltration technologies. Today, Veolia Water Technologies and Solutions operates with over 10,000 employees and addresses the needs of over 50,000 customers worldwide. Additionally, relying on 650 R&D and expert staff as well as 17 Research & Excellence Centers, the business unit is committed to expanding its water treatment offerings and digital capabilities to deliver best-in-class solutions.

Veolia is one of the only players in North America with the capacity to offer a fully integrated treatment and operation solution from a single-source provider of both the membranes and the integrated systems and controls and have supplied complete MBR systems for over 30 years. We have the flexibility and capabilities to answer any client challenge in terms of technology, delivery model, contract approach and add-on services. We draw upon a complete portfolio of proven technologies to meet our clients' needs for a wide range of applications.

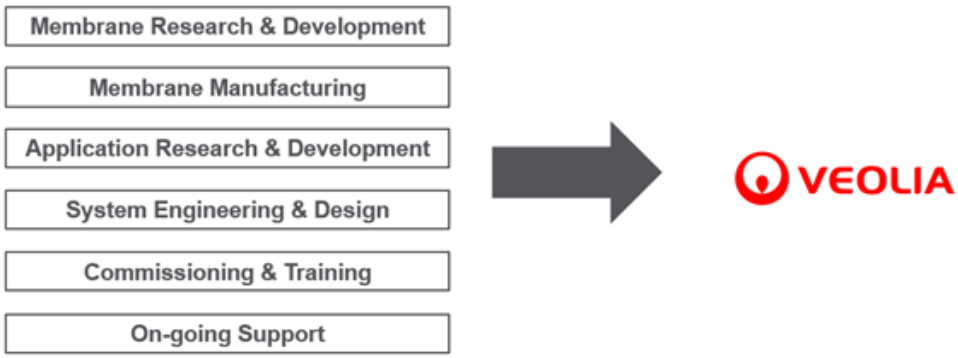
When it comes to supporting your plant and meeting your aftermarket service requirements, Veolia has distinguished itself from other MBR membrane manufacturers with the quality and range of post-commissioning service support offered to our clients. After initial project start-up and commissioning is complete, Veolia equipment system owners have access to comprehensive support through flexible, responsive, and professional service packages. Veolia has developed the systems and technical expertise necessary to anticipate and resolve any process or equipment problem

5.4.1. Veolia - A Leading Membrane Manufacturer and Equipment Supplier

Veolia Offers a Simple, Single Point of Accountability.

Veolia is 100% committed to the development of hollow fiber membrane-based technologies and their integration with wastewater and water treatment processes. The membrane polymers, modules, cassettes, and systems are entirely designed, tested, manufactured, delivered, and supported by Veolia.

The benefit to Eagle Mountain City and the Advanced Engineering and Environmental Services is that you will have a single, knowledgeable point of contact at all times for your system. The inevitable questions, areas of concern, and exploration are always answered quickly, and any process adjustment can be made promptly by your Veolia project team.



Veolia has distinguished itself from other UF-MBR membrane manufacturers with its exceptional membrane products, deep technical expertise, mature service culture, and the quality and range of commissioning and post-commissioning service support offered to its clients. We are ready to ensure the successful delivery, implementation, and long-term support for the Eagle Mountain City Water Filtration System**.**

Alongside 160 years of expertise in water, energy and waste, Veolia offers innovative solutions in the pursuit of human progress and well-being. At Veolia, we're more than the world's leading provider of environmental solutions - we're dedicated to customized, cost-effective solutions that reflect best practices, environmental protection, and a better quality of life.

Today, water, waste and energy can all be recovered – transforming what is discarded into a valuable resource. Veolia embraces this future by developing access to, preserving, and replenishing the world's resources.

Our Mission: Resourcing the World

Today we know that our planet's natural resources are limited, and the world's demands are increasing. Veolia is Resourcing the world — helping develop access to resources, preserving available resources and replenishing them.

Resourcing the world is not just about protecting the environment, but also regenerating it by developing sustainable access to resources while committing to their preservation and renewal.

Culture of Safety

Veolia's "Goal Zero" safety pledge is our commitment to strive for zero- work related injuries and illnesses and is a foundational element of our safety culture.

Veolia places great importance and emphasis on the health & safety of our employees, customers, and the communities in which we conduct business. Our Goal Zero vision is part of our continual improvement philosophy regarding worker and workplace safety.

Quite simply, we invest enormous amounts of time and resources to ensure our employees receive the necessary training and tools for success to perform their daily activities in a safe and compliant manner. We operate in strict compliance with all rules, regulations, and laws to meet and then exceed our commitments.

Veolia

At Veolia, we provide our customers with innovative products, processes, and solutions that directly support their business operations and goals. We're uniquely positioned to provide solutions in water, waste, and energy that promote sustainability and the circular economy. Working across the globe, Veolia has helped hundreds of customers reach their performance and compliance goals with sustainable solutions.

Veolia enables municipalities to meet growing population needs, overcome scarcity challenges, and comply with regulatory requirements.

Optimization Programs

Municipalities are facing increasing pressures, challenging water quality and wastewater services. Veolia can optimize existing infrastructure to get the most out of your plant while tailoring solutions that fit the needs of each individual plant.

Veolia is a complete service solution supplier by supplying expert engineering design services, commissioning services, operations, and aftermarket services to our customers. Whether it is providing capital equipment, saving on operations, or fulfilling emergency needs, Veolia is a trusted partner for the life of your plant.

Partnerships

We believe in long-term partnerships built on trust and proven performance to help industry maximize its water resources. Through these partnerships, we're helping cities and public agencies provide safe, reliable, and efficient water and wastewater services.

We are living in a world where water availability and quality is becoming an increased issue and water reuse is an emerging necessity. Veolia's reuse ready ZeeWeed membranes already provide the building blocks for water recycling; this, paired with our water reuse experts, are the critical key to successful reuse.

Produced Water Reuse

Water reuse is becoming increasingly important. Pairing with an experienced water management partner like Veolia is critically important for successful water reuse application.

Veolia's MBR systems have been tried and tested over decades of operational and R&D experience to become the leading membrane in the industry that not only offers process benefits, but operation and maintenance benefits that last the life of your plant.

Proprietary Wastewater Treatment Technology

ZeeWeed ultrafiltration hollow-fiber membranes reduce operating costs and maintain efficiency with a longer lasting membrane that gives you the confidence in your water treatment system's operation and ability to comply with regulatory requirements.

5.4.2. History of Veolia Water Technologies and Solutions (VWTS)

Veolia has a rich history defined by expertise and innovation, and has merged with various companies to develop and expand our portfolio and expertise in membrane bioreactor systems and ultrafiltration technologies.

ZENON Environmental

From modest beginnings in 1980, ZENON Environmental Inc. grew to become the global leader of low-pressure membrane filtration technologies. Driven by the vision that membranes are the world's answer to water shortages, overuse, and pollution, the company focused on a single goal—to make superior membrane systems a cost-effective solution for everyone who needs them. The ZeeWeed ultrafiltration membrane, developed in 1990, was a paradigm shift in membrane technology. At that time, membrane systems were primarily using pressurized cartridges with many components and high energy requirements. ZENON transformed the industry with the introduction of membranes that are immersed directly into process tanks and needing only a slight vacuum to filter water.

GE Water & Process Technologies

GE Water & Process Technologies acquired ZENON Environmental Inc. on June 1, 2006, uniting patented ZENON technologies with GE's corporate leadership and financial depth to provide unparalleled performance and the best overall water treatment solutions. GE Water & Process Technologies became a worldwide leading systems and services provider for municipal and industrial customers, supplying state-of-the-art water, wastewater, and process system solutions.

SUEZ – Water Technologies & Solutions

In 2017, SUEZ purchased GE Water & Process Technologies. GE Water & Process Technologies joined forces with SUEZ's Industrial Water activities to create the Water Technologies & Solutions business unit within the SUEZ Group. With a solid financial position and a wide breadth of portfolios, this business unit aimed to be a worldwide leader in water and treatment solutions for the industrial and municipal markets.

Veolia Water Technologies & Solutions

On January 18th, 2022 Veolia Group acquired SUEZ – Water Technologies & Solutions and began integration in September 2022 to become **Veolia Water Technologies & Solutions**. Veolia Group was already widely established worldwide, with nearly 220,000 employees. Veolia Water Technologies & Solutions now operates with over 10,000 employees and addresses the needs of over 50,000 customers worldwide. Additionally, relying on 650 R&D and expert staff as well as 17 Research & Excellence Centers, the business unit is committed to expanding its water treatment offerings and digital capabilities to deliver best-in-class solutions.

VWTS is the leading MBR company in the world and has achieved nearly 50% global market share and around 70 - 80% North American market share. Examples of available third-party research are provided below.

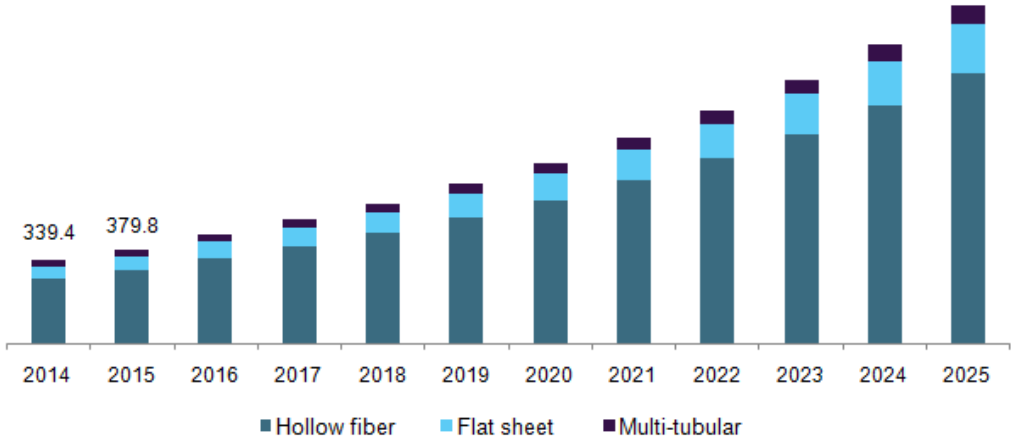


Figure 1-1: U.S. Membrane Bioreactor Market Revenue by Product, 2014 - 2025 (USD Million)
Source: Grand View Research - Membrane Bioreactor (MBR) Market Analysis By Product (Hollow Fiber, Flat Sheet, Multi-Tubular), By Configuration (Submerged, Side stream), By Application, And Segment Forecasts, 2018 – 2025.

5.5. Location of manufacturer and service centers

5.5.1. Main Headquarters

Veolia's UF/MBR Center of Excellence and North American membrane design center is located at 3239 Dundas Street West, Oakville, Ontario. The Oakville office employs approximately 500 staff, and is focused on developing, designing, and supporting water and wastewater treatment solutions using leading-edge membrane technologies. The Oakville facility is the focal point for Veolia's expertise with membrane-based treatment systems, including:

- Product research and development
- Sales and applications engineering
- Water and wastewater process engineering
- Project execution, including engineering, management, and commissioning services
- Long term post-commissioning field service support

Fig 1-1: Veolia's global UF/MBR Center of Excellence located in Oakville, ON, Canada

All design and engineering services for the Eagle Mountain City Water Filtration System project will be directed out of the **Oakville, Ontario UF/MBR Center of Excellence.**

Veolia proudly serves our customers at numerous facilities across North America. Veolia owns and operates all facilities related to the design, manufacturing, and supply of membranes, modules, and cassettes. All design activities of Municipal UF/MBR projects in North America occur at our UF/MBR Center of Excellence in Oakville, Ontario. All manufacturing of our membranes occurs at our world-class manufacturing facility in Oroszlány, Hungary.

5.5.2. Veolia Additional Offices and Locations

In addition to the UF/MBR Center of Excellence, Veolia has numerous facilities across North America and globally that are related to the design, delivery, manufacturing, and service support of ZeeWeed membrane treatment systems. The main facilities that will support Eagle Mountain City Water Filtration System include:

- Oakville, Ontario, Canada – Veolia UF/MBR Center of Excellence
- Guelph, Ontario, Canada – System Manufacturing Facility for UF/MBR equipment
- Oroszlány, Hungary – Manufacturing facility for ZeeWeed membranes
- Scottsdale, Arizona – Hubgrade Operations Center

Along with these locations, Veolia has a number of offices across North America dedicated to serving our customers in the design, manufacturing, R&D, and service support for water and wastewater treatment systems.

Table 5-2: Veolia's Offices

Office	Location
UF/MBR Center of Excellence	Oakville, ON
Membrane Manufacturing	Oroszlány, Hungary
Manufacturing	Minnetonka, MN
Manufacturing	Boulder, CO
Design Center & Office	Bellevue, WA
Design Center & Office	Richmond, VA
Design Center & Office	Ancaster, ON
Veolia WTS Corporate Headquarters	Trevose, PA
R&D Laboratory	Woodlands, TX
Service Center	Salt Lake City, Utah
Service Center	Phoenix, AZ
Service Center	Atlanta, GA
Service Center	Norfolk, VA
Service Center	Baytown, TX
Service Center	Fontana, CA

5.5.3. Membrane Manufacturing

The proposed ZeeWeed 500 Series membranes are manufactured in house at Veolia's world-class facility located in Oroszlány, Hungary. Veolia leads the membrane industry with the world's largest capacity for UF membrane manufacturing. By leveraging the capabilities of this manufacturing hub, Veolia can assure customers of on-time and on-budget product delivery no matter where treatment plants are located.

Built on a solid foundation of dedication and excellence, Veolia's membrane manufacturing division is committed to delivering high quality membrane products to global customers. Veolia owns and operates all of its manufacturing resources to ensure strict controls over the manufacturing process and rigid quality standards for every membrane module that leaves the plant. A dedicated team of individuals monitor incoming project orders that incorporate ZeeWeed membranes and are responsible for planning the production at the Oroszlány factory to ensure that all projects are delivered on time. As our backlog of orders increases, production capacity is continually reviewed to ensure that it is adequate.

Veolia employs the industry's most advanced manufacturing techniques, which enables the production of top-quality membranes with maximum efficiency. The manufacturing process is almost completely automated, which minimizes quality issues and maximizes product consistency. While the manufacturing facilities maintain an inventory of products, we constantly monitor bidding activity to confirm that sufficient manufacturing capacity is available to meet customer demand and that adequate product supplies are available to avoid project delays. Prior to shipping, all of our products undergo a rigorous inspection to verify that all system components meet the quality and performance standards that Veolia customers have come to expect.

The ZeeWeed membrane was invented in the early 1990s and currently specific product lines are manufactured in various facilities, those being Hungary, China, and the Netherlands. Prior to the inventions of ZeeWeed, Veolia (as Zenon), produced a tubular membrane product from the early 1980s until the early 2010s, at which time the product line was sold. Our experience with membrane supply and system design means that we have traveled up the learning curve and optimized both membrane and system design independently for cohesive operation. No other manufacturer has the same breadth and depth of experience to ensure that every aspect of the proposed MBR system is completely optimized and the best long-term solution is available for your project.

Figure 1-2: ZeeWeed Membrane Manufacturing

5.5.4. Local Presence and Support

Veolia is a proven leader in delivering tangible value to our clients over the life of the plant. Our measure of success is how well we deliver solutions that help our clients meet their critical business objectives in each and every year of operation. Veolia has distinguished itself from other UF membrane manufacturers with the quality and range of post-commissioning service support offered to its clients. After initial project start-up and commissioning is complete, Veolia equipment system owners have access to comprehensive support through flexible, responsive, and professional service packages. Veolia has developed the systems and technical expertise necessary to anticipate and resolve any process or equipment problem

5.5.4.1. Veolia In Utah

Veolia is uniquely qualified to deliver commissioning services, technical support, and maintenance activities through all phases of the plant's life, from equipment installation to long term plant operation. Should your treatment plant require immediate service, we are prepared to provide the support you need with our dedicated service team.

After initial project start-up and commissioning is complete, Veolia equipment system owners have access to comprehensive support through flexible and responsive professionals. Veolia has developed the systems and technical expertise necessary to anticipate and resolve any process or equipment problems.

Bri Braach
Utah Field Service Manager

Veolia's service team has over 200 UF/MBR trained experts in North America, with seven dedicated field service representatives (FSRs) located in the state of Utah and several more nearby in Wyoming, Colorado, Idaho and Arizona. Their local presence in Utah assures prompt service support. We stand behind our product and our service team prides itself in supporting and motoring your plant.

Brie Braach is Veolia's local Services Manager, overseeing this staff of FSRs living in the mountain region. Should you require assistance that cannot be resolved through 24/7 assistance, Brie and her team can provide a timely response.

Salt Lake City Service Center

Veolia's local service center is less than an hour from the Eagle Mountain site. Chris Jackson leads the team that is located at

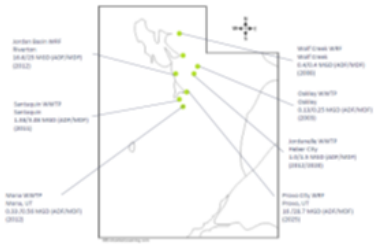
1698 S Gramercy Rd., Ste A , Salt Lake City UT 84105

Chris Jackson
Veolia SLC Service Center Leader

ZeeWeed Community in Utah

Utah is home to a community of Veolia ZeeWeed MBRs, including the largest (Jordan Basin and Provo) and the oldest (Oakley WWTP) in the state. This community is accessible to operators from Eagle Mountain through official events like the annual Veolia MBR Users Group Conference (hosted this year by Jordan Basin), but is also available informally – for questions, consultations, site training, etc.

ZeeWeed MBR Utah Experience



There are currently 7 operating ZeeWeed MBRs in the greater Salt Lake Area

5.5.4.2. Regional Lifecycle Manager

Veolia knows the importance and long-term implications involved in selecting a membrane supplier and we invest in the partnership through our regional lifecycle manager and other communications and services set up to support the operations staff over the life of the plant. The regional lifecycle manager will act as the Veolia's "quarterback", engaging in frequent communication with plant staff ensuring timely access to all the technical resources provided by Veolia. **Jason Diamond** has over 29 years of experience in water treatment and has extensive experience with technical support through her process engineering and commissioning roles.

Jason Diamond – Regional Lifecycle Manager
Ph: 905 399-7055
E-mail : jason.diamond@veolia.com

5.5.4.3. Local Representation

The Eagle Mountain City will be supported by Coombs-Hopkin Located in Salt Lake City.

Coombs-Hopkins Contact Information:

- **Location:** 8706 South 700 East, Suite 201, Sandy, UT 84070 (Salt Lake City Area)
- **Phone:** (801) 674-217
- **Key Contact:** James Goldhardt
- **Email** : *james@chcwater.com*

Veolia and Coombs-Hopkins are committed to long-term customer service and satisfaction, continuously improving through established customer relationships. With over 30 years of MBR experience in California, Coombs-Hopkins is well-equipped to assist operations staff locally.

This partnership ensures the City has reliable support, guaranteeing that someone will be available to answer the phone at any time of day to proactively anticipate or promptly resolve any process or equipment issues.

6. References

6.1. ZeeWeed MBR Experience

Veolia is the world leader in membrane filtration technology for wastewater treatment and has been a pioneer in the development of membranes for all water and wastewater treatment applications. Developed in the early 1990's, the patented ZeeWeed membrane is well-proven, with hundreds of ZeeWeed MBR plants in operation around the world, in a variety of wastewater treatment applications.

Globally, Veolia has similar experience furnishing MBR facilities for plants as small as 0.004 m^3/day to as large as 142 MGD (ADF). In comparison to any other manufacturer around the world, and more specifically in North America, Veolia has, by far, the most experience in design, delivery, commissioning, operation, and after-sales support of MBR systems. Customers trust Veolia as a project partner because of our experience and expertise delivering membrane bioreactor facilities to meet diverse customer needs. Veolia is the demonstrated leader in MBR systems and has delivered numerous successful plants, as shown below:

Table 6-1: MBR Experience

Total No. of ZeeWeed Membrane Treatment Plants Worldwide	**> 2,300**
Total No. of ZeeWeed Membrane Wastewater Treatment Plants in North America	**> 800**
Total No. of ZeeWeed Membrane Municipal Wastewater Treatment Plants in USA	**> 400**
Date of First MBR Installation in North America	**1993**

Over the next few years, global ZeeWeed treatment capacity will double, as plants currently in design and/or under construction are brought online.

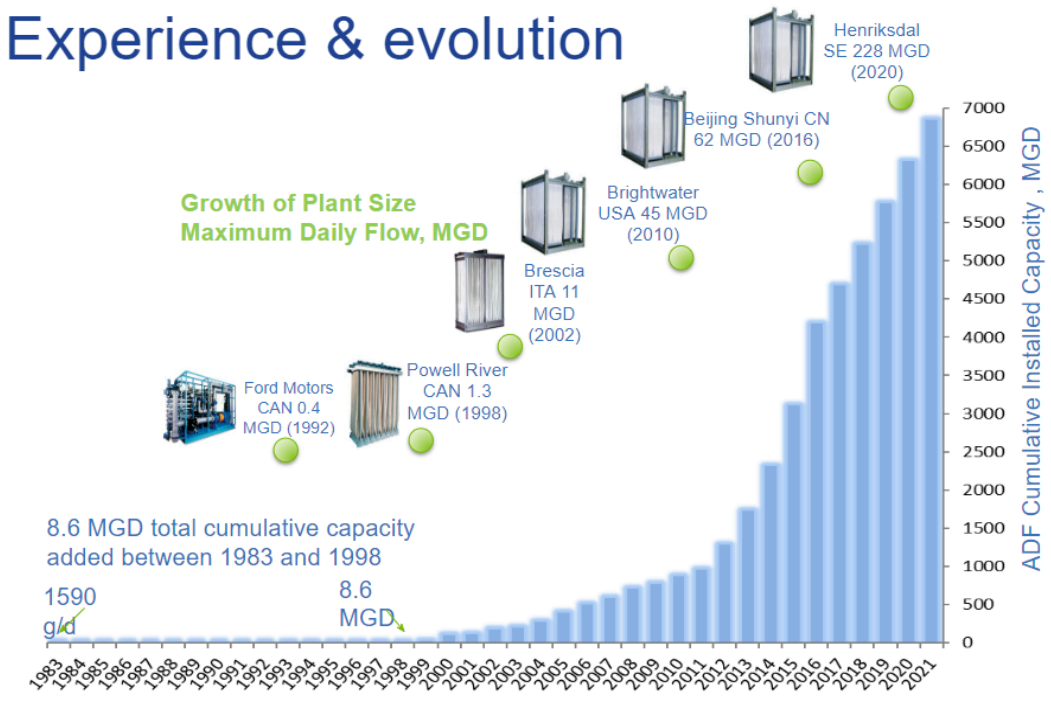


Figure 1-4: Veolia Cumulative MBR Capacity (2021)

The Eagle Mountain Wastewater Treatment Facility (EMWWTF) will benefit from the experience and lessons learned through the completion of these previous MBR projects. Veolia's regional knowledge combined with our experience in delivering membrane treatment projects of all sizes means that choosing Veolia as a partner will substantially **reduce risk and minimize additional project costs**.

Highlights of Veolia's Extensive MBR Experience include:

- ✔ Earliest ZeeWeed immersed MBR systems in operation for more than 28 years
- ✔ More than 50 municipal plants in North America that have demonstrated membrane life over 12 years
- ✔ MBR treatment capacity greater than double that of the next largest membrane supplier
- ✔ ZeeWeed wastewater treatment installations in 58 countries
- ✔ 12 of the 13 largest MBR plants operating in the United States

6.2. Veolia MBR Installations Between 2 and 10 MGD

Veolais is proud that most of the world's largest MBRs use Veolia ZeeWeed technology. The following list highlights a partial list showing **67 ZeeWeed MBR facilities in North America** that were designed by Veolia engineers and are operating with ZeeWeed membrane technology at an **ADF between 2 and 10 MGD, a similar flow range to the Design Conditions of Eagle Mountain City Water Filtration System.**

Table 6-2: MBR Operation Experience at the ADF similar or greater to Eagle Mountain City Water Filtration System (Partial List)

Facility Name	State/Province	ADF (MGD)	Commissioned
Butler Drive WRF (Peoria)	AZ	10.0	2008
NORSD	CA	10.0	2028
Ventura WRF	CA	8.5	2027
Brandon WWTF	MB	8.0	2009
Henderson South WWRF	KY	8.0	2011
Spokane County RWRF	WA	8.0	2011
Cave Creek	AZ	8.0	2027
Lloydminster WWTF	AB	7.9	2023
Crest Avenue WWTF	FL	7.5	2026
Fowler WRF	GA	7.5	2004
Redlands WWTP	CA	7.2	2004
Brush Creek WWTP	PA	7.2	2018
Traverse City WWTP	MI	7.1	2004
Canton WWTP	GA	7.0	2023
Rowlett Creek WRF	TX	7.0	2023
Owatonna WWTF	MN	7.0	2024
Gainesville Regional Utilities	FL	7.0	2028
Utley WRF, Town of Holly Springs	NC	6.7	2028
Ocotillo WRF (Chandler)	AZ	6.6	2015
Walnut Creek WRF	GA	6.4	2025

City of Beaumont	TX	6.3	2022
Pooler WWTF	GA	6.223	2004
San Luis Obispo WRRF	CA	6.2	2023
Beaver Creek WWTP	TN	6.0	2009
Parcc Side Clean Water Plant (North Kent Sewer Authority)	MI	6.0	2008
Butte-Silver Bow WWTP	MT	5.5	2016
Ironhouse Sanitary District WRF	CA	5.3	2011
Caesars Lane WTF	NY	5.0	2025
Copper Basin WRF	AZ	5.0	2024
Fresno-Clovis RWRF	CA	5.0	2015
Grand Forks WWTF	ND	5.0	2025
Hollister WRF	CA	5.0	2008
Lake Havasu North Regional WRF	AZ	5.0	2007
Marco Island WWTP	FL	5.0	2007
Republic WWTF	MO	5.0	2025
Sarnival WRF	AZ	5.0	2023
Temecula Valley WRF	CA	5.0	2019
Linwood WRF	GA	4.6	Aug 2007
Schofield Barracks WWTP	HI	4.2	Nov 2006
Bonita Springs East WRF	FL	4.1	Mar 2007
Anthem WWTP Village Water Campus	AZ	4	Feb 1999
Hollister Water Reclamation Facility	CA	4	Jun 2008
Tri-City WPCP	OR	4	Dec 2010
Oxford PCP	ON	3.6	Oct 2008
Lake Stevens Sewer District	WA	3.56	Jan 2012
North Regional WWTP	AZ	3.5	Sep 2007
Pooler WWTP	GA	3.34	Dec 2004
Blaine WWTP	WA	3.1	Aug 2010
American Canyon WWTP	CA	3	Aug 2002
Mid-Continent WRF	KS	3	Jun 2010
Randolph Park	MI	3	Dec 2003
Rubes Creek WWTF	GA	2.5	Dec 2003
Modesto WWTP	CA	2.3	Jul 2010
SCLA MBR	CA	2.23	Aug 2010

6.3. Project References

Of the Veolia municipal facilities with an ADF ≥ 3 MGD, the following were selected as the ZW500 MBR project references to meet the requested requirements as per spec section 46 53 49 - 6- 1.04 and addendum 2. All of the references provided are publicly operated facilities. These facilities will justify the proposed design for Eagle Mountain with regards to flux design, membrane life, and effluent requirements.

1. Jordan Basin Water Reclamation Facility, Utah
2. Yellow River Water Reclamation Facility, Georgia
3. Butler Drive Water Reclamation Facility, AZ
4. Riverside Regional Water Quality Control Plant, CA
5. Visalia Water Conservation Plant, CA
6. Rowlett Creek Water Reclamation Facility, North Texas MWD

6.3.1. Jordan Basin Water Reclamation Facility, UT

In response to Addendum 2's request, we confirm that we have no record of membrane warranty claims for the Jordan Basin Water Reclamation Facility in UT.

Project Description

The largest MBR in the state of Utah is the Jordan Basin Water Reclamation Facility (JBWRF), a state-of-the-art MBR wastewater treatment facility in the Jordan Basin Improvement District (JBID). The JBWRF, owned and operated by JBID, has a current treatment capacity of 16.6 million gallons per day (MGD) and is designed to be expanded in the future to an ultimate capacity of 33 MGD in order to meet the community's growth demands. The JBWRF was commissioned in 2012 with a capacity of 13.9 MGD, and expanded in 2018 to the current treatment capacity of 16.6 MGD, with ZW500D membranes. In 2024 as part of the membrane replacement project JBID upgraded some of the trains with Veolia's 500EV membrane and LEAPmbr aeration.

Plant Name	**Jordan Basin Water Reclamation Facility**
Owner (*Location*):	South Valley Sewer District (*Riverton, Utah*)
Installation Type:	New facility
Project Method:	Design, bid, build
Commissioned:	June 2012, Membrane upgrade in 2024
Contact Information	
Owner/Operator Contact:	Joel Thompson – JBWRF Facility Manager, *JBID* Tel: 801-571-1166 Email: joelt@svsewer.com
Prime Consultant Contact:	Jeff Beckman - Principal Engineer, *Bowen, Collins & Associates* Tel: 801-495-2224 Email: jbackmana@bowencollins.com
General Contractor Contact:	Mike McKinney - Vice President, *PCL Construction* Tel: 412-763-2709 Email: mmckinney@plc.com
Description of Facility	
System Type:	ZeeWeed MBR

Plant Name	Jordan Basin Water Reclamation Facility
Feed Source:	Municipal wastewater (13 to 25°C)
Facility Type:	Centralized
Process:	Enhanced biological nutrient removal
Effluent Use:	Surface water discharge to Jordan Basin
Unit Operations:	Influent pumping, course screens, vortex grit removal, 2-mm fine screens, biological treatment, membrane filtration, dewatering, sludge holding, UV disinfection
Process Configuration:	Bardenpho process (deoxygenation, anaerobic, anoxic, swing, anoxic + aerobic zones, 1 recycle)
Membrane Configuration:	8 membrane trains (L:43.6ft x W:21ft x D:11.5ft) 12 cassettes per train in two rows, 12 cassette spaces 1 train: 576 modules total ● 576 ZW500D modules in 48-module cassettes 7 trains: 3,304 modules total ● 376 ZW500EV modules in 64-module cassettes, and ● 96 ZW500D modules in 48-module cassettes
Membrane Type:	ZeeWeed 500D modules and 500EV modules manufactured by Veolia
Aeration Type:	Original cyclic aeration. Upgrade to LEAPmbr aeration in 2024, 105.6/211.2 dcfm per cassette in LEAP-Lo & LEAP-Hi respectively
Cassette Access:	Aluminum grating on membrane tanks, lifting bracket for cassette removal, cassette laydown on membrane tank grating Safety protocols outlined in Section 3.6
Membrane Life:	13 years (1 train, 500D) 12 years (7 trains, 500D) 1 year (7 trains, 500EV)
Membrane Replacement History:	Original membranes upgraded to ZW500EV in 2024
Additional Services Provided:	Detailed design support, membrane system startup, testing and training, and commissioning InSight-Basic

Project Delivery		Scheduled	Actual
Equipment Submittal Dates:	1st submittal	3-Aug-12	25-Jun-12
Equipment Delivery Dates:	1st delivery - equipment 2nd delivery - equipment 3rd delivery - equipment 4th delivery - membranes	24-Aug-10 29-Dec-10 3-Feb-11 19-Sep-11	24-Aug-10 29-Dec-10 3-Feb-11 19-Sep-11
Design & Operational Information	**Parameter**	**Influent**	**Effluent**
Influent & Effluent Design Criteria:	BOD (mg/L) TSS (mg/L) NH_3-N(mg/L) TKN (mg/L)	192 243 25 31	 ≤10 ≤5

	TP (mg/L) turbidity (NTU) fecal coliforms(SFU/100ml)		6 -	≤3.7 *summer* ≤5.6 *winter* - - ≤2.0 for 90% 126
Flow & Net Flux:		**Flow (mgd)***		**Flux (gfd)***	
		Design	**Operating**	**Design (at 13°C)**	**Operating (at 13°C)**
	ADF MMF PDF PHF**	16.6 18.0 25.06 28.34	15.1 - - 20.05	8.94 9.69 13.48 15.27	8.14 - - 10.80
	*** PHF is limited by original pump selection, not the membranes*				
TMP Range	Design: 0 to 8 psi		Operating: 1.0 to 4.8 psi	
MLSS:	Design: 10,000-12,000 mg/L in mem tank		Operating: 7,100-12,150 mg/L in bioreactor 14,000-17,000 mg/L in the RAS	
Plant Performance:	Plant meeting design objectives by performance test			
Failures/Repairs after Start up:	Tank coating issues - membranes were redistributed to avoid loss of capacity screen bypass during start-up - contractor manually removed debris from memb system capacity was not affected			
Power Consumption:	110 kWh/MG - (for the membrane blowers)			
Cleaning Information	**Frequency**		**Volume (gal/clean)**	
Maintenance Clean:	**Design**	**Actual**	**Design**	**Actual**
NaOCl (500 mg/L) Citric acid (2000 mg/L)	2/week 0/week	2/week -	32.5 -	80 -
Recovery Clean:	**Design**	**Actual**	**Design**	**Actual**
NaOCl (1000 mg/L) Citric Acid (4000 mg/L)	2/year 1/year	2/year 2/year	238 185	240 380
Manual Cleaning Events:	No manual cleaning events			
Relaxation Regimen				
Relaxation Duration:	30 seconds			
Relaxation Frequency:	Once every 12 minutes			

6.3.2. Yellow River Water Reclamation Facility, GA

In response to Addendum 2's request, we confirm that we have no record of membrane warranty claims for the Yellow River Water Reclamation Facility, GA

Project Description

The Gwinnett County Department of Water Resources is responsible for providing wastewater treatment for Gwinnett County, located just northeast of Atlanta. Two of the smaller wastewater treatment plants in the county, the Beaver Ruin WRP and the Jackson Creek WRF, are aging and will be decommissioned. The Yellow River WRF will be expanded in order to accommodate the flows previously treated by the two smaller plants. The consolidation of three plants into one will reduce the overall operating costs for the county, as well as improve the efficiency of treatment.

The Yellow River Basin consists of a sensitive river ecosystem, and during times of dry weather, effluent from the Yellow River WRF could comprise up to 80 percent of the river flow. It was critically important, therefore, that the Yellow River WRF be upgraded in order to provide a high level of treatment and minimize pollutant loadings to the river.

During the initial assessment in 2004, conventional wastewater treatment technology was considered for the Yellow River WRF expansion. At the time, MBR technology had relatively limited application, in particular for large treatment plants, and for this reason was not considered. However, the project capital cost using conventional treatment was significantly over budget, and a decision regarding the expansion and upgrade of the plant was delayed. By 2006, experience with MBR technology had grown significantly, and Gwinnett County decided to review the Yellow River WRF expansion using MBR rather than conventional technology. This review indicated that the capital cost for the MBR alternative was approximately $51 million less than the conventional alternative. In addition, although the annual operation and maintenance costs for the MBR alternative were slightly higher than conventional alternatives, a 20-year-life-cycle cost analysis revealed that the MBR alternative had a present worth approximately $41 million less than the conventional alternative.

A competitive bidding process resulted in the selection of Veolia to provide ZeeWeed MBR technology for the expansion and upgrade of the Yellow River WRF. ZeeWeed membranes produce superior effluent quality, ensuring that the pollutant loadings to the Yellow River will be reduced even with the increased flow rates.

The team of CH2M Hill, Jordan Jones & Goulding, and Precision Planning provide the overall design for the expanded Yellow River WRF. The wastewater will first be passed through 5-mm screens, followed by primary clarification. Primary effluent will then be passed through 2-mm fine

screens prior to entering the biological reactor basins. The biological treatment system has been designed with significant flexibility of operation within the bioreactors, with the intent of maximizing biological nutrient removal efficiency. The solid/liquid separation is achieved using ZeeWeed membranes, arranged into 10 parallel membrane trains, with each train containing 1-membrane cassettes. With a pore size of 0.04 microns, ZeeWeed membranes effectively remove all particles from the activated sludge, resulting in excellent effluent quality. Following membrane filtration, the treated water will pass through UV disinfection as a final treatment step.

Plant Name	**Yellow River Water Reclamation Facility**
Owner (*Location*):	Gwinnett County (*Lilburn, Georgia*)
Installation Type:	Expansion of existing facility
Project Method:	Construction manager at risk (CMAR)
Commissioned:	May 2011
Contact Information	
Owner/Operator Contact:	David Jones – Operations Superintendent *Gwinnett County* Tel: 678-376-7108 *david.e.jones@gwinnettcounty.com*
Prime Consultant Contact:	Scott Levesque - *Jordan Jones & Goulding (now Jacobs), CH2M* Tel: 678-619-6070 Email: scott.levesque@jacobs.com
General Contractor Contact:	Bob Huie – *PC Construction Company* Tel: 802-922-6535 Email: bhuie@pcconstruction.com
Description of Facility	
System Type:	ZeeWeed MBR
Feed Source:	Municipal wastewater (11 to 28°C)
Facility Type:	Centralized
Process:	Enhanced biological nutrient removal
Effluent Use:	Surface water discharge to Yellow River
Unit Operations:	Influent pumping, course screens, grit removal, equalization, primary clarification, fine screens, biological treatment, membrane filtration, GAC, UV disinfection, post aeration, gravity solids thickening, aerobic solids digestion, dewatering
Process Configuration:	Bardenpho process (pre-anoxic, anaerobic, & aerobic zones)
Membrane Configuration:	10 membrane trains (L:80.3ft x W:10ft x D:14.5ft SWD: 13.3ft) 12 cassette spaces per train, 10 cassettes installed in each train 480 modules per train in 48-module cassettes, 4800 modules total
Membrane Type:	ZeeWeed 500D modules manufactured by Veolia
Aeration Type:	Cyclic aeration, 225 dcfm per cassette
Cassette Access:	Covers on membrane tanks, lifting bracket for cassette removal, cassette laydown on membrane tank covers Safety protocols outlined in Section 3.6
Membrane Life:	14.5 years to date
Membrane Replacement History:	No modules replaced or repaired

Plant Name	Yellow River Water Reclamation Facility
Additional Services Provided:	Detailed design support, membrane system startup, testing and training, and commissioning InSight Basic, 24/7 technical support services, 1 site visit/year

Project Delivery		Scheduled	Actual
Equipment Submittal Dates:	Submittal Package	20-Jan-10	20-Jan-10
Equipment Delivery Dates:	Delivery	16-Dec-10	16-Dec-10

Design & Operational Information	Parameter	Influent	Effluent
Influent & Effluent Design Criteria:	BOD (mg/L) TSS (mg/L) TKN(mg/L) NH_3-N(mg/L) TP (mg/L) turbidity (NTU)	236 340 30 - 6.5 - -	TOC ≤8 ≤10 - ≤1.0 ≤0.3 ≤0.2 for 90% ≤0.5 for 100%

Flow & Net Flux:		Flow (mgd)		Flux (gfd)*			
				Design		Operating	
		Design	Operating	11°C	13°C	11°C	13°C
	ADF	18.3	14.5	13	13.7	12.7	13.4
	MMF	22.0	-	14.3	-	-	-
	PDF	29.3	22	21.7	22.9	22.2	23.5
	** The flux data reported is typical as of recent. The flux data taken for justification was from 2011 and can be provided upon request*						

TMP Range	Design: 0 to 8 psi	Operating: 1.0 to 4.8 psi
MLSS:	Design: 10,000-12,000 mg/L in mem tank	Operating: 5,100 mg/l in bioreactor 7,500 mg/L in RAS line
Plant Performance:	Plant meeting design objectives by performance test	
Failures/Repairs after Start up:	No failures or repairs	
Power Consumption:	3,357 kWh/MG (for the entire plant including equipment by others)	

Cleaning Information	Frequency		Volume (gal/clean)	
Maintenance clean:	Design	Actual	Design	Actual
NaOCl (200 mg/L) Citric Acid (2000 mg/L)	1/week 1/week	3/month 1/month	7.9 16.3	20* 25*
Recovery Clean:	Design	Actual	Design	Actual
NaOCl (1000 mg/L) Citric Acid (2000 mg/L)	2/year 2/year	2/year 2/year	328 136	~400* ~200*
**Chemical consumption volumes based on 12.5%wt/wt NaOCL and 50%wt/wt citric acid*				
Manual Cleaning Events:	no manual cleaning events			
Backwash/Relaxation Regimen				

Relaxation Duration:	30 seconds
Relaxation Frequency:	Once every 12 minutes

The PFD of this reference system has been provided on the following page.

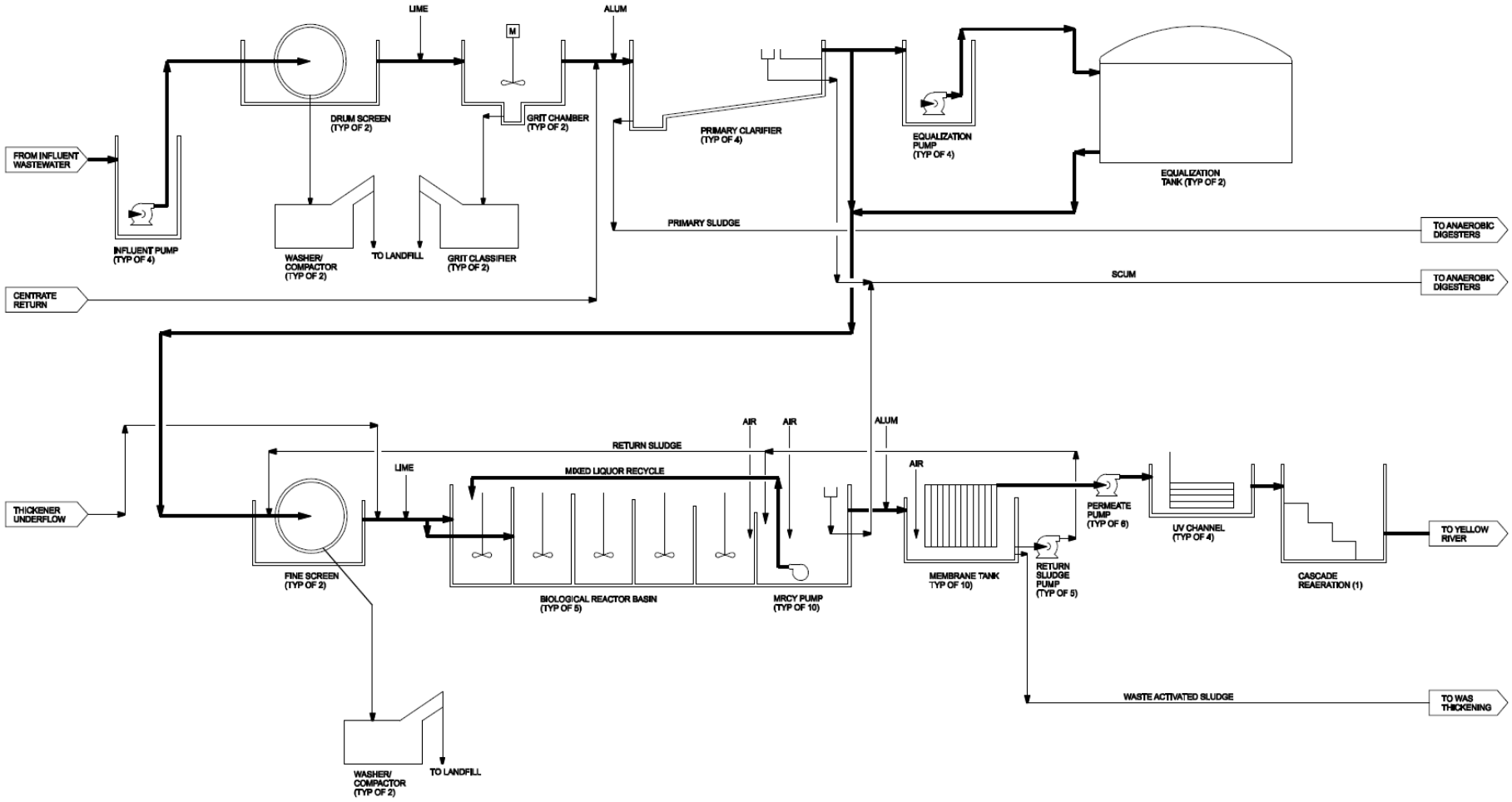


Figure 1-6: PFD of Yellow River Water Reclamation Facility, GA

6.3.3. Butler Drive Water Reclamation Facility, AZ

plant name	Butler Drive Water Reclamation Facility
owner (location):	City of Peoria (Peoria, Arizona)
installation type:	new facility
project method:	design, bid, build
commissioned:	June 2008, LEAPmbr upgrade in 2015
contact information	
owner/operator contact:	Rene Corral Tel: +1 (623)773-7224 rene.corral@peoriaaz.gov
description of facility	
system type:	ZeeWeed LEAPmbr
feed source:	municipal wastewater (9 to 37°C)
process:	enhanced nutrient removal
effluent use:	water reuse for non-potable purposes
unit operations:	influent pumping, course screens, grit removal, fine screens, biological treatment, membrane filtration, dewatering UV disinfection
process configuration:	2-stage Bardenpho process (pre-anoxic & aerobic zones)
membrane configuration:	10 membrane trains (L:56.5ft x W:10ft x D:12ft SWD:8.5-9.5ft) 4 cassettes per train in a single row (space for 8 cassettes) 192 modules per train in 48-module cassettes, 1920 modules total
membrane type:	ZeeWeed 500D 370 ft^2 modules manufactured by SUEZ
aeration type:	LEAPmbr aeration 80/160 dcfm per cassette in LEAP-Lo & LEAP-Hi respectively
cassette access:	aluminum covers on membrane tanks, lifting bracket for cassette removal, cassette laydown on beside membrane tank

membrane life:	7.5 years before upgrade to LEAP
membrane replacement history:	facility upgraded to ZeeWeed 500D 370 ft^2 modules in 2015 and LEAPmbr aeration to reduce their energy consumption by 30% thirty ZeeWeed 500D 370 ft^2 modules replaced in 2016 due to damage during handling by contractor (non-warranty replacement)
current additional services provided:	none

project delivery			**scheduled**		**actual**
equipment submittal dates:	schedule not available		N/A		N/A
equipment delivery dates:	schedule not available		N/A		N/A
design & operational information		**parameter**	**influent**		**effluent**
influent & effluent design criteria:		BOD (mg/L) TSS (mg/L) TN(mg/L) NH_3-N(mg/L) TP (mg/L) turbidity (NTU)	342 250 - 37 8 -		<2 <2 <6 <1 <1 <2
flow & net flux:		**flow (mgd)**		**flux (gfd)**	
		design	**operating**	**design**	**operating**	**@20°C**
	ADF	10.0	7.0	14.1	9.9	13.3
	MMF	12	-	-	-	-
	MDF	15.0	-	-	-	-
	PHF	20.0	12.0	28.2	16.9	22.7
TMP range	design: 0 to 8 psi			operating: 0.1 to 2.0 psi		
MLSS:	design: 10,000-12,000 mg/L in mem tank			operating: 8,500-11,000 mg/L in mem tank		
plant performance:	plant meeting design objectives by performance test					
power consumption:	power data not available					
cleaning information	**frequency**			**volume (gal/clean)**		
maintenance clean:	**design**	**actual**		**design**	**actual**	
NaOCl (200 mg/L) citric acid (2000 mg/L)	1/week 1/week	1/week 0/week		20 16.4	23 0	
recovery clean:	**design**	**actual**		**design**	**actual**	
NaOCl (1000 mg/L) citric acid (2000 mg/L)	2/year 2/year	1/year 0/year		263 109	300 0	

In response to Addendum 2's request, we confirm that we have no record of membrane warranty claims for the Butler Drive Water Reclamation Facility, AZ

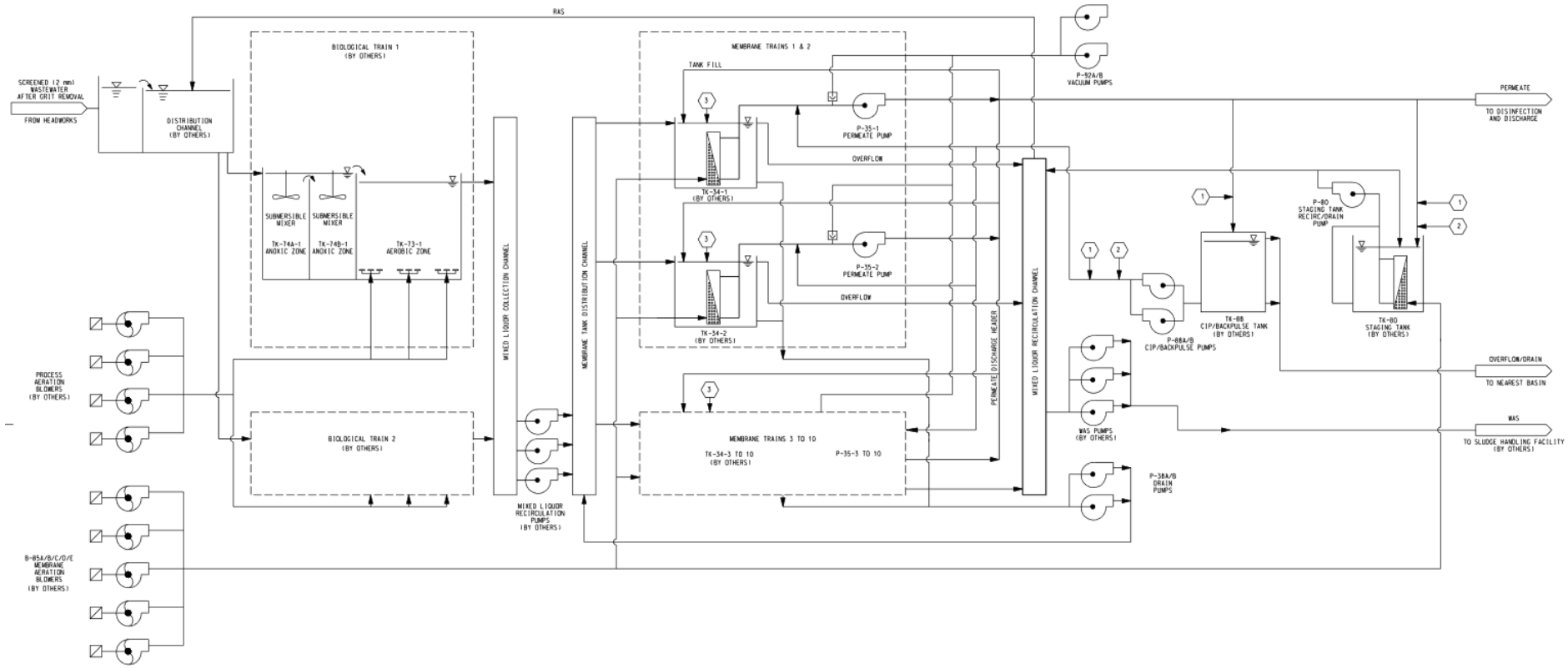


Figure 1-5: Butler Drive Water Reclamation Facility PFD

6.3.4. Riverside Regional Water Quality Control Plant, CA

plant name	Riverside Regional Water Quality Control Plant
owner (*location*):	City of Riverside (*Riverside, California*)
installation type:	retrofit/expansion
project method:	design, bid, build
commissioned:	March 2016
contact information	
owner/operator contact:	Bryan Padilla - Operations Supervisor *City of Riverside* Tel: 951-521-7283 EXT. 6205 Email: BPadilla@riversideca.gov
description of facility	
system type:	ZeeWeed LEAPmbr
feed source:	municipal wastewater (20 to 30°C)
process:	biological nutrient removal
effluent use:	surface water discharge to Santa Ana River
unit operations:	influent pumping, bar screens, vortexing grit removal, primary clarification, fine screens, biological treatment, membrane filtration, digestion, sludge thickening, chlorine disinfection & dechlorination
process configuration:	4-stage Bardenpho (pre-anoxic, aerobic post-anoxic, 1 recycle)
membrane configuration:	8 membrane trains (L:73.2ft x W:19.4ft x D:12.8ft) 14 cassettes per train in 2 rows (space for 20 cassettes) 672 modules per train in 48-module cassettes, 5,376 modules total
membrane type:	ZeeWeed 500D 370 ft^2 modules manufactured by SUEZ
aeration type:	LEAPmbr aeration 80/160 dcfm per cassette in LEAP-Lo & LEAP-Hi respectively
cassette access:	Aluminum covers on membrane tanks, lifting bracket for cassette removal, cassette laydown beside the membrane tanks

membrane life:	9.5 years to date
membrane replacement history:	no modules replaced or repaired
additional services provided:	InSight-Pro, 24/7 technical support services, 8 service visits

project delivery		**scheduled**	**actual**
equipment submittal dates:	1st submittal - P&IDs & BOMs 2nd submittal - GAs & cutsheets 3rd submittal - control/electrical final submittal - design submittal	21-Dec-10 4-Mar-11 30-Jun-11 11-Nov-11	21-Dec-10 4-Mar-11 30-Jun-11 11-Nov-11
equipment delivery dates:	1st delivery - stage 1 spares 2nd delivery - kits, electric, spares 3rd delivery - DS-hardware	8-May-14 4-Jun-15 10-Apr-15	8-May-14 4-Jun-15 10-Apr-15

design & operational information	**parameter**	**influent**	**effluent**
influent & effluent design criteria:	BOD (mg/L) TSS (mg/L) NH_3-N(mg/L) turbidity (NTU)	257 248 30.1 - -	- - - ≤0.2 for 95% ≤0.5 for 100%

flow & net flux:		**flow (mgd)**		**flux (gfd)**		
		design	**operating**	**design**	**operating**	**@20°C**
	ADF	26.0	18.0	14.4	13.3	11.4
	MMF	30.7	-	24.7	-	-
	MWF	39.0	-	19.7	-	-
	MDF	39.0	37.3	22.5	30.5	20.3

TMP range	design: 0 to 8 psi	operating: 0.1 to 0.2.5 psi
MLSS:	design: 8,000-12,000 mg/L in mem tank	operating: 7,000 mg/L in bioreactor 9,500 mg/L in the RAS
plant performance:	plant meeting design objectives by performance test	
power consumption:	power data not available	

cleaning information	**frequency**		**volume (gal/clean)**	
maintenance clean:	**design**	**actual**	**design**	**actual**
NaOCl (200 mg/L)	2/week	2/week	15.5	~16
citric acid (2000 mg/L)	1/week	1/week	30.0	~30
recovery clean:	**design**	**actual**	**design**	**actual**
NaOCl (1000 mg/L)	2/year	2/year	648	~650
citric acid (2000 mg/L)	2/year	2/year	251	~250

In response to Addendum 2 request, we confirm that we have no record of membrane warranty claims for the Riverside Regional Water Quality Control Plant, CA

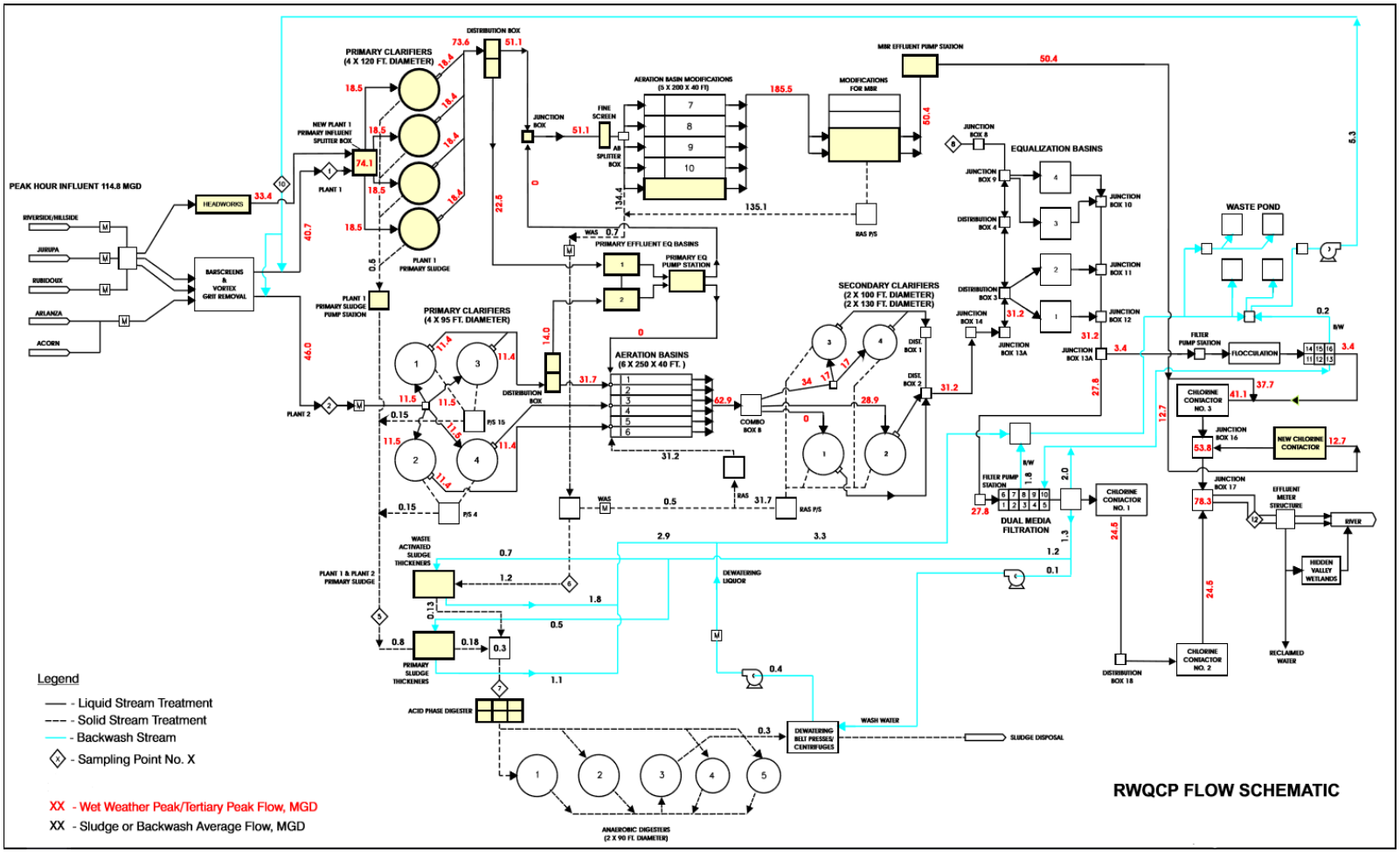
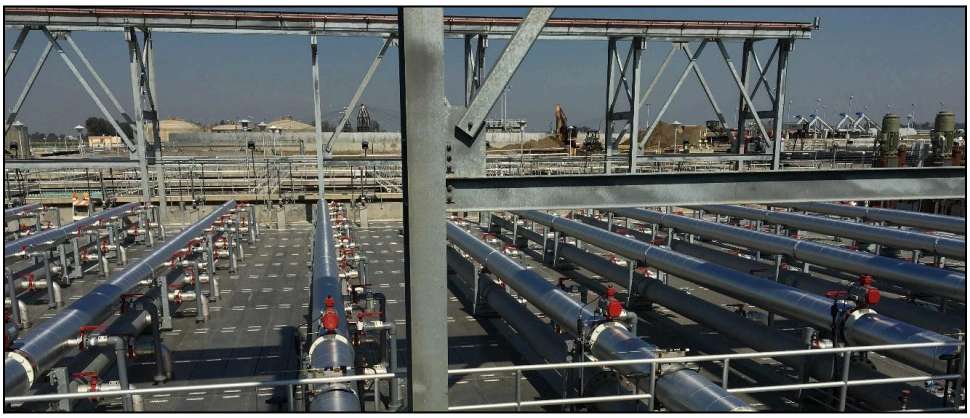


Figure 1-6: Riverside Regional Water Quality Control Plant PFD

6.3.5. Visalia Water Conservation Plant, CA



plant name	Visalia Water Conservation Plant
owner (*location*):	City of Visalia (*Visalia, California*)
installation type:	upgrade of existing facility
project method:	design, bid, build
commissioned:	July 2016
contact information	
owner/operator contact:	Ben Litwack - Public Works Manager Email: ben.litwack@visalia.gov
description of facility	
system type:	ZeeWeed LEAPmbr
feed source:	municipal primary effluent (15 to 25°C)
process:	biological nutrient removal
effluent use:	reuse
unit operations:	influent pumping, course screens, grit removal, primary clarification, 2-mm fine screens, biological treatment, membrane filtration, anaerobic sludge digestion, sludge dewatering, gravity belt thickener, sludge disintegrator, UV disinfection
process configuration:	modified Ludzack-Ettinger (pre-anoxic, aerobic, 1 recycle)
membrane configuration:	10 membrane trains (L:76.2ft x W:9ft x D:12ft , SWD 9.1-9.8ft) 8 cassettes per train in single row (11 cassette spaces) 382 modules per train in 48-module cassettes, 3820 modules total
membrane type:	ZeeWeed 500D 370 ft^2 modules manufactured by Veolia
aeration type:	LEAPmbr aeration 80/160 dcfm per cassette in LEAP-Lo & LEAP-Hi respectively
cassette access:	steel tank covers on membrane tanks, lifting bracket for cassette removal, cassette laydown on membrane tank covers
membrane life:	9.3 years to date
membrane replacement history:	no modules repaired or replaced
additional services provided:	InSight-Pro, 24/7 technical support services, 8 service visits

project delivery		scheduled	actual
equipment submittal dates:	1st submittal - P&IDs & cutshts 2nd submittal - Electrical 3rd submittal - Electrical final submittal	19-Jan-11 2-Mar-11 13-Apr-11 12-May-11	19-Jan-11 2-Mar-11 13-Apr-11 12-May-11
equipment delivery dates:	1st delivery – kit for headers 2nd delivery - cassettes 3rd delivery - control panels 4th delivery – spare parts 5th delivery - blowers 6th delivery - permeate pumps 7th delivery - backpulse pumps 8th delivery - header pipe 9th delivery - membranes	2-Jul-15 2-Jul-15 4-Nov-15 2-Dec-15 21-Sep-15 21-Sep-15 8-Sep-18 21-Aug-15 1-Jun-16	2-Jul-15 2-Jul-15 4-Nov-15 2-Dec-15 21-Sep-15 21-Sep-15 8-Sep-18 21-Aug-15 1-Jun-16

design & operational information	parameter	influent	effluent
influent & effluent design criteria:	BOD (mg/L) TSS (mg/L) TN TKN(mg/L) NH_3-N (mg/L) TP (mg/L) turbidity (NTU)	400 500 61 - - - - -	≤5 for 95% ≤2.5 for 95% ≤8 for 95% - - - ≤0.2 for 95% ≤0.5 for 100%

flow & net flux:		flow (mgd)		flux (gfd)		
		design	operating	design	operating	@20°C
	ADF	18	10.9	12.74	12.36	10.2
	MWF	19	-	13.44	-	-
	MMF	19	-	13.44	-	-
	MDF	28.8	-	20.38	-	-
	PHF	36	17.8	25.47	30.6	25.5

TMP range	design: 0 to 8 psi	operating: 0.3 to 7.4 psi
MLSS:	design: 8,000-12,000 mg/L in mem tank	operating: 6,500-7,500 mg/L in bioreactor 8,000-10,000 mg/L in mem tank
plant performance:	plant meeting design objectives by performance test	
power consumption:	348 kWh/MG - (for the membrane blowers)	

cleaning information	frequency		volume (gal/clean)	
maintenance clean:	design	actual	design	actual
NaOCl (200 mg/L)	1/week	1/week	9.15	10-15
citric acid (2000 mg/L)	0/week	-	21.5	-
recovery clean:	design	actual	design	actual
NaOCl (1000 mg/L)	4/year	4/year	300	220-240
citric acid (2000 mg/L)	1/year	1/year	141	150-160

In response to Addendum 2 request, we confirm that we have no record of membrane warranty claims for the Visalia Water Conservation Plant, CA

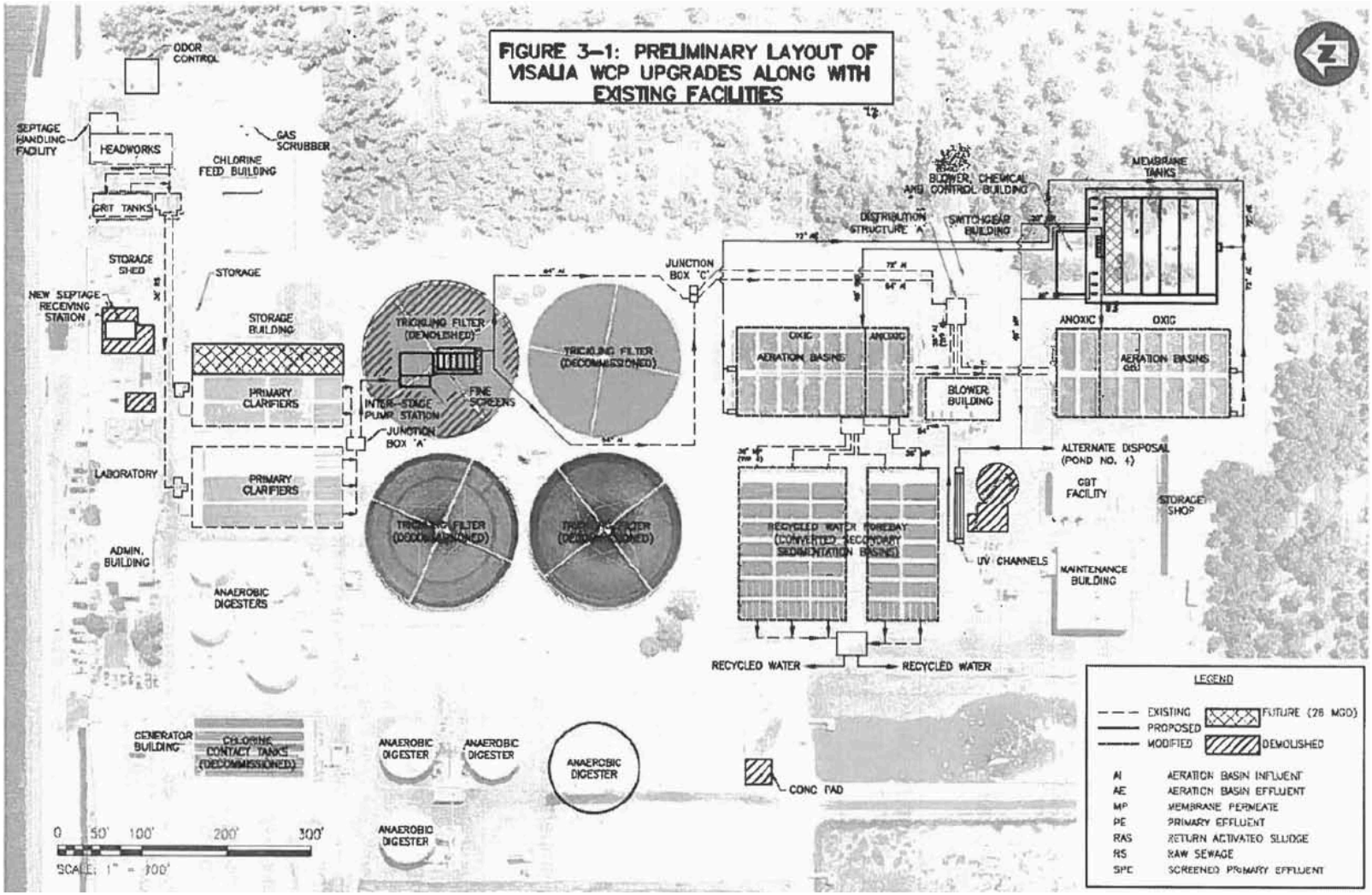


Figure 1-7: Visalia Water Conservation Plant PF

6.3.6. Rowlett Creek Water Reclamation facility

plant name	Rowlett Creek Water Reclamation Facility		
owner (*location*):	North Texas Municipal Water District *(Plano, Texas)*		
commissioned:	2023		
contact information			
owner/operator contact:	Jason Pittsinger | North Texas Municipal Water District 214-315-5321 *jpittsinger@ntmwd.com*		
design engineer contact:	Jim Nagel | Jacobs 703-728-6566 *Jim.Nagel@jacobs.com*		
description of facility			
system type	ZeeWeed MBR | ZeeWeed 500		
membrane configuration:	3 membrane trains 13 cassettes per train 1,776 modules total		
design & operational information	**parameter**	**influent**	**effluent**
influent & effluent design criteria:	Turbidity (NTU) TSS (mg/L)	- -	≤ 0.2 (90%) | ≤ 0.5 (100%) ≤ 0.5 (90%) | ≤ 2.0 (100%)

flow & net flux:		flow (mgd)	flux (gfd)
		design	**design**
	ADF	7.0	10.65
	MMF	9.45	14.38
	MDF	17.5	26.63

In response to Addendum 2 request, we confirm that we have no record of membrane warranty claims for the Rowlett Creek Water Reclamation facility

6.4. Membrane Thickener Experience

Veolia is the leader in membrane filtration technology, including drinking water, wastewater and membrane thickening systems. The following eight plants have been completed in the past 10 years and are of similar scope and approach as proposed for the Eagle Mountain Membrane Thickener System.

Table 6-3: Membrane Thickener Reference Plants

Province/ State	City	WAS Influent Flow (m3/d)	Target Thickened MLSS (%)	Commission Date
Ontario	Oxford	390	4.5%	2008
Georgia	Cauley Creek	379	4.0%	2002
California	Victorville	274	3.0%	2010
Virginia	Woodstock	227	4.0%	2009
Washington	Blaine	121	4.0%	2010
Ontario	Port McNicoll	35	4.0%	2001
Georgia	Austell	13	4.0%	2011
Ontario	Creemore	24	4.0%	2000
Ontario	Region of Waterloo	343	4.0%	2019
Minnesota	Detroit Lakes	19	3.0%	2018
Georgia	Woodstock	140	4.0%	2018
British Columbia	Salt Spring Island	3.5	4.0%	2020

6.5. ZeeWeed 500 Membrane Reuse

The availability of freshwater resources is an enormous challenge that is being faced all over the world. One of the biggest untapped opportunities that communities have to alleviate water stress is the recycling of wastewater to augment freshwater supplies. Veolia has extensive experience using the ZeeWeed 500 membranes in many wastewater reuse applications. Veolia has been at the forefront supporting our customers and partners on their reuse journeys with the application of MBR technology.

Veolia provides a full set of solutions to make indirect and direct potable recycling plans come to life. Veolia's various technologies create treatment solutions that fit into a municipality's existing infrastructure, regulatory structure, treatment objectives, and regional challenges. MBR has been identified as an ideal technology for direct or indirect potable water reuse due to, amongst other things, its robust pathogen reduction ability, reliable pre-treatment for advanced water technologies, and cost savings ability. Veolia's unique experience spans many potable reuse programs including full-scale implementation, demonstration programs and pilot operations. The ZeeWeed membrane is the perfect partner for water reuse for the following reasons:

- Excellent solids removal

- Customizable biological design to match the desired nutrient removal
- Virus and protozoa LRV credits for potable reuse
- Trace chemical and microplastic removal
- Ideal effluent for potential downstream advanced treatment
- Capable of achieving the following effluent quality:
    - BOD5 < 2 mg/L
    - TSS < 2 mg/L
    - Turbidity < 0.1 NTU
    - Fecal Coliform 0 cfu/100 mL
    - SDI < 3

Water reuse with Veolia's ZeeWeed membranes is the key to sustainability and has become a choice for many water stressed communities including those highlighted on the following pages.

Heritage Pointe Golf & Country Club, Alberta

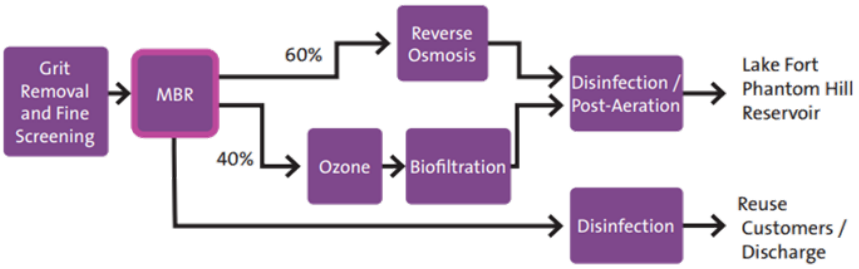
Heritage Pointe opened in 1992 as a full-service golf facility and residential neighborhood in De Winton, AB, just outside of Calgary. The community was self-contained without municipal services. An MBR was selected due to the minimal odor and sound emissions, aesthetic conformance with the natural environment, and exceeded Alberta's effluent discharge limit permitted to the Bow River. The effluent produced by the facility is reused for irrigation to the adjacent golf course.

Hamby Water Reclamation Facility, Abilene, TX

Challenge: Reservoirs in drought-stricken areas were hitting critically low levels of less than 30% of their capacity. The existing infrastructure was aging and unable to consistently meet the quality requirements for non-potable reuse customers.

Solution: As the first phase of a drought response initiative to combat these conditions, the City of Abilene moved to upgrade its treatment infrastructure to enable the City to replenish the water levels in Lake Fort Phantom Hill, one of the City's key reservoirs. The water reclamation facility was upgraded to an MBR process with downstream advanced treatment of reverse osmosis, ozone/biofiltration, and disinfection.

Results: The MBR originally treated 45 MLD on average, and was recently expanded to an Average Daily Flow of 68 MLD. The full treatment process can replenish the reservoir with over 26 million liters of advanced treated water a day and has been in operation since 2015 and awarded the 2016 WateReuse Large Project of the Year.



Santa Monica, CA

Challenge: The City of Santa Monica faced multiple challenges, including water scarcity and a reliance on imported water sources. The city created a Sustainable Water Infrastructure Project (SWIP) whose primary goal is to establish a secure and drought-resilient water supply for the city

Solution: The SWIP combines several components to maximize local water resources and reduce reliability on imported water. The project's centerpiece is the advanced water treatment facility (AWTF), an underground facility processing almost 4 million liters daily. The AWTF uses a membrane bioreactor with ZeeWeed 500D membrane followed by reverse osmosis and UV/AOP for advanced treatment.

Results: The AWTF came online in 2022 as California's first permitted groundwater augmentation project using a membrane bioreactor. The city is able to reduce its reliance on imported water 10% by injecting treated water into the aquifer.

Surprise, AZ

The city of Surprise, Arizona, uses a ZeeWeed* MBR system at the Surprise SPA-2 Water Reclamation Facility to produce Class A+ quality recycled water, meeting all state and federal regulations for direct reuse and recharge. The 2.0 MGD system has been running for over 12 years, and treated effluent is recycled for an assortment of uses, including direct reuse customers as well as groundwater recharge through recharge basins and vadose zone recharge wells.

American Canyon, CA

With growing concerns about water shortages, and a population that is expected to grow rapidly, the City of American Canyon required a wastewater treatment facility that would meet their current and future needs. At the time, the City's wastewater was sent to a regional wastewater treatment facility, and the City determined the best option was to construct a new City owned facility and wanted to reuse a portion, if not all, of the treated effluent from its wastewater treatment plant for vineyard and golf course irrigation to reduce the amount of fresh water drawn from the Napa River. To do so, the plant would have to achieve stringent California Title 22 water reuse standards.

Working with the project's consulting engineer, HydroScience Engineering, the City of American Canyon reviewed several treatment options, and decided that membrane bioreactor (MBR) technology would best suit its needs. In July 2000, the City selected ZENON Environmental Corporation (a wholly owned business of Veolia Water Technologies & Solutions), to supply a ZeeWeed* MBR system.

In addition to those highlighted above, Veolia has a number of projects that implement reuse with their MBR technology, as detailed in the following list.

Table 6-4: Partial List of Veolia MBR Reuse Facilities

Facility	Plant Location
Morro Bay Water Reclamation Facility	Morro Bay, CA, USA
Surprise Water Reclamation Facility	Surprise, AZ, USA
Butler Water Reclamation Facility	Peoria, AZ, USA
Hamby Water Reclamation Facility	Abilene, TX, USA
PureWater California Demonstration Facility	Los Angeles, CA, USA
PureWater Project	Cloudcroft, NM, USA
Johns Creek Environmental Campus	Fulton County GA, USA
Shadow Isles Golf Course	Colts Neck, NJ, USA
Anthem Golf and Country Club	Phoenix AZ, USA

Facility	Plant Location
Meadow at Mystic Lake Golf Course	Mdewankanton, MN, USA
Santa Maria Golf Course	Laguna County Sanitation District, USA
Sunset Ridge Golf Course	
Rancho Maria Golf Course	
Atlanta Athletic Club	Cauley Creek, Atlanta, GA; Fulton County, USA
St. Ives Country Club	
River Pines Golf Club	
Key Colony Beach Golf and Tennis Club	Key West, FL, USA
Pennant Hills Golf Club	Sydney, Australia
Gordon Golf Course	Sydney, Australia
Hiddenbrooke Golf Course	Vallegjo, CA, USA
Eagle Glen Golf Course	Corona, CA, USA
Randolf Park Golf Complex	Tucson, AZ, USA
City of Corona	Corona, CA, USA

Veolia is actively engaged in the implementation of MBR in advanced water recycling schemes, especially related to closing the existing knowledge gaps around pathogen reduction credits and monitoring of MBR systems. Several of Veolia's key contributions include:

- Leadership and participation in several studies to prove the efficacy of pathogen reduction in MBR
- Development of new monitoring techniques for system integrity
- Driving discussions on forming regulations and technology implementation
- Program partner for the first systems in potable reuse in California and across the world
- Member of the Project Advisory Committee (PAC) for the Water Research Foundation project WRF-4959 looking at the evaluation of a protocol for correlated surrogate to achieve pathogen reduction credits in MBR
- Team member for 5+ industry research projects related to MBR in potable recycling applications, including key Water Research Foundation projects
- Published 15+ papers on the topic at leading international conferences and publications (WEF, IWA, AWWA, AMTA, PUB/SIWW)
- Chair of the Water Environment Federation Water Reuse Committee

6.6. ZeeWeed MBR Utah Experience

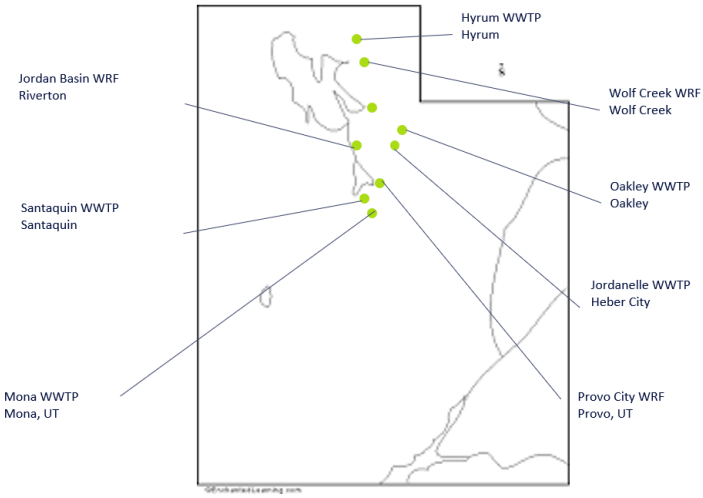


Table 6-5: Veolia In Utah

Facility Name	Location	Capacity	Owner/Contact	Commissioned
Jordan Basin WRF	South Valley Sewer District (*Riverton, Utah*	ADF: 16.6 MGD MDF: 25 MGD	Jordan Basin Improvement District Joel Thompson – JBWRF Facility Manager	June 2012, Membrane upgrade in 2024
Santaquin WWTP	Santaquin, Utah	ADF: 1.38 MGD MDF: 3.08 MGD	City of SantaquinJason Callaway - Public Works Director	2011
Mona WWTP	Mona, Utah	ADF: 0.33 MGD MDF: 0.57MGD	City of Mona Brent Arns - Plant Manager	2012
Wolf Creek WRF	Wolf Creek, Utah	ADF: 0.4 MGD MDF: 0.4MGD	Wolf Creek Water and Sewer Improvement District Rob Thomas - General Manager	2008
Oakley WWTP	Oakley, Utah	ADF: 0.13MGD MDF: 0.25MGD	City of Oakley Larry Hall - Plant Manager	2003
Jordanelle WWTP	Heber City, Utah	ADF: 1.0MGD MDF: 1.5MGD	Jordanelle Special Service District Drew Robinson - General Manager	2020
Provo City WRF	Provo, Utah	ADF: 16 MGD MDF: 28.7MGD	City of Provo Matthew Kesler - Reclamation Operations Supervisor	2025

7. Comprehensiveness of Bid

7.1. Scope of Supply by Veolia

7.1.1. Equipment Scope

Veolia's scope of supply for the Eagle Mountain Wastewater Treatment Facility (EMWWTF) includes the equipment detailed in the tables below. These tables must be reviewed in conjunction with the Veolia Piping and Instrumentation Diagrams (P&IDs), which are located in Section 7.6. While the P&ID's provided in the RFP were reviewed during the preparation of this proposal, the Veolia P&IDs will be the definitive source for clarity and consistency regarding the scope of supply. In the event of a discrepancy between the following equipment tables and the P&IDs, the Veolia P&IDs will take precedence for all Veolia-supplied equipment and devices.

On the P&IDs, scope items are shown in the Notes section. Pipes shown as dotted are to be furnished by the Contractor (by others). The sizes of all pipes are indicated on the P&IDs. Valves are typically the same size as the pipe on which they are located. Digital inputs and outputs are also shown on the P&IDs. Items not shown on the P&IDs, including spare parts, special tools, and Engineering Services, are listed in Section 7.1.3.

General Arrangement (GA) drawings of the membrane tanks are provided in Section 7.4 with dimensions and sectional views. Equipment sizing, max rating, and motor horsepower for equipment supplied by Veolia is shown on the P&IDs. Make/model of major equipment (i.e. pumps, blowers, etc.) are shown on the P&IDs. Please note, all equipment and services supplied by Veolia are for Phase 1 (Base) only.

Table 7-1: Veolia's Scope of Supply for the Membrane Filtration System and Membrane Thickener system Equipment

Quantity	Description
The Membrane ultrafiltration and Thickener system will consist of the following equipment: **MFS Blowers** **639082-WTS-PR-SYS-EN21-DS-102 (Sheet 1)**	
3+1	Blower packages each consisting of the following equipment: • Positive Displacement membrane aeration blowers. Each unit includes an acoustic enclosure as well the following: • One (1) inlet flexible connector • One (1) inlet filter and silencer • One (1) discharge silencer • One (1) pressure safety valve • One (1) discharge pressure gauge complete with isolation valve • One (1) check valve • One (1) discharge flexible connector
4	Low air flow switches
4	Membrane blower isolation valves
MTH Blowers **639082-WTS-PR-SYS-EN21-DS-102(Sheet 2)**	
2+1	Blower packages each consisting of the following equipment: • Positive Displacement membrane aeration blowers. Each unit includes an acoustic enclosure as well the following: • One (1) inlet flexible connector

	• One (1) inlet filter and silencer • One (1) discharge silencer • One (1) pressure safety valve • One (1) discharge pressure gauge complete with isolation valve • One (1) check valve • One (1) discharge flexible connector
3	Low air flow switches
3	Membrane blower isolation valves
ZeeWeed Membranes and MFS Tank Equipment (SDs between 1.01-1.3) 639082-WTS-PR-SYS-EN21-DS-104 (Sheet 1)	
Lot.	MFS tank cassette mounting assemblies including: • Cassette support beams and beam brackets • Cassette hanger arms and braces • Associated hardware
24	ZeeWeed 500 membrane cassette frames
1408	ZeeWeed 500 membrane modules
4	Permeate Collection Header Piping (316 SS)
4	Air Distribution Header Piping (304 SS)
4	Permeate Collection Header Connection Spools (316 SS)
4	Air Distribution Header Connection Spools (CPVC)
4	Permeate Collection Cassette Isolation Valves
4	Air Distribution Cassette Isolation Valves
4	MFS tank level transmitters (1 per train)
8	MFS tank level switches (2 per train)
4	Pressure transmitters (1 per train)
4	Airflow actuated valve from membrane blowers to membrane train (1 per train)
4	RAS suction pneumatic actuated knife gate valves
ZeeWeed Membranes and MTH Tank Equipment (SDs between 1.01-1.3) 639082-WTS-PR-SYS-EN21-DS-104 (Sheet 2)	
Lot.	MTH tank cassette mounting assemblies including: • Cassette support beams and beam brackets • Cassette hanger arms and braces • Associated hardware
4	ZeeWeed 500 membrane cassette frames
144	ZeeWeed 500 membrane modules
2	Permeate Collection Header Piping (316 SS)
2	Air Distribution Header Piping (304 SS)
2	Permeate Collection Header Connection Spools (316 SS)
2	Air Distribution Header Connection Spools (CPVC)
2	Permeate Collection Cassette Isolation Valves
2	Air Distribution Cassette Isolation Valves
2	MTH tank level transmitters (1 per train)
4	MTH tank level switches (2 per train)
2	MTH tank Pressure transmitters (1 per train)
2	Airflow actuated valve from MTH blowers to membrane train (1 per train)
2	Drain/Recirculation/TWAS suction pneumatic actuated knife gate valves

Air Ejector (MTH & MFS system) 639082-WTS-PR-SYS-EN21-DS-104 (Sheet 3)	
4 (MFS) 2 (MTH)	Air Ejector Assembly Complete With Air Supply Assembly
MFS Process Pumps 639082-WTS-PR-SYS-EN21-DS-105 (Sheet 1)	
4	Sodium hypochlorite chemical injection line consisting of: • One (1) actuated ball valve • One (1) check valve • One (1) isolation valve
4	Citric acid chemical injection line consisting of: • One (1) actuated ball valve • One (1) check valve • One (1) isolation valve
4	Permeate header to process pump actuated valve
4	Positive displacement, rotary lobe process pump with TSH sensor for motor protection
4	Suction/discharge pressure gauges complete with isolation valves
8	Pressure switches
4	Flow transmitters
4	Permeate Discharge Isolation Valves
4	Turbidimeter Sample Isolation Valves
MTH Process Pumps (Filtrate Pumps) 639082-WTS-PR-SYS-EN21-DS-105 (Sheet 2)	
1+1	Sodium hypochlorite chemical injection line consisting of: • One (1) actuated ball valve • One (1) check valve • One (1) isolation valve
2	Citric acid chemical injection line consisting of: • One (1) actuated ball valve • One (1) check valve • One (1) isolation valve
2	Permeate header to process pump actuated valve
2	Positive displacement, rotary lobe process pump
2	Suction/discharge pressure gauges complete with isolation valves
4	Pressure switches
2	Turbidimeter Sample Isolation Valves
2	Flow transmitters
2	Manual isolation valve
2	Pneumatic actuated valve for permeate from Backpulse Tank to MTH
2	Pneumatic actuated valve for permeate to RAS header
Turbidity Meter (Both MFS and MTH system) 639082-WTS-PR-SYS-EN21-DS-105 (Sheet 3)	
4 (MFS) 2 (MTH)	Turbidimeter panels including: • Wall mounted low range laser turbidimeter, automatic cleaning unit, flow regulator, and flow sensor • Controller and mounting hardware • Isolation and solenoid valves

	• Degassing column
Backpulse System(Concrete Backpulse Tank by Others) 639082-WTS-PR-SYS-EN21-DS-107	
2	Pneumatic actuated valve for Backpulse tank discharge to MTH
1	Backpulse tank Level Transmitter with Instrument Isolation Valve
1	Tank Drain Isolation Valve
Each.	Sodium Hypochlorite for Biogrowth prevention including: • Two (2) Manual ball valves • One (1) Pneumatic Actuated ball valve • One (1) Check valve
4	Pneumatic actuated valve for Backpulse tank discharge to MFS
4	MFS process pump line check valve
1	MFS permeate collector Temperature Transmitter
1	Backpulse Tank fill pneumatic actuated valve
1	Permeate collector pneumatic actuated valve
MTH Drain / Recirculation / TWAS Pumps 639082-WTS-PR-SYS-EN21-DS-108	
2	Suction Pressure Gauges with Instrument Isolation Valves
2	Suction Manual Isolation Valve
2	Positive displacement, rotary lobe process pump
2	Discharge Pressure Gauges with Instrument Isolation Valves
2	Discharge pressure switches
2	Check valves
2	Discharge Manual isolation Valve
2	Flow Transmitters
2	TSS sensors
2	Pneumatic actuated knife gate valves for sludge recirculation from MTH back-end to MTH front-end
2	Pneumatic actuated knife gate valves for TWAS to solids handling facility
2	Pneumatic actuated valve for MTH drain to bioreactor
MFS RAS/WAS/Drain Pumps 639082-WTS-PR-SYS-EN21-DS-110	
4	Suction Pressure Gauges with Instrument Isolation Valves
4	Centrifugal RAS Pumps for Transfer of Mixed Liquor from Membrane Tanks to Bioreactor
4	Discharge Pressure Gauges with Instrument Isolation Valves
4	Check Valves
4	Flow Transmitters
4	RAS Isolation Valves
1	WAS Isolation Valve
2	WAS Pneumatic actuated Isolation Valve
2	WAS Flow Transmitter
2	Pneumatic actuated diaphragm valves
Membrane Cleaning Chemical Pump Skids 639082-WTS-PR-SYS-EN21-DS-111	
1	Sodium Hypochlorite System Isolation Valve

1	Sodium Hypochlorite Strainer
1	Skidded Sodium Hypochlorite Feed System Including: • 1 Duty + 1 Standby Mag Drive Centrifugal Pumps and Motors • Isolation Valves • Suction/Discharge Pressure Gauge and Instrument Isolation Valve • Suction/Discharge Drain • Check Valves • Flow Transmitter • Diaphragm Valves • Spring (Close) Isolation Valve • Pressure Safety Valve
1	Citric Acid System Isolation Valve
1	Citric Acid Strainer
1	Skidded Citric Acid Feed System Including: • Mag Drive Centrifugal Pumps and Motors • Isolation Valves • Suction/Discharge Pressure Gauge and Instrument Isolation Valve • Suction/Discharge Drain • Check Valves • Flow Transmitter • Diaphragm Valves • Spring (Close) Isolation Valve • Pressure Safety Valve
Air Compressor 639082-WTS-PR-SYS-EN21-DS-112	
2	Air compressor assembly for air ejector operation including: • Two (2) air compressors, each with integral horizontal mounted pressure gauges, pressure low switches, drain flow valves, and isolation valves • Two (2) refrigerated air driers with manual isolation valves
1	Common discharge line primary coalescing filter with isolation valves, pressure regulator and pressure switch
1	Solenoid drain valve

Note 1: All Veolia supplied equipment is designed for installation in an unclassified area.

7.1.2. Electrical and Controls

Table 7-2: Veolia's Scope of Supply for Electrical and Controls

Electrical and Controls (both MFS and MTH)	
1	Main control panel (MCP, NEMA 12 CS construction) with one (1) main M580 PLC processors and all associated PLC components, and one (1) panel-mount Schneider Electric Harmony HMI
6	Remote I/O panels (NEMA 4X, 304SS)
1	NEMA 4X Veolia InSight Online Monitoring System communication panel, equipped with a Linux-based data logging computer, a 4G cellular router, a power supply and an antenna
Included	All PLC and OIT programming of the Veolia-Supplied Membrane System
Included	Custom tagging to be incorporated following approval of P&IDs

7.1.3. Spare Parts List

Spare parts have been provided per Specification requirements

Table 7-3 Veolia's Scope of Supply for Spare Parts and Special Tools

Spare Parts	
1	Special Tools/Spare Parts for Membranes including: • ZW500EV Membrane Cassette Lifting Bracket (1) • ZW500EV Safety Hoist Ring (4) • ZeeWeed Fiber Repair Kit (1) • ZeeWeed Module Removal Tool (1)
1	MFS Blower Spare Parts including: • V-Belt Set (1) • Filter element (2) • Lubrication for first year of operation (1)
1	MTH Blower Spare Parts including: • V-Belt Set (1) • Filter element (2) • Lubrication for first year of operation (1)
1	MFS Process Pump Spare Parts including: • Spare Process pump only (1) • Mechanical seals (1) • lobes and O-rings (1) • Wear plates (1)
1	MTH Process Pump Spare Parts including: • Spare Thickener Process pump only (1) • Mechanical seals (1) • lobes and O-rings (1) • Wear plates (1)
1	Thickener Drain / Recirculation / TWAS Pumps Spare Parts including: • Spare pump only (1) • Mechanical seals (1) • lobes and O-rings (1) • Wear plates (1)
1	RAS Pump Spare Parts including: • Spare RAS pump only (1) • Mechanical Seal - Cartridge Single (2) • Side Plate (4) • Side Plate Service Kit (Gasket, O-rings, Nuts & Screws) (4) • Impeller (1) • Impeller Service Kit (Gasket, Socket Head Screw, O-rings) (1)
1	Air compressor Spare Parts including: • maintenance kit
1	Valves Spare Parts including: • O-ring and seat per valve (1 each) • Actuator seal per valve (1 each) • lSolenoid (1)
1	Instrumentation Spare Parts including: • Flow Switch (1) • Level Transmitter (1) • Float switch (1)

	• Pressure transmitter (1) • Pressure switch (1) • Turbidity transmitter (1) • Turbidity sensor (1) • Limit switch (1)
1 each	Electrical Spare Parts including: • X80 AC Power Supply Module, 100…240 V AC, 36W • M580 CPU • M580 I/O Scanner Module, Ethernet/IP & Modbus TCP, 3 ports • X80 Performance Ethernet Drop adapter, Ethernet Backplane • X80 Digital Input Module, 16 channels, 24 V DC, Positive (sink) • X80 Digital Output Module, 16 channels, 24 V DC, Positive • X80 Analog Input Module, High Speed, 8 channels, not isolated • X80 Analog Output Module, 8 channels, non isolated

Note 1: spare parts package was included as per recommended by Veolia and Vendors

7.1.4. Engineering, Commissioning, and Aftermarket Services

Table 7-4: Veolia's Scope of Supply for Engineering, Commissioning, and Aftermarket Services

Engineering, Commissioning and Aftermarket Services
Engineering Services and Submittals including Operation and Maintenance Manuals: • Submittals per the RFP Section 01 33 00 and further discussed in section 7.1.4.1.
Services of Veolia's Field Representative per the RFP section 46 53 49 , 3.02 and further discussed in this section. • Factory acceptance test - Section 46 53 49 , 3.03 • Functional testing -Section 01 91 00 and 46 53 49 , 3.04 • Start-up and Commissioning --Section 01 91 00 and 46 53 49 , 3.05 • Performance and operational testing --Section 01 91 00 and 46 53 49 , 3.06 • Operator training --Section 01 79 00 and 46 53 49 , 3.07
Post commissioning services and First Year Service Plan per the RFP Section 46 53 49 , 3.08 and further discussed in Section 6.2 of this proposal • 24/7 Telephone Technical Support Service - 1 Year • InSight Pro - 1 Year • Site visits - minimum of 15 person days over three (3) trips.
• InSight Pro for additional second year
Warranties per Section 13 of this proposal which includes: • Equipment Mechanical Warranty – 2 year (except for Blowers which are 5 years) • MFS Membrane Module Warranty – 20 years comprised of 12 year full replacement + 8 year pro-rated • MTH Membrane Module Warranty – 10 years comprised of 2 year full replacement + 8 year pro-rated • Performance Warranty – as per section 13 of the proposal

Note 1: Additional man-hours will be billed separately from the proposed system capital cost at an additional rate per day plus living and travelling expenses. Detailed Veolia service rates are presented in Appendix A.
Note 2: A day on-site is considered 8-hours

7.1.4.1. Design Submittals

Having successfully executed hundreds of MBRs we understand the specific deliverables and standards required for executing projects of this size and scope. As a company, Veolia has traveled up the “learning curve” of membrane treatment and in doing so has allowed all of our designs to incorporate the lessons learned from previous experience.

After the notice of vendor selection, it is recommended that a Project Kick-Off Meeting be scheduled as soon as possible. Veolia’s Engineering and Commercial team members will participate in this meeting, leveraging our team’s deep domain experience and further solidifying the transition from proposal to initial design. In future design meetings, on an as needed basis, Veolia’s Design Engineer, Electrical Designer, Process and Controls Engineers will be in attendance. As well, Veolia’s Senior Technical staff will provide technical review and will oversee the completion of the design details.

It is during these initial meetings and workshops that Veolia’s technical design staff can provide valuable input and lessons learned in the overall MBR design and integration. Our team’s dedication to the overall success of this project extends beyond our equipment scope of supply.

The table below summarizes the coordination meeting as below.

Table 7-5: Design Support Meetings

Location	Quantity/Duration	Team Members in Attendance
In person/Virtual	As needed	Project Manager Process Engineer Electrical Engineers Controls Engineers Commissioning Manager As needed

Note: for inperson meeting rates, Detailed Veolia service rates are presented in Appendix A

The Project Manager will develop a detailed project schedule based around the milestones outlined in the Specification. They will outline internal deliverables required for the Veolia team to meet the major milestones on the project and will provide progress reports to highlight issues, setbacks and to expedite any work item or equipment issue on the critical path to ensure the project schedule is maintained.

Veolia has a number of procedures in place to ensure that this project is properly documented, reviewed and adheres to ISO 9001:2008 requirements. Veolia’s extensive internal process of design review is intended to ensure submittals are of the highest quality prior to meeting with the Owner and Engineer. The Design Engineer will participate in all key design review meetings with the Owner and Engineer. Changes agreed to in the meetings will then be integrated into the Veolia system and reviewed internally to ensure the design incorporates the appropriate functionality.

Along with internal processes and procedures to facilitate a smooth design phase with the Owner and Engineer, Veolia will be readily available to provide design assistance to the Engineer on items detailed in the Specification. A detailed master document list (MDL) will be created for the project and a detailed submittal schedule will be coordinated with all the parties during the kickoff meeting to ensure that key information which is required for the design of the project is provided in a timely manner.

Veolia’s engineering team requires the following information from the Engineering team prior to commencing work on the submittals.

- ❑ Confirmation of value engineering ideas (if any proposed).

- ❑ Confirmation of the hydraulic profile of the plant, especially regarding the feed to the membrane system and the pump discharge head requirements for all pumping applications connected outside of Veolia's system.
- ❑ Site considerations for plant layout and preliminary plant information including overall plant layout considerations from the Buyer and elevations.
- ❑ Environmental conditions including relative humidity range, ambient temperature (minimum and maximum)
- ❑ Confirmation of all site conditions such as elevation or any wind loading and seismic requirements
- ❑ Confirmation of voltage and classification requirements.

A preliminary submittal schedule is proposed in Section 17.9 of the proposal.

After approved shop drawings and an NTP to manufacture has been provided, Veolia will work with the Contractor to coordinate a firm schedule for equipment delivery. During this time, Veolia will work with our Project Team and Vendors to identify any long-lead items to ensure that the project schedule is maintained. To reduce manufacturing durations, we recommend that we identify any long lead items during submittals such that certain items may be released for purchase ahead of the complete submittal approval. For example, the specific PLC CPU can be approved for purchase prior to the complete control panel submittal approval. This approach has been used on many projects in the past couple of years to help relieve the bottlenecks we have seen with certain long lead components.

Veolia will also work closely with the Owner, Engineer, and Contractor to ship equipment as needed for the installation to progress smoothly. For example, typically the hardware for the membrane tanks may be shipped earlier to site, as well as any key items that are required to be installed earlier in the process. Upon project award, our Project Manager will work to develop a project schedule for all the equipment to suit site and installation requirements.

7.1.4.2. Installation, Startup, and Commissioning

With Veolia's extensive experience in membrane-based Municipal wastewater and water treatment plants, the Commissioning Group has developed a skilled and experienced team that will provide timely support and management of all installation and commissioning activities. With more than 900 full scale membrane-based wastewater plants commissioned and in operation in North America, Veolia has numerous experiences in delivering installation and commissioning services to facilities that require continued operation of the existing plant and can use this expertise during the commissioning of the Eagle Mountain Wastewater Treatment Facility.

Veolia's Project Manager for the Eagle Mountain Wastewater Treatment Facility will be the prime contact for all communication during detailed engineering and project execution and will coordinate activities to ensure the appropriate team members are available as required.

Throughout installation, commissioning, testing, and start-up, Veolia will assign an internal field service supervisor that will support our expert Field Service Representative (FSR) to ensure rapid response to any on-site issues that may arise. During the installation and commissioning phase of the project, regular updates will be provided to document site progress. Potential delays, site issues and planning of future activities will be communicated within these reports.

The following is a high-level summary of the on-site technical support services provided by trained Veolia field service representatives.

Veolia will provide the Owner and Contractor with:

- ❑ Construction and installation assistance related to Veolia supplied equipment;
  - Recommendations for Veolia equipment off-loading and installation
  - Materials inspection
  - Supervision of Veolia membrane installation
- ❑ Assistance with commissioning and start-up of the membrane system
  - Mechanical inspection (prior to commissioning)
  - Loop checking, instrumentation and control system verification
  - Pipe loss testing
  - Clean water permeability testing
  - Sludge seeding
- ❑ Operator training
- ❑ Assistance with the acceptance/performance testing of the system.

The following table outlines Veolia's proposed number of trips and field days for the initial installation of equipment, testing, and start-up procedures outlined in Section 11500 Item 3.07 of the Specification.

Table 7-6: Veolia's On-Site Services

Service	Estimated Person-Days	Estimated Trips
Installation of membrane equipment	10	1
Installation assistance and commissioning of membrane equipment system and component including the on-site presence of a qualified PLC programmer to assist in any required changes in the MFS controls programming	25	3
System Performance Testing	14	1
Classroom Dem and Refresher Training	5	1
First Year Service Plan	15	3

Note 1: Owner and/or Contractor must complete Veolia's customer readiness forms before Commissioning services can begin.

Note 2: Additional man-hours will be billed separately from the proposed system capital cost at an additional rate per day plus living and traveling expenses. Detailed Veolia service rates are presented in Appendix A

Note 3: A day on-site is considered 8-hours.

Delivery Inspection and Unloading Equipment

The Veolia Project Team will work closely with the Owner, Contractor, Engineer, and the Operations team to build a strong partnership to support all phases of the project.

Veolia will be available for the Owner, Contractor and Engineer to assist in the following ways:

- ❑ Develop a Commissioning and Start-up schedule
- ❑ Provide guidance to questions related to Veolia supplied equipment
- ❑ Discuss and review control system integration
- ❑ Identify all Veolia supplied equipment
- ❑ Ensure all Veolia supplied equipment has been delivered in good order and that no damage has occurred during delivery

- ❑ Identify any discrepancies between the shipping lists and the equipment received
- ❑ Provide construction and installation assistance related to Veolia supplied equipment
- ❑ Provide recommendations for Veolia equipment off-loading and installation

Equipment Installation Inspection

After the Contractor has completed the installation of the membrane filtration system equipment and provided a completed installation checklist, Veolia's Field Service Representative will inspect the installation to ensure the work has been carried out correctly and has reached a degree of completion adequate to allow commissioning, installation of the membranes, and plant start-up to proceed smoothly and without delays.

The following is a summary of the on-site technical support services provided by trained Veolia Field Service Representatives prior to membrane installation, start-up, training, and commissioning.

- ❑ **Installation inspection including:**
  - Inspection of all wiring to Veolia supplied equipment (I/O checks).
  - Rotation checks on all Veolia supplied equipment.
  - Witness flushing of all piping using potable water for Veolia supplied equipment.
  - Witness correct operation of pre-screening equipment.
  - Setup of Veolia supplied instrumentation; verify ranges and calibration.
  - Stroking Veolia supplied valves.
  - Verify operation of Veolia supplied pumps, blowers, and air compressors.
  - Verify ranges and calibration of Veolia supplied instrumentation
  - Establishing communication between Veolia supplied control equipment and control equipment supplied by others.
- ❑ **Equipment acceptance**

Membrane Installation Assistance

Following the above, the ZeeWeed membranes are installed just prior to commissioning and after the Field Service Representative has checked that equipment has been installed correctly. Veolia's Field Service Representative will be present during membrane installation to advise and provide direction to the Contractor on the assembly of the ZeeWeed membrane cassettes and their installation into the membrane tanks. Veolia has prepared detailed instructions on ZeeWeed membrane installation which will be given to the Contractor prior to the beginning of this work.

Once the membranes are installed, Veolia's Field Service Representative will perform tests to ensure membrane quality. The membrane system is then ready for commissioning.

Startup Assistance and Commissioning

The Field Service Representative will assist with the process of starting up the membrane system and will be onsite for guidance and technical support during the system start-up. The Field Service Representative will work directly with Veolia's Project Engineer, Process Engineer, and Project Manager to ensure that a reliable and fully functional system is transferred to the Owner.

Veolia's Project and Process Engineer's primary roles during the Start-up Phase will be to ensure that the system design is correctly represented and translated from the drawings into the "real world". A key component of this work will be to ensure that control functionality bridges the gap

between the desired wastewater process outputs of the system and the need to have a reliable, controllable, and user-friendly system. Commissioning and start-up assistance includes:

- ❑ Flushing glycerin solution from the membranes
- ❑ Confirming the performance of all Veolia supplied rotational equipment
- ❑ Testing the membrane system operation on clean water
- ❑ Running chemical and cleaning systems
- ❑ Tuning membrane system operation
- ❑ Functional testing of the entire system

Once all of the above tasks are completed, the membrane system can take feed from the seeded bioreactors and begin treating wastewater. This occurs once the biological process acclimation period is complete. Once the plant is operating and meets the design treated water quality, the treated water is suitable for discharge. This effectively completes the installation and commissioning of the equipment.

7.1.4.3. Operator Training

Veolia has developed numerous operator training courses, each catered to the individual needs of its client. The training included by Veolia will empower the staff to operate the membrane system proficiently and confidently. Client training packages are developed, maintained, and delivered by the Commissioning Group. Veolia has full-time training experts responsible for training methodologies and curriculum development.

Shadowing: During the commissioning and start-up of the system and for membrane installation, Veolia recommends that an Operator Representative shadows the Field Service Representative. Shadowing provides superior operator understanding and confidence in all aspects of membrane system operation. Our partner-focused Field Service Representatives will instruct a “Shadow” Operator over the course of start-up and commissioning.

Classroom: Veolia will conduct classroom training at the facility. It is recommended that this section of training is conducted prior to the completion of commissioning, but after the installation of membranes, so that the information learned is quickly put into practice and reinforced through actual application on the system.

One of our training specialists will deliver the classroom training, covering the theory and practice required to operate a Veolia system. Up to twenty (20) people can be accommodated in one session with material covering:

- ❑ Membrane application theory
- ❑ Performance monitoring
- ❑ Membrane cleaning theory
- ❑ System controls theory
- ❑ The reasoning method of troubleshooting

Veolia requires that there be a suitable classroom with associated teaching materials such as blackboards, overhead projectors, pens, pencils, writing pads etc. be available for the duration of

the course. It is preferred that, where possible, training be carried out at the plant where the equipment supplied is located.

Hands-On: Immediately following the classroom training, the training specialist will further train the Owner's personnel through hands-on operation of the membrane system. The material to be covered includes:

- ❑ Use of the computer operator interface
- ❑ Plant maintenance
- ❑ Instrument and equipment maintenance
- ❑ Membrane cleaning
- ❑ Troubleshooting

Veolia's experience shows that groups for hands-on training should be kept to five (5) or less.

Learning Outcomes

Upon successful completion of this learning program the learner will be able to:

- ❑ Understand the terminology used in membrane filtration
- ❑ Understand the primary flows and equipment functions
- ❑ Navigate the P&IDs to locate components and understand their function
- ❑ Navigate the Operating Manual and controls documentation
- ❑ Use and navigate within the HMI
- ❑ Understand the concept of PID controllers, set-points, the mechanism of adjusting set-points and where to find the default listing of standardized set-points within the Veolia documentation supplied
- ❑ Understand the primary mechanical components and know the preventive maintenance steps which can improve system reliability
- ❑ Understand the electrical systems required for continued operation
- ❑ Develop a basic capability with the reasoning technique of troubleshooting of both electrical and mechanical issues

Recording of training sessions is the responsibility of the Contractor. Veolia will provide a copy of the presentation material in pdf format. Veolia will take attendance during both classroom and hands-on training.

7.2. Post Commissioning services

We are ready to put our team to work with Eagle Mountain Wastewater Treatment Facility (EMWWTF) . Veolia has included the following aftermarket services as part of our First year service plan:

Table 7-7: Veolia Post commissioning services

Service	Included in Proposal
Regional Lifecycle Manager	Indefinite
ZeeWeed Users Group	Attendance for one operator for first year is provided

Office hour telephone support service	Lifetime
24/7 telephone support service	1st year
Post on-site training and service for first year	15 days on-site with 3 trips
InSight Pro On-line Monitoring Service	1st year

Partnership Communication

Veolia knows the importance and long-term implications involved in selecting a membrane supplier. We are committed to continuing to build our partnership with Eagle Mountain City and their operations team, and believe communication is the essential ingredient to achieve this as such, we offer the following communication mechanisms:

- ❑ Access to a regional lifecycle manager;
- ❑ Participation in the ZeeWeed users group;
- ❑ Dedicated warranty coordinator, and;
- ❑ Technical support.

Regional Lifecycle Manager

The regional lifecycle manager (RLM) will act as the Veolia Services “quarterback”, engaging in frequent communication with plant staff and ensuring timely access to all the technical resources provided by Veolia. The RLM can help design a schedule and package of services suited to your needs and budget, including:

- ❑ Additional years of 24/7 telephone technical support coverage
- ❑ Additional years of InSight
- ❑ Greater frequency of site visits and or special provisions for emergency site visits
- ❑ Plant optimization and plant upgrades
- ❑ Membrane replacement planning/budgeting
- ❑ Membrane cleaning studies

ZeeWeed Users Group

As an on-going support to ZeeWeed plants, an annual, two-day ZeeWeed users group meeting is organized by Veolia consisting of formal meetings and a tour of a hosting ZeeWeed plant. New technologies are introduced, current issues are tabled, and roundtable discussions ensue. The users group has become an excellent forum for experienced operators to keep current, to renew old acquaintances, to exchange the “tricks of the trade” with each other, and to impart their knowledge to newer ZeeWeed operators. Generous hospitality combines with informal experiences and exercises to enhance the camaraderie amongst domestic and international plant operators.

All ZeeWeed owners are invited to send operators representing their plant. Veolia covers the conference, food, and hospitality expenses. Veolia supports this forum to facilitate interaction

between ZeeWeed plant operators and to provide real-world feedback to Veolia's management, design and operations staff.

Warranty Support

To promptly manage warranty claims, Veolia lifecycle services has a warranty coordinator dedicated to that function and that function only. Our warranty coordinator has access to all Veolia resources to ensure timely resolution of problems that may occur.

Customer Forums

It is important to Veolia that our customers have ongoing access to the wide breadth of knowledge that is available in the water treatment industry. Veolia hosts an online customer forum platform that provides an informal environment for industry professionals to communicate directly with each other. Plant owners, engineers, operators, and maintenance personnel will be able to discuss issues important to them through the forum. They will be able to receive technical feedback, best practices, and customer experiences from peers with a diverse experience base from which to draw. These discussions are facilitated by Veolia technical support staff who provide context and input based on their own expertise.

The forum is a great place to stay up to date on industry networking events. Veolia's conference announcements are shared on the forum and preliminary agendas are provided to allow customers to be aware of all events that are available to them. Veolia is a proven leader in delivering tangible value to our customers over the life of the plant.

7.2.1. Telephone Technical Support

For the life of the system, plant operators have telephone access to a skilled Veolia technical support specialist who will assist plant operators in troubleshooting system problems such as electrical (PLC/HMI), mechanical and process control issues.

Plant operators call the telephone number provided below at any time during business hours and ask for technical support.

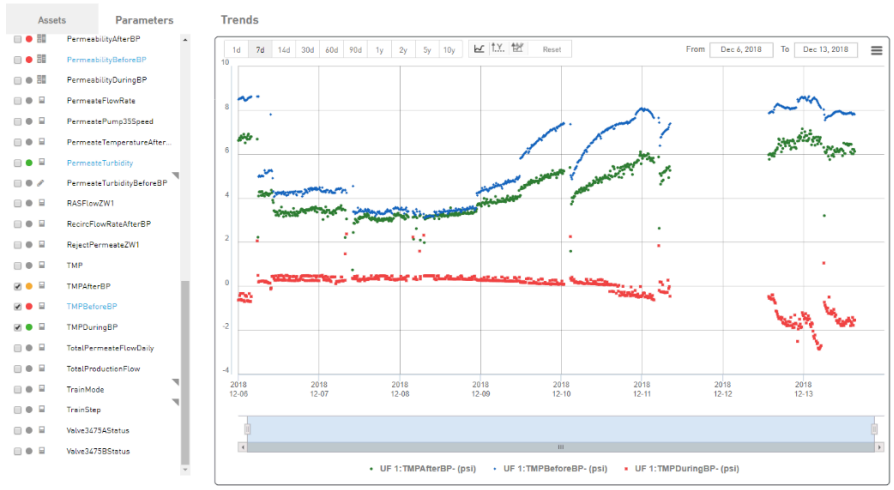
Business hours - hours of operation:	8:00 am to 6:00 pm Monday to Friday, EST
Telephone, toll free in North America:	+1-866-271-5425 Press 1 for technical support, Press 2 for non-warranty parts quotations

Calls After-Hours - 24/7 Emergency Telephone Technical Support

Our 15-person technical support team is always on call and is equipped with the system information for effective communication with a plant operator through an emergency, potentially averting loss of plant production and expensive call outs. The telephone technical support group maintains access to all plant drawings for rapid reference during 24/7 support calls and maintains remote connectivity to dial into a plant's control system in order to gain a better understanding of the situation, and to make any necessary adjustments to control set-points or software. Dial-in access requires a LAN modem or hi-speed internet connection at your facility and requires that permissions are setup in advance. If a situation requires more detailed investigation of control code, a Veolia programmer is on call at all times. Our technical support specialists will manage the resources needed within Veolia to assist you in resolving your plant issues.

7.2.2. Remote Control System Support - InSight Monitoring System

InSight captures and transforms your plant data into meaningful and actionable information, ultimately providing the knowledge you need to maximize performance, avoid operational interruptions, optimize your processes, and reduce the total cost of operation. Insight collects data from the PLC and makes it available for trending or analysis, as shown in the figure below where TMP data is being trended.



InSight provides:

- ❑ Analytics: Seeing, at any point in time, historical and current plant performance against success criteria and the trajectory of future performance; where it's on track and the weaknesses that need improvement.
- ❑ Early detection and alarming: Detecting emerging problems, so that action can be taken now, before a failure is experienced in the future.
- ❑ Optimization: Identifying opportunities to optimize and extend the life of membranes and equipment, lowering total cost of operations without sacrificing performance.
- ❑ Productivity: Reducing the tedious work of entering and reporting operator- collected data including data required for membrane warranties. Helping staff get more done with tools that enhance their personal productivity, enabling them to see and do more.
- ❑ Reporting: Reporting on key performance indicators and their impact on business objectives.
- ❑ Membrane replacement strategy: Planning a cost-effective strategy for membrane replacement and upgrades with a deep understanding of factors affecting membrane performance.

Key Benefits:

- ❑ Allowing you to consolidate all your data to pull out valuable information to drive better business results.
- ❑ Driving safety, reliability, accountability and increased throughput.

- ❑ Digitizing data and tools to liberate your operations and service teams to do their jobs more effectively.
- ❑ Providing peace of mind by having another level of surveillance which allows you to redefine operational excellence.

InSight

With InSight Basic, you will gain visibility into your plant's current and future performance by having complete access to your plant data through InSight. InSight allows you to perform your own process monitoring, trending and analysis suited to your individual plant operations and success criteria. You will have access to the tools in InSight to add your own annotations, load your own analytical data and configure your own reports and alerts.

The service is enhanced with weekly automated performance reports and daily alarm notification summaries, allowing you to identify emerging problems earlier so that action can be taken now, before a failure can occur.

InSight customers have access to personnel from Veolia's service reliability center (SRC) who will provide training and support on the use and features of InSight.

InSight Pro puts a professional Veolia process expert onto your team, collaborating to empower your operating team to apply the power of InSight.

The process expert is specifically assigned to your plant and will monitor key parameters on a regular rhythm using the InSight platform. The process expert will be in regular contact with the key members of your operations team to discuss and resolve performance, process and operational issues. While supporting your operations team with day-to-day issues, the process expert will also use InSight to bring attention to long term trends and provide operational recommendations.

As part of InSight pro, the process expert provides process reports with analysis of key trends and recommendations to support plant operation, membrane cleaning and overall performance. In addition, an annual summary performance report is provided.

If the need for troubleshooting does arise, your Veolia process expert is accessible, familiar with your system and empowered with accurate information to assist.

7.2.3. Site Visits

Veolia and the Eagle Mountain City operations team will cooperatively plan site visit duration and agenda, which can be project specific or selected from the scope of services below. The Veolia service representative and plant operators can initially define priority tasks and jointly revise these as required.

Plant operators have found it beneficial to schedule the first site visit alongside the first membrane recovery cleaning or prior to the expiry of the mechanical warranty period to identify warrantable issues.

Process Review

- ❑ Inspect the facility with the operator(s);
- ❑ Review results of analytical tests;
- ❑ Evaluate influent, effluent and wasting flow rates;
- ❑ Review chemical dosage rates and overall chemical usage.;
- ❑ Review operating logs with the operator(s). Discuss operator concerns and Veolia issues emerging from this review;

- ❑ Discuss imminent seasonal shifts, and;
- ❑ Advise the operations manager of technical updates as they become available.

Membrane Cleaning and Integrity

- ❑ Provide direct assistance to the plant operator(s) in the membrane cleaning procedures. Assess the effectiveness of on-going maintenance cleaning and recovery cleaning procedures and provide recommendations to the plant operator;
- ❑ Evaluate the aeration patterns in the tank and blower performance, and;
- ❑ Lift and inspect membrane cassettes to assess membrane, tank, and connection conditions.

Controls Verification

- ❑ Review system alarm history, discuss any related issues with operator(s) and recommend appropriate actions to be taken;
- ❑ Perform limited PLC code modifications as planned, secured by proper documentation, dial-in capabilities and file backup precautions.
- ❑ Verify operation of all safety interlock/controllers, pressure switches and temperature switches.

Mechanical and Electrical

- ❑ Evaluate heat, vibration, wear and tear, and other abnormal conditions of mechanical and electrical equipment.
- ❑ Evaluate energy consumption patterns.
- ❑ Recommend required maintenance.

Calibration Verification

- ❑ Review system set points.
- ❑ Assist the plant operator to verify the condition of all control instruments, sensors, probes, and transmitters including switching action and output.
- ❑ The Veolia service representative will collaborate with the plant operator in maintaining a log of calibration activities.

Spares

- ❑ Review the spares provisions with the plant operator to identify any additional spare parts which should be brought into inventory to provide the desired level of security to the plant including spares related to non-Veolia equipment.
- ❑ Develop a preventative maintenance plan with the plant operator.

Training

Learning to operate and manage an MBR system is a life-long vocation. On each service visit, we will share our own expanding experience and know-how with operators. They will benefit from the latest developments in operating and maintenance procedures and from technical updates brought by the Veolia service representative.The Veolia service representative will provide operators with on-site, informal training to cover areas of concern in the operation, process, membrane inspection procedures, maintenance, or troubleshooting.

Reporting

Before leaving the site, Veolia will record observations and discuss with operators concerning the condition of the equipment, tasks accomplished during the visit, and key operating and

maintenance issues requiring further attention. Veolia will provide a service visit report to the plant operator within a reasonable timeframe of the site visit. The Owner will be asked to sign a work order that describes the hours on site and tasks accomplished.

7.3. Scope of Supply by Others

Veolia has provided a detailed list of the equipment and services to be provided. All equipment or services not specified in the scope of supply by Veolia and as designated on the P&IDs are to be provided by the Contractor or Others. Supply by the Contractor or Others includes but is not limited to:

Mechanical

- Overall plant design.
- Review of all submittals and equipment cutsheets.
- Lifting equipment for installation and removal of membrane subunits (10,000 lbs capacity). Veolia's preference is an overhead traveling bridge crane.
- Bulk chemicals for membrane cleaning including:
    - Sodium hypochlorite (12.5% w/w concentration)
    - Citric acid (50% w/w concentration)
- Headworks and pretreatment equipment and facilities including grit removal, coarse and fine screening (2mm), and associated equipment (collection/disposal of screenings), with associated instruments and valves.
- Biological tanks and equipment including but not limited to process chemical pumps, process blowers, diffusers, mixers, raw sewage feed pumps and associated instrumentation and valves.
- All post-treatment equipment and facilities including UV and chlorine contact with associated instruments and valves.
- Membrane tank distribution channel and influent gates and associated electrical/pneumatic actuators required by the membrane system
- Membrane tank influent deflector plate and anchoring
- Sprayers and surface wasting equipment for foam control in bioreactor system and membrane distribution channel
- Finished water disinfection, post-aeration tank, pumping equipment with associated instruments and valves.
- Design, supply, and installation of day/bulk chemical storage facilities (if required), transfer pumps and associated controls.
- Design, supply, and installation of containment for chemical storage tanks or totes as required. Level or weight monitoring for the latter if required.
- Any spacer rings that may be required for valves.
- Equalization tank facilities and systems including associated equipment, instruments, and valves.

- Sludge handling facilities and sludge disposal.
- Scum removal system, as required.
- All heat-tracing and insulation of pipes, supports, valves, and equipment (as required) with associated electrical and controls.
- Energy/power measurement and equipment for startup, acceptance, and confirmation testing.
- Alignment of all rotating equipment.
- All required permits and permissions including but not limited to civil works, mechanical and electrical works, environmental permits, or other permits to allow operation.
- Mechanical support labor for commissioning activities.

Electrical

The electrical installation should meet the requirements of best practice guidelines which include standards for facility grounding, lightning protection, transient control, single-point grounding, load-balancing, and management of harmonics.

- Electrical wiring interconnections (including wiring, conduit and other appurtenances required to provide connections as needed) from the electrical power source to the membrane equipment MCC, membrane master control panels, and local control panels.
- Electrical wiring interconnections (including wiring, conduit and other appurtenances required to provide power connections as needed) from membrane equipment MCC and control panels to the Membrane Equipment System.
- All electrical labor and supplies including fittings, conduit, supports, cable trays, wire and hardware, and air-conditioning of panels as required for installation and ongoing operations. Power monitoring equipment, if required.
- Instrumentation wiring, conduit and other appurtenances required to provide connections as needed between the terminal boxes at the membrane equipment, pumps, etc., and the membrane PLC control panel.
- Ethernet communications connection to the Owner's SCADA system and master PLC control panel.
- Weather protection as required for all Veolia supplied equipment.
- Supply and installation of panel boards, transformers, and other equipment as necessary to provide power distribution and control for all membrane system equipment.
- Design, supply, and installation of motor control centers complete with motor starters and variable frequency drives (VFDs) as required for all Veolia supplied equipment
- Integration of plant PLC or DCS, including SCADA configuration, testing, and interfacing with the Veolia supplied control system.
- SCADA/DCS to control Seller's supplied equipment. Seller shall supply a functional logic description (control narrative). SCADA alarm notification system to include Supplier alarms.

- Design, supply and installation of all power distribution and instrumentation interconnecting wiring, optical fibers, conduit, and appurtenances, as follows:
    - Power connections as needed from the electrical power source to the Veolia control panels, owner supplied MCC and from the MCC to Veolia supplied equipment.
- Connections as needed between the various field-mounted instruments and valve actuators to the Veolia control panels.
- Control of equipment and systems not supplied by Veolia
- Power monitoring equipment if required.
- Internet network provisions to permit remote access of MBR control system
- UPS, power conditioner, and emergency power supply for all equipment as required.

Commissioning

- Receiving, unloading, and safe storage of equipment at site or a storage facility until ready for installation. Must be stored in a climate-controlled environment.
- Equipment installation of all Veolia supplied equipment and membranes.
- Alignment of rotating equipment supplied by Veolia by a qualified and certified millwright. Submission of an alignment report to Veolia is required for equipment warranty validation purposes for each piece of equipment.
- Unloading of delivered equipment and membranes at the defined point of destination including receiving, sign-off and safe storage of equipment at site until ready for installation.
- Storage of membrane cassettes, if required and must meet Veolia's storage requirements.
- Trailers/offices and washroom facilities for the Veolia site personnel and its representatives, as required.
- Installation and removal of suitable temporary screens (if required) on all process lines entering the membrane basins to prevent foreign construction related debris from coming in contact with the membranes.
- Raw materials, seeding sludge and utilities during equipment start-up and operation including a supply of raw water feed that meets all design parameters for the successful commissioning of the membrane equipment.
- Seeding sludge during equipment start-up and operation including a supply of raw water feed that meets all design parameters for the successful commissioning of the system.
- Supply and installation of all required oil and lubricants for equipment start-up and initial operation per the manufacturer's specifications.
- Replacement of lubricants in all drives and intermediate drives of mechanical equipment after initial break-in of the equipment.

- Flushing and disinfection of all piping and membrane tanks and verification of removal of all residual debris from construction.
- Laboratory services, operating and maintenance personnel during equipment checkout, start-up, and operation.
- Instrumentation installation including continuity checks and assistance with related loop checkout.
- All required permits and approvals to run the plant.
- Temporary piping/hosing that may be required for the commissioning of the plant before effluent distribution is authorized.
- Installation materials for instrumentation and automatic valves including but not limited to air/sample line tubing, fittings, and mountings.
- Contractor checklists are required to be complete prior to commissioning.
- Supply and installation of a suitable secure remote internet connection for 24/7 emergency telephone technical service.
- Mechanical support labor for commissioning activities.
- Disposal of initial start-up wastewater and associated chemicals.
- All data collection, sampling and operation during initial performance test and monitored testing period.

Civil

- Buildings for housing membrane equipment, provision of main plant structures, existing tank modifications, buildings, equipment foundation pads, concrete work, etc.
- Equipment access platforms, walkways, stairs, safety tie off points, handrails, grating, ladders, full floor coverage equipment contact pads, etc.
- Concrete tankage including membrane tanks, biological tanks, channels, and overflow weirs as required.
- Design and supply of Anchor bolts
- Chemical day tank and bulk storage, with secondary containment.
- Embedded wall spools in concrete tank walls for the various process pipe connections
- Wall penetrations
- Covers or grating over membrane trains/Tanks, including support of covers/grating
- Equipment and membrane tank access platforms, walkways, stairs, safety tie off points, handrails, ladders, full floor coverage equipment contact pads, etc.
- Supply, and installation of anchor bolts, brackets and fasteners for Veolia supplied equipment.
- Buried pipe, including soil requirements, thrust blocks, and galvanic protection
- Any on-site touch-up primer or painting of equipment supplied by Veolia.
- HVAC equipment design, specifications, and installation (where applicable).

Piping Interfaces

- Supply and installation of interconnecting piping between equipment supplied by others and Veolia equipment.
- Installation of supplied air and permeate header pipes that run the length of the membrane tanks. Supply and installation of pipe supports and hangers for this piping.
- Design, supply and installation of process and utilities piping, pipe supports, hangers, valves, etc., to and from Veolia supplied equipment including but not limited to:
    - Piping, pipe supports and valves (unless otherwise noted) between Veolia-supplied equipment and other plant process equipment.
- CIP piping, including branch connections and headers
- Temporary piping systems required for the start-up and commissioning of the Veolia equipment.
- Any heat tracing, insulation, and cladding of piping and equipment as required.

Hazardous Area Classification

- Unless stated otherwise, the equipment & instrumentation quoted is to be installed in a NFPA 820 non-classified area.

Seismic Zone Consideration

- All civil works to be designed and built with seismic considerations to properly support Veolia supplied equipment.

Miscellaneous

- Stamping, signing, or sealing of general drawings as per Federal, State, or local regulations or codes, where required.

7.4. General layout Drawings

The proposed Eagle Mountain MTH and MFS system is a compact, high-performance Membrane system designed for superior efficiency and easy expansion

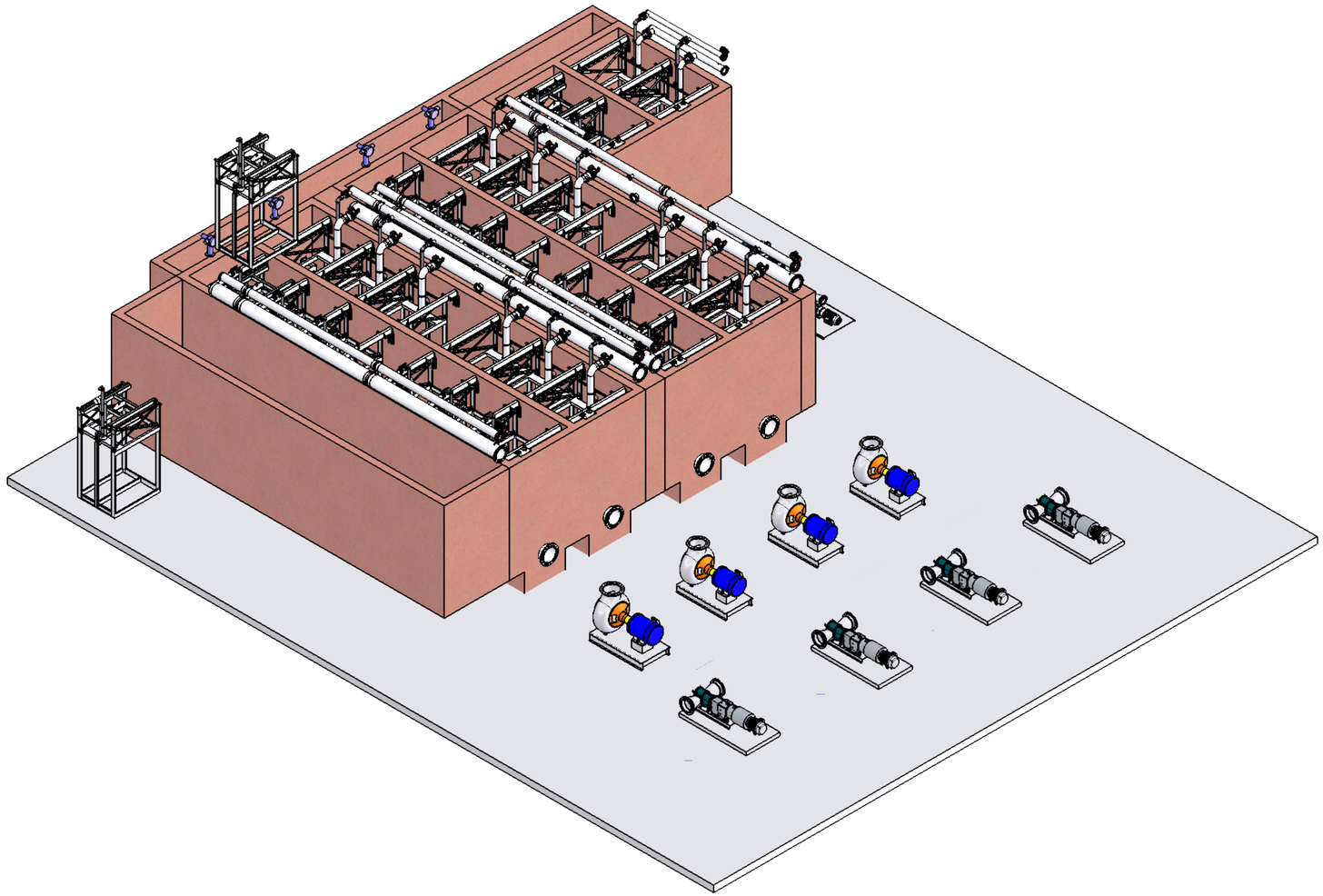
Membrane Filtration System (MFS) Layout Advantages:

The proposed MFS layout provides significant operational and expandability advantages through its modular train configuration. Each train utilizes a compact 9-foot width with an efficient length of approximately 49 feet, minimizing overall facility footprint while maximizing treatment capacity. The design incorporates substantial built-in spare capacity (21.4%), allowing for future flow increases without major infrastructure modifications or additional tank construction. The standardized train design with consistent dimensions and operating depths simplifies construction, operations, and maintenance across all units. The modular cassette approach allows for incremental capacity expansion by adding modules or cassettes within existing tank spaces as needed, providing flexibility to match actual growth patterns. The uniform tank sizing and configuration enable efficient site layout planning and facilitate phased expansion, allowing seamless integration of additional trains without disrupting existing operations while protecting the initial capital investment.

Membrane Thickener System (MTH) Layout Advantages:

The proposed MTH layout features a highly compact footprint with each train measuring only 9 feet wide by approximately 15.5 feet long, significantly reducing space requirements. The dual-train configuration provides operational redundancy for continuous operation during maintenance activities. Generous spare capacity (35.7%) accommodates future loading increases without additional construction, capacity can be expanded by adding modules within existing tank spaces. The standardized design with uniform 13-foot tank depths simplifies construction and reduces project costs. The compact operating volume enables efficient batch processing, while the identical train configuration streamlines operator training and maintenance procedures.

System layout and general arrangement drawings are provided on the subsequent pages.



ISO VIEW

REFERENCE ONLY
DO NOT USE FOR CONSTRUCTION

VEOLIA

CUSTOMER
EAGLE MOUNTAIN
WASTEWATER TREATMENT FACILITY

SITE

TITLE
GENERAL ARRANGEMENT
LAYOUT

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN	KK			03 FEB 26

PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF VEOLIA AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY VEOLIA AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN12-DL-100	A

PROJECT NO.	PART/MATERIAL	SCALE	SIZE	SHEET
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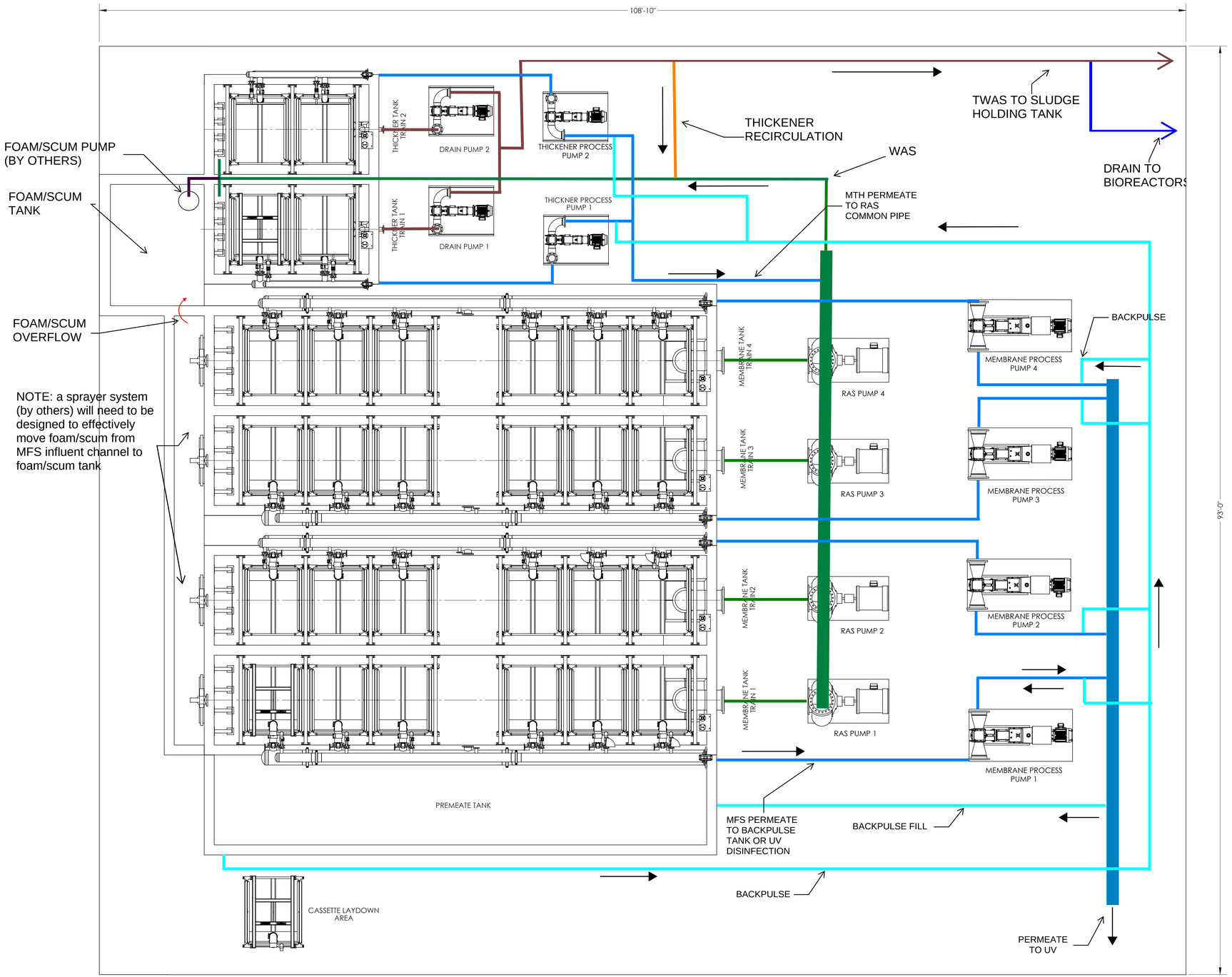
NOTES:
1. ALL DIMENSIONS ARE IN FEET & INCHES.
2. FOR REFERENCE ONLY, PIPING LAYOUTS TO BE DESIGNED, COORDINATED, AND PROVIDED BY OTHERS.
3. SUBJECT TO CHANGE PENDING FINAL HYDRAULIC PROFILE.
4. BACKPULSE TANK INLET AND OUTLET POSITIONED IN SUCH A WAY TO PREVENT DEAD ZONES.



PLAN VIEW

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REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN	KK			03 FEB 26

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CUSTOMER
EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY (EMWWTF)

SITE

TITLE
GENERAL ARRANGEMENT LAYOUT

DRAWING NUMBER	REVISION
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PROJECT NO.	PART/MATERIAL	SCALE	SIZE	SHEET
639082		1:65	D	2 OF 2

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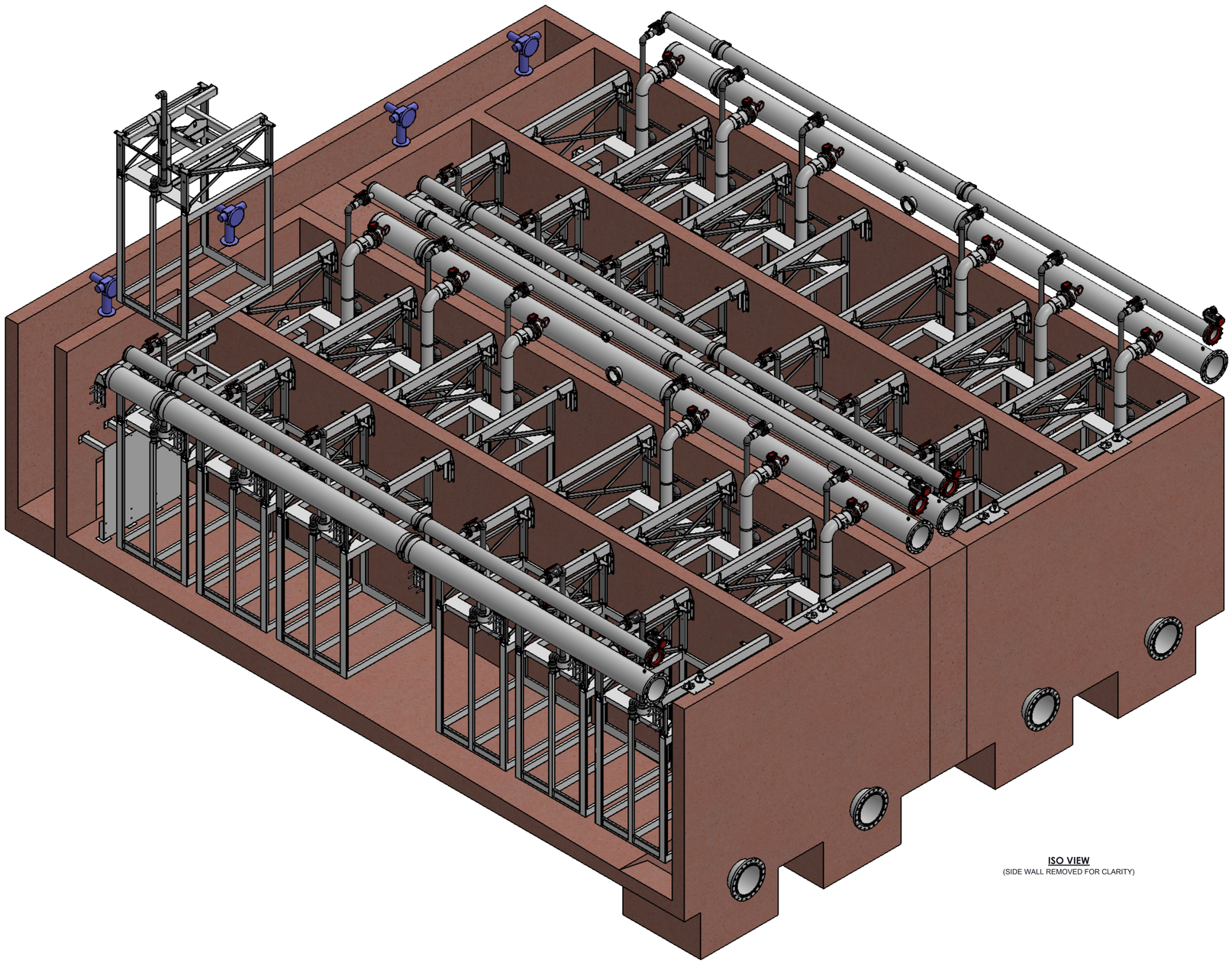
FILE LOCATION: C:\SWPDM\VAM-MTO\639082 - EAGLE MOUNTAIN CITY, UT\AM\V2_Mechanical Drawings\



ISO VIEW
(SIDE WALL REMOVED FOR CLARITY)

REFERENCE ONLY
DO NOT USE FOR CONSTRUCTION

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
& MEMBRANE THICKNER SYSTEM (MTH)

SITE

TITLE
GENERAL ARRANGEMENT
FOUR (4) MEMBRANE TANKS, 500EV-TX
SDs 1.01 - 1.3

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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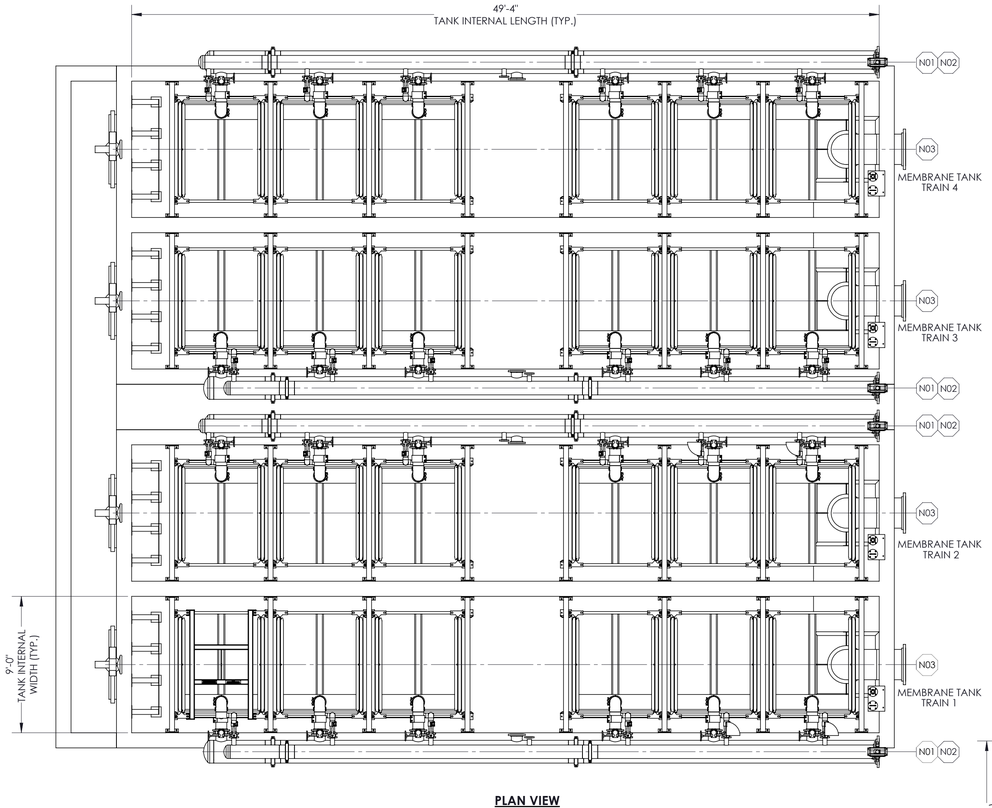
DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN12-DA-100	A

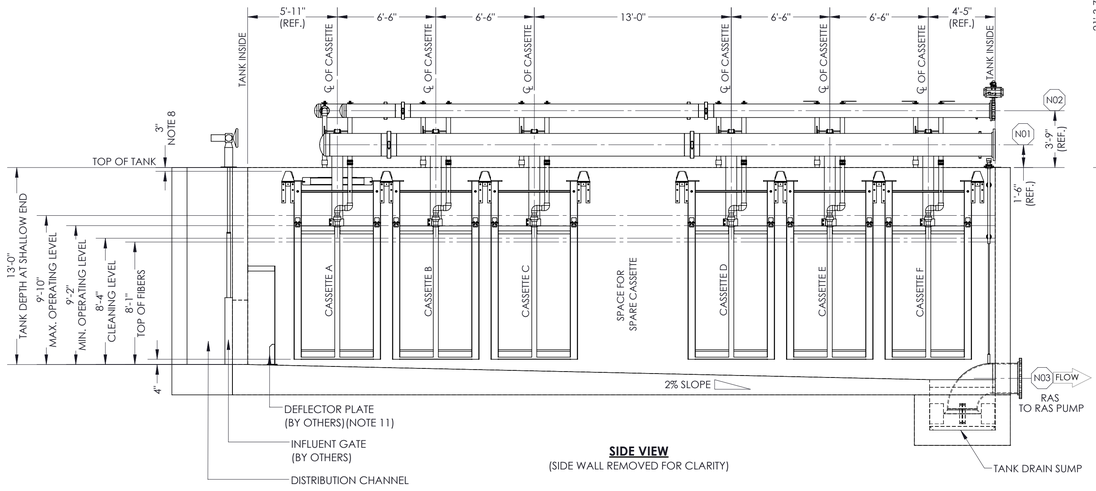
PROJECT NO.	PART/MATERIAL	SCALE	SIZE	SHEET
639082		1:40	D	1 OF 2

FILE LOCATION: C:\SWPDM\NAM-ITO\639082 - EAGLE MOUNTAIN CITY, UT\MFV2 Mechanical Drawings\

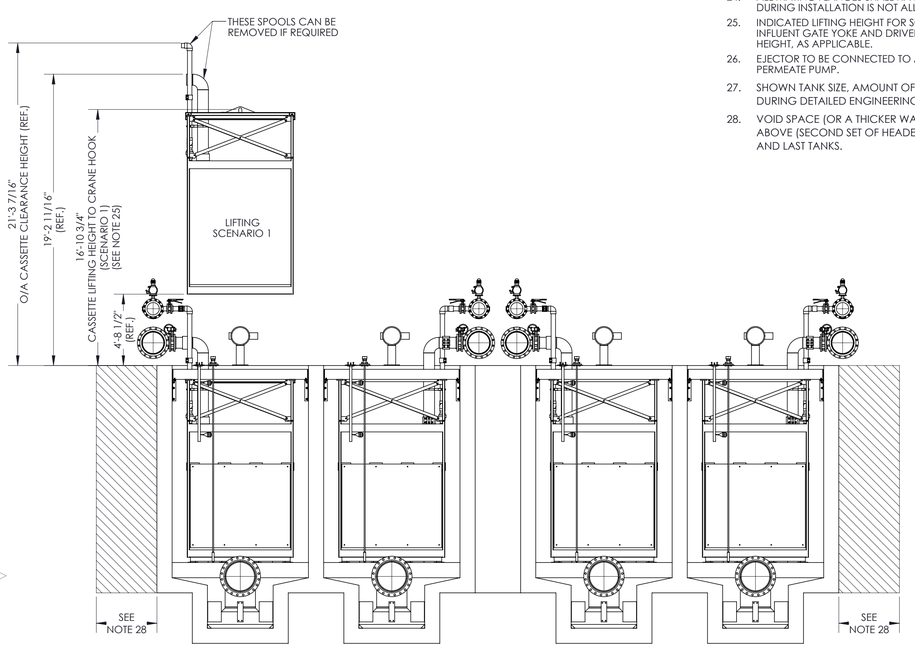
LAST SAVED: Wednesday, February 4, 2026 7:49:49 PM



PLAN VIEW



SIDE VIEW
(SIDE WALL REMOVED FOR CLARITY)



FRONT VIEW
(FRONT WALL REMOVED FOR CLARITY)

REFERENCE ONLY
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NOZZLE SCHEDULE			
NOZZLE	DESCRIPTION	TYPE	SIZE
N01	PERMEATE/BACKPULSE/CIP SOLUTION TO/FROM PROCESS PUMP	150# RF FLG	18"
N02	AIR FROM MEMBRANE AERATION BLOWERS	150# RF FLG	10"
N03	RAS / WAS / DRAIN PUMP SUCTION LINE (BY OTHERS)	150# RF FLG	24"

NOTES:

1. UNLESS NOTED OTHERWISE, DIMENSIONS GIVEN FOR INSTALLATION HAVE THE FOLLOWING TOLERANCES: DIMENSIONS TO INTERFACE/NOZZLES: ± 3/8"; ANGLES: ± 0.5°. ALL DIMENSIONS SHOWN ARE FINAL DIMENSIONS INSIDE THE TANK.
2. DESIGN DATA:
   • EST. CASSETTE SHIPPING WEIGHT:5,313 lbs [2,410 kg]
   • EST. CASSETTE MAX. WEIGHT (SLUDGED AND WITH LIFTING BRACKET): 9537 lbs [4,326 kg].
   • RECOMMENDED CRANE LIFTING CAPACITY: 10,000 lbs [4,535 kg]. THE VEOLIA LIFTING DESIGN GUIDELINE IS LISTED BELOW.
3. USE CRANE SCALE IF CASSETTE'S WEIGHT IS UNKNOWN. THE VEOLIA CRANE SCALE USE GUIDE IS LISTED BELOW.
4. CRANE HOIST CHAINFALL SHOULD BE IN LINE WITH CASSETTE CENTERLINE, FOR BOTH ALONG AND ACROSS THE TANK, BEFORE LIFTING CASSETTE.
5. LIFTING MODULE IS NOT TO BE LEFT INSIDE MEMBRANE TANK DURING OPERATION. A STORAGE SPACE WILL BE REQUIRED WHEN LIFTING MODULE IS NOT IN USE.
6. FOR SCOPE OF VEOLIA SUPPLIED EQUIPMENT AND TECHNICAL DATA REFER TO THE P&IDs (680821-WTS-PR-SYS-EN21-DS-104 SHEET 1) AND EQUIPMENT BILL OF MATERIAL.
7. DESIGN, SUPPLY AND INSTALLATION OF MEMBRANE TANKS, MEMBRANE TANK DISTRIBUTION CHANNEL, SLUICE GATES, EMERGENCY OVERFLOW, AND/OR WALKWAYS/HANDRAIL (IF REQUIRED) ARE BY OTHERS. SOME OF THOSE ARE NOT SHOWN FOR CLARITY.
8. DESIGN AND SUPPLY OF MEMBRANE TANK COVERS ARE BY OTHERS (TANK MUST BE VENTED). WALL BRACKETS/BEAMS ELEVATION SHOULD BE COORDINATED WITH TANK COVER THICKNESS. DEFAULT COVER THICKNESS OF 3" HAS BEEN USED AS A TEMPORARY PLACEHOLDER UNTIL COVER DESIGN IS FINALIZED (BY OTHERS).
9. DO NOT PUT THE CASSETTE ON TOP OF TANK COVERS.
10. DESIGN AND SUPPLY OF SUPPORTS FOR PERMEATE AND AIR HEADERS ARE BY OTHERS. OVERALL SYSTEM ENGINEER TO DETERMINE DESIGN, NUMBER AND LOCATION OF SUPPORTS. INDICATED HEADER ELEVATIONS ARE FOR REFERENCE ONLY. ANY CHANGE WILL AFFECT LIFTING HEIGHT AND CASSETTE CONNECTIONS DESIGN.
11. INFLUENT DEFLECTOR PLATE IS REQUIRED TO PREVENT DIRECT IMPACT OF FEED WATER ON CASSETTES. DEFLECTOR PLATE SIZE OF 70"(W)X63"(H) AND LOCATED WITH THE GAP OF 1" FROM TANK BOTTOM. CHANGE OF THE INFLUENT GATE DIMENSIONS AND/OR ELEVATION MAY AFFECT THE DEFLECTOR PLATE SIZE.
12. MEMBRANE TANK COVER DESIGN TO BE COORDINATED WITH VEOLIA TEAM FROM INITIAL STAGES OF COVER DESIGN. THE VEOLIA DESIGN GUIDELINE IS LISTED BELOW.
13. THE FOLLOWING DESIGN GUIDELINES ARE AVAILABLE FROM VEOLIA UPON REQUEST:
    • E000001-WTS-ME-T02-8522-SG-001 - MEMBRANE TOLERANCES.
    • E000001-WTS-ME-T02-8522-SG-016 - ZeeWeed 500D SERIES MEMBRANE LIFTING EQUIPMENT GUIDELINE
    • CRANE SCALE INSTALLATION AND USE (IN SERV-0083 ZW500 CASSETTE SOLIDS REMOVAL PROCEDURE).
14. ANY ANCHOR BOLT TO BE MINIMUM 4" AWAY FROM CONCRETE EDGES.
15. FOR INTERIOR TANK WALLS THAT HAVE BRACKETS ON BOTH SIDES, IF THE ANCHOR EMBEDMENT PLUS TWO TIMES THE ANCHOR DIAMETER IS GREATER THAN HALF OF TANK WALL THICKNESS, THEN THRU-WALL THREADED RODS MUST BE USED TO FIT 0.6875" DIA. HOLE (RODS TO BE SUPPLIED BY OTHERS)
16. PIPING MATERIAL:
    • AIR: SCH. 10, 304L SS FOR TRAIN HEADERS AND SCH. 80, CPVC FOR CASSETTE CONNECTIONS.
    • PERMEATE: SCH. 10, 316L SS
17. GASKET MATERIAL:
    • SS LINES: EPDM
18. FASTENER MATERIAL:
    • PROJECT SPEC TO BE DETERMINED DURING DETAILED PROJECT ENGINEERING.
19. ALL DIMENSIONS IN FEET-INCHES.
20. CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO INSTALLING PIPING/EQUIPMENT.
21. SUMP DESIGN IS BY OTHERS. TO ENSURE FULL TANK DRAIN, VORTEX BREAKER IS RECOMMENDED. FOR SUCTION LOSSES REDUCTION, A BELLMOUTH FITTING CAN BE USED. LONG RADIUS ELBOW IS RECOMMENDED IF FEASIBLE. INTRODUCTION OF ANY OF THESE FEATURES MAY REQUIRE SUMP SIZE INCREASE.
22. THIS SPOOL IS A PLACEHOLDER FOR RECOMENDED VORTEX BREAKER AND OPTIONAL FLARE (BELLMOUTH) SYSTEM ENGINEER TO DETERMINE DESIGN AND DIMENSIONS OF ANY OF THESE COMPONENTS, AS APPLICABLE.
23. UNLESS NOTED OTHERWISE, ALL FLANGE BOLT HOLES TO STRADDLE MAJOR CENTERLINES.
24. ALL MATING FLANGES SHALL HAVE PARALLEL FACE WITH NO OFFSET BETWEEN PIPE CENTERLINES. COLD SPRINGING OF PIPING DURING INSTALLATION IS NOT ALLOWED.
25. INDICATED LIFTING HEIGHT FOR SCENARIO No. 1 IS BASED ONLY ON COMPONENTS SHOWN ON THIS DRAWING. BE AWARE OF INFLUENT GATE YOKE AND DRIVER HEIGHT (NOT SHOWN IN THIS DRAWING); THOSE COULD CAUSE THE INCREASE OF LIFTING HEIGHT, AS APPLICABLE.
26. EJECTOR TO BE CONNECTED TO A PIPE OBVERT AT PIPE'S HEIGHEST POINT BETWEEN PERMEATE HEADER TIE POINT AND PERMEATE PUMP.
27. SHOWN TANK SIZE, AMOUNT OF MEMBRANES, AND PIPING ARE ALL BASED ON 10 C. OPTIMIZATION MIGHT BE POSSIBLE DURING DETAILED ENGINEERING. LARGER TANKS COULD BE USED FOR LOWER TEMPERATURE DESIGNS.
28. VOID SPACE (OR A THICKER WALL) IS REQUIRED IN BETWEEN PAIRS OF TANKS TO ACCOMMODATE TWO SETS OF HEADERS ABOVE (SECOND SET OF HEADERS IS NOT SHOWN). VOID SPACE (OR A THICKER WALL) IS NOT REQUIRED FOR THE FIRST AND LAST TANKS.

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
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CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
& MEMBRANE THICKNER SYSTEM (MTH)

SITE

TITLE
GENERAL ARRANGEMENT
FOUR (4) MEMBRANE TANKS, 500EV-TX
SDs 1.01 - 1.3

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN12-DA-100	A

PROJECT NO.	PART/MATERIAL	SCALE	SIZE	SHEET
639082		1:60	D	2 OF 2

FILE LOCATION: C:\SWPDM\MAM\ITO\639082 - EAGLE MOUNTAIN CITY, UTAH\2. Mechanical Drawings\

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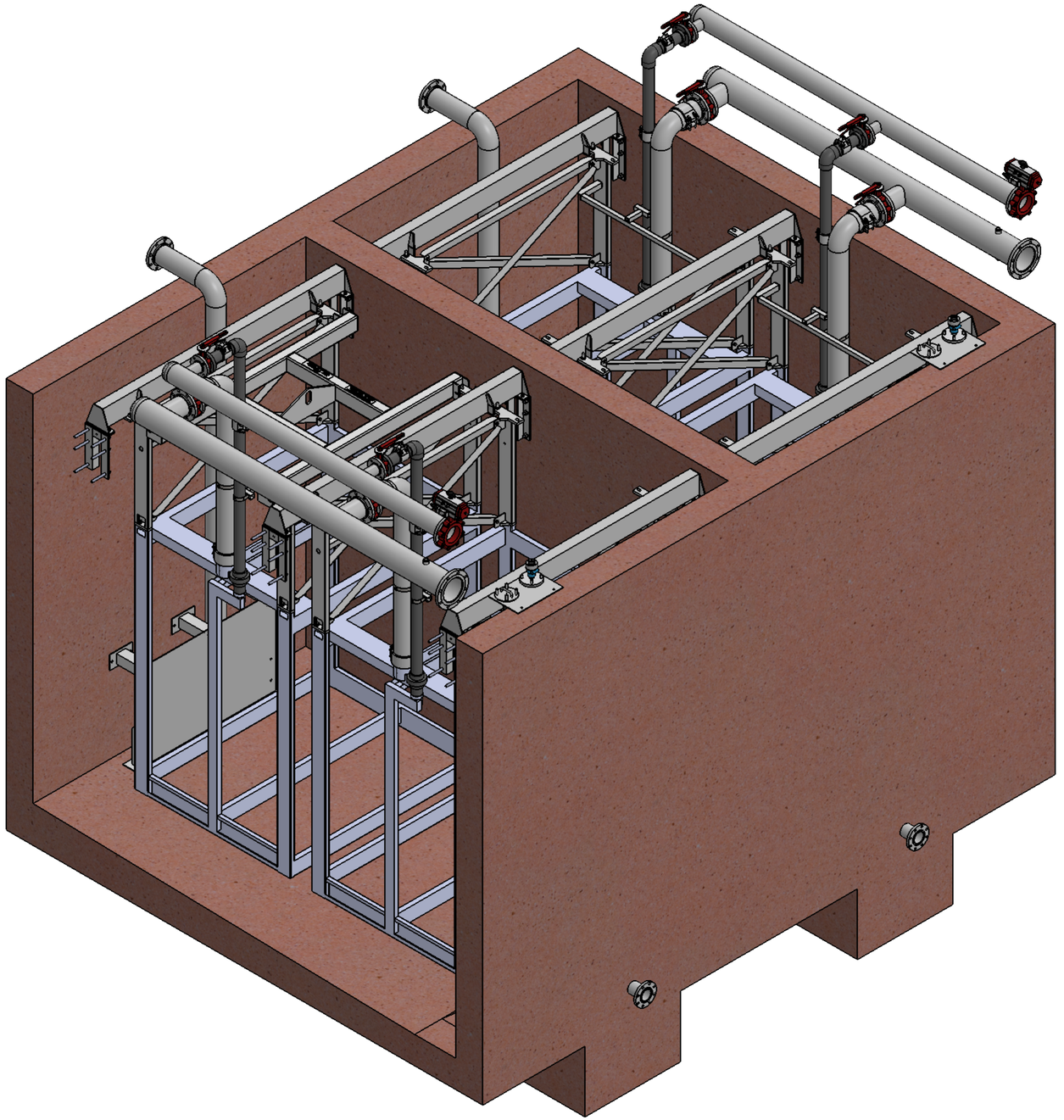

ISO VIEW

VEOLIA

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
& MEMBRANE THICKENER SYSTEM (MTH)

SITE

TITLE
GENERAL ARRANGEMENT
TWO (2) THICKENER TANKS
500EV RX 56M

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
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DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN12-DA-200	A

PROJECT NO.	PART/MATERIAL	SCALE	SIZE	SHEET
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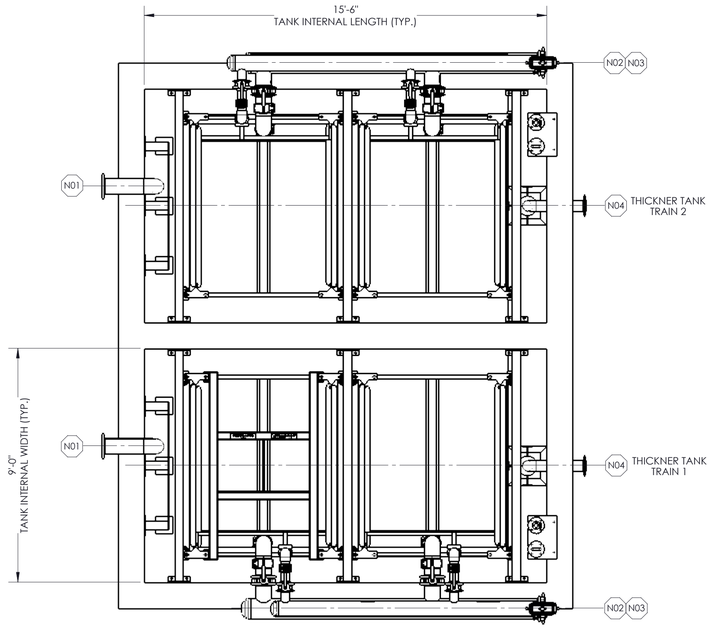
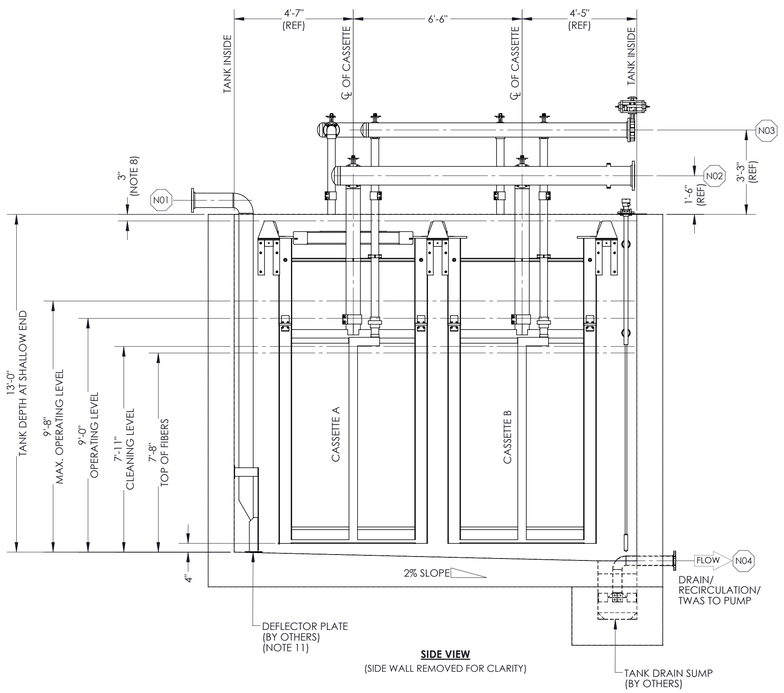


PLAN VIEW



SIDE VIEW
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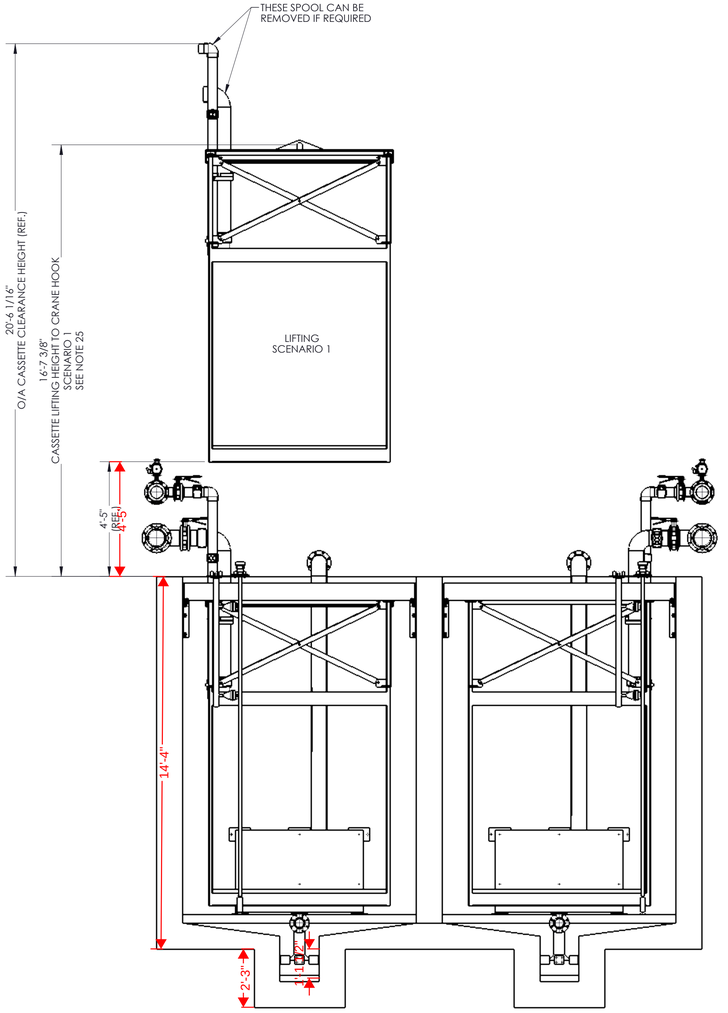

FRONT VIEW
(FRONT WALL REMOVED FOR CLARITY)

NOZZLE SCHEDULE

NOZZLE	DESCRIPTION	TYPE	SIZE
N01	WASTE ACTIVATED SLUDGE (WAS)	150# RF FLG	6"
N02	PERMEATE TO/FROM PROCESS PUMP	150# RF FLG	8"
N03	AIR FROM THICKENER AERATION BLOWERS	150# RF FLG	6"
N04	DRAIN/ RECIRCULATION/ TWAS PUMP SUCTION LINE	150# RF FLG	4"

NOTES:

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2. DESIGN DATA:
   • EST. CASSETTE SHIPPING WEIGHT:5,313 lbs [2,410 kg]
   • EST. CASSETTE MAX. WEIGHT (SLUDGED AND WITH LIFTING BRACKET): 9537 lbs [4,326 kg].
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3. USE CRANE SCALE IF CASSETTE'S WEIGHT IS UNKNOWN. THE VEOLIA CRANE SCALE USE GUIDE IS LISTED BELOW.
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5. LIFTING MODULE IS NOT TO BE LEFT INSIDE MEMBRANE TANK DURING OPERATION. A STORAGE SPACE WILL BE REQUIRED WHEN LIFTING MODULE IS NOT IN USE.
6. FOR SCOPE OF VEOLIA SUPPLIED EQUIPMENT AND TECHNICAL DATA REFER TO THE P&IDs (680821-WTS-PR-SYS-EN21-DS-104 SHEET 2) AND EQUIPMENT BILL OF MATERIAL.
7. DESIGN, SUPPLY AND INSTALLATION OF MEMBRANE THICKENER TANKS, MEMBRANE THICKENER FOAM/SCUM TANK DISTRIBUTION CHANNEL, INFLUENT PIPING, EMERGENCY OVERFLOW, AND/OR WALKWAYS/HANDRAIL (IF REQUIRED) ARE BY OTHERS. SOME OF THOSE ARE NOT SHOWN FOR CLARITY.
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11. INFLUENT DEFLECTOR PLATE IS REQUIRED TO PREVENT DIRECT IMPACT OF FEED WATER ON CASSETTES. DEFLECTOR PLATE SIZE OF 16"(W)X16"(H) AND LOCATED WITH THE GAP OF 1" FROM TANK BOTTOM.
12. MEMBRANE TANK COVER DESIGN TO BE COORDINATED WITH VEOLIA TEAM FROM INITIAL STAGES OF COVER DESIGN. THE VEOLIA DESIGN GUIDELINE IS LISTED BELOW.
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    • CRANE SCALE INSTALLATION AND USE (IN SERV-0083 ZW500 CASSETTE SOLIDS REMOVAL PROCEDURE).
14. ANY ANCHOR BOLT TO BE MINIMUM 4" AWAY FROM CONCRETE EDGES.
15. FOR INTERIOR TANK WALLS THAT HAVE BRACKETS ON BOTH SIDES, IF THE ANCHOR EMBEDMENT PLUS TWO TIMES THE ANCHOR DIAMETER IS GREATER THAN HALF OF TANK WALL THICKNESS, THEN THRU-WALL THREADED RODS MUST BE USED TO FIT 0.6875" DIA. HOLE (RODS TO BE SUPPLIED BY OTHERS)
16. PIPING MATERIAL:
    • AIR: SCH. 10, 304L SS FOR TRAIN HEADERS AND SCH. 80, CPVC FOR CASSETTE CONNECTIONS.
    • PERMEATE: SCH. 10, 316L SS
17. GASKET MATERIAL:
    • SS LINES: EPDM
18. FASTENER MATERIAL:
    • PROJECT SPEC TO BE DETERMINED DURING DETAILED PROJECT ENGINEERING.
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21. SUMP DESIGN IS BY OTHERS. TO ENSURE FULL TANK DRAIN, VORTEX BREAKER IS RECOMMENDED. FOR SUCTION LOSSES REDUCTION, A BELLMOUTH FITTING CAN BE USED. LONG RADIUS ELBOW IS RECOMMENDED IF FEASIBLE. INTRODUCTION OF ANY OF THESE FEATURES MAY REQUIRE SUMP SIZE INCREASE.
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24. ALL MATING FLANGES SHALL HAVE PARALLEL FACE WITH NO OFFSET BETWEEN PIPE CENTERLINES. COLD SPRINGING OF PIPING DURING INSTALLATION IS NOT ALLOWED.
25. INDICATED LIFTING HEIGHT FOR SCENARIO No. 1 IS BASED ONLY ON COMPONENTS SHOWN ON THIS DRAWING. (ITEMS NOT SHOWN ON THIS DRAWING) COULD CAUSE THE INCREASE OF LIFTING HEIGHT, AS APPLICABLE.
26. EJECTOR TO BE CONNECTED TO A PIPE OBVERT AT PIPE'S HEIGHEST POINT BETWEEN PERMEATE HEADER TIE POINT AND PERMEATE PUMP.
27. SHOWN TANK SIZE, AMOUNT OF MEMBRANES, AND PIPING ARE ALL BASED ON 10oC.

REFERENCE ONLY
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REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
& MEMBRANE THICKENER SYSTEM (MTH)

SITE

TITLE
GENERAL ARRANGEMENT
TWO (2) THICKENER TANKS
500EV RX 56M

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN12-DA-200	A

PROJECT NO.	PART/MATERIAL	SCALE	SIZE	SHEET
639082		1:35	D	2 OF 2

FILE LOCATION: C:\SWPDM\NAM\TO\639082 - EAGLE MOUNTAIN CITY, UTAH\2. Mechanical Drawings\
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7.5. Electrical drawings

LINE/CONNECTION DESCRIPTION	LINE STYLE/ SYMBOL
PANEL AND EQUIPMENT WIRING	
FIELD INTERCONNECTING WIRING BY OTHERS	
ELECTRICAL ASSEMBLY BOUNDARY	
CROSSING OF CONDUCTORS (NOT CONNECTED)	
INTERLOCK	
JUNCTION OF CODUCTORS	
UPWARD POWER FLOW	
CIRCUIT NUMBER	2
CONTINUATION ARROW	SHEET
CIRCUIT BREAK	POWER / CONTROL
IEC 2–WIRE CIRCUIT	
IEC 3–WIRE CIRCUIT	
IEC 4–WIRE CIRCUIT	
–	

SYMBOL DESCRIPTION	SYMBOL ANSI	SYMBOL IEC
CIRCUIT BREAKER WITH THERMAL OVERCURRENT TRIP	30HP	M 3~
HEATER LOAD	36kW	
ELECTRODIALYSIS STACK	EDR STACK	
TRANSFORMER		
CURRENT TRANSFORMER		
POTENTIAL TRANSFORMER		
TRANSFORMER WITH MULTIPLE WINDINGS		
3–PHASE, DELTA		
3–PHASE, WYE, UNGROUNDED		
3–PHASE, WYE, GROUNDED NEUTRAL		
INDUCTOR, REACTOR	3%	
CAPACITOR		
EARTH GROUND		

SYMBOL DESCRIPTION	SYMBOL ANSI	SYMBOL IEC
CIRCUIT BREAKER WITH THERMAL OVERCURRENT TRIP		
FUSE	3A	3A
1 SUPPLEMENTARY PROTECTOR 2 CIRCUIT BREAKER	1	2
OVERLOAD		
CONTACTOR		
OPERATING COIL		
AC/DC POWER SUPPLY, RECTIFIER, DC DRIVE		
VARIABLE FREQUENCY DRIVE, UNINTERRUPTIBLE POWER SUPPLY		
KEY INTERLOCK		
REFLECTED WAVE TRAP		
TERMINAL BLOCK		
RECEPTACLE, FEMALE CONNECTOR		
PLUG, MALE CONNECTOR		
SEPARABLE CONNECTOR		

SYMBOL DESCRIPTION	SYMBOL ANSI	SYMBOL IEC
CIRCUIT BREAKER WITH THERMAL OVERCURRENT TRIP	30AT 60AF	30AT 60AF
CIRCUIT BREAKER WITH MAGNETIC OVERCURRENT TRIP	30AT 60AF	30AT 60AF 1 >
FUSED DISCONNECT SWITCH 1 IEC: ON–LOAD ISOLATING	3A	3A
MAGNETIC STARTER WITH OVERLOAD DEVICE		
SELF–PROTECTED MAGNETIC MOTOR CONTROLLER		

NOTES AND WARNINGS:

1. WHERE A SYSTEM INCLUDES ONE OR MORE VFD'S THE WIRING FROM EACH MOTOR TO ITS VFD MUST BE SEPARATED FROM OTHER WIRING (BY DISTANCE OR BY METAL CONDUIT) TO PREVENT INTERFERENCE WITH OTHER ELECTRICAL CIRCUIT. ALSO EXCESSIVE VFD TO MOTOR WIRING DISTANCE MAY REQUIRE ADDITIONAL EQUIPMENT TO PREVENT MOTOR/WIRE DAMAGE DUE TO REFLECTED WAVES. TO PREVENT BOTH OF THESE POSSIBLE PROBLEMS, FOLLOW THE INSTALLATION RECOMMENDATIONS IN THE VFD MANUFACTURER'S MANUAL OR LITERATURE.
2. THE CONDUCTOR SIZES WHEN SHOWN ARE MINIMUM SIZES. LARGER SIZES MIGHT BE NEEDED TO MEET REQUIREMENTS FOR THE INSTALLATION CONDITIONS (SUCH AS HIGH AMBIENT TEMPERATURE OR LONG RUN VOLTAGE DROP).

DESIGNATIONS AND ABBREVIATIONS

A	AMPERE
AF	AMPERES FRAME
AT	AMPERES TRIP
AWG	AMERICAN WIRE GAUGE
C	CAPACITOR
cos•	POWER FACTOR
FLA	FULL LOAD AMPERES
GND	GROUND
icc	SHORT CIRCUIT CURRENT
ics	SERVICE SHORT CIRCUIT BREAKING CAPACITY
icu	SHORT CIRCUIT BREAKING CAPACITY
in	NOMINAL CURRENT
kA	KILO AMPERE
kAIC	KILO AMPERES INTERRUPTING CAPACITY
kVAR	KILO VOLT AMPERE REACTIVE
kVA	KILO VOLT AMPERE
kW	KILO WATT
MCC	MOTOR CONTROL CENTER
Ω	OHM
RMS	ROOT MEAN SQUARE
RPM	REVOLUTIONS PER MINUTE
SCCR	SHORT–CIRCUIT CURRENT RATING
THD	TOTAL HARMONIC DISTORTION
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLTS
VA	VOLTS AMPERE
VAC	VOLT, ALTERNATING CURRENT
VOC	VOLT, DIRECT CURRENT
VFD	VARIABLE FREQUENCY DRIVE
W	WATTS

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	AH	JW	JW	-	03-FEB-26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

SITE

TITLE
SINGLE LINE DIAGRAM
SYMBOL LEGEND

DRAWING NUMBER	REVISION
639082-WTS-EL-SYS-EN23-DI-200	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	01 OF 08

LAST SAVED: Tuesday, February 3, 2026 9:32:25 PM

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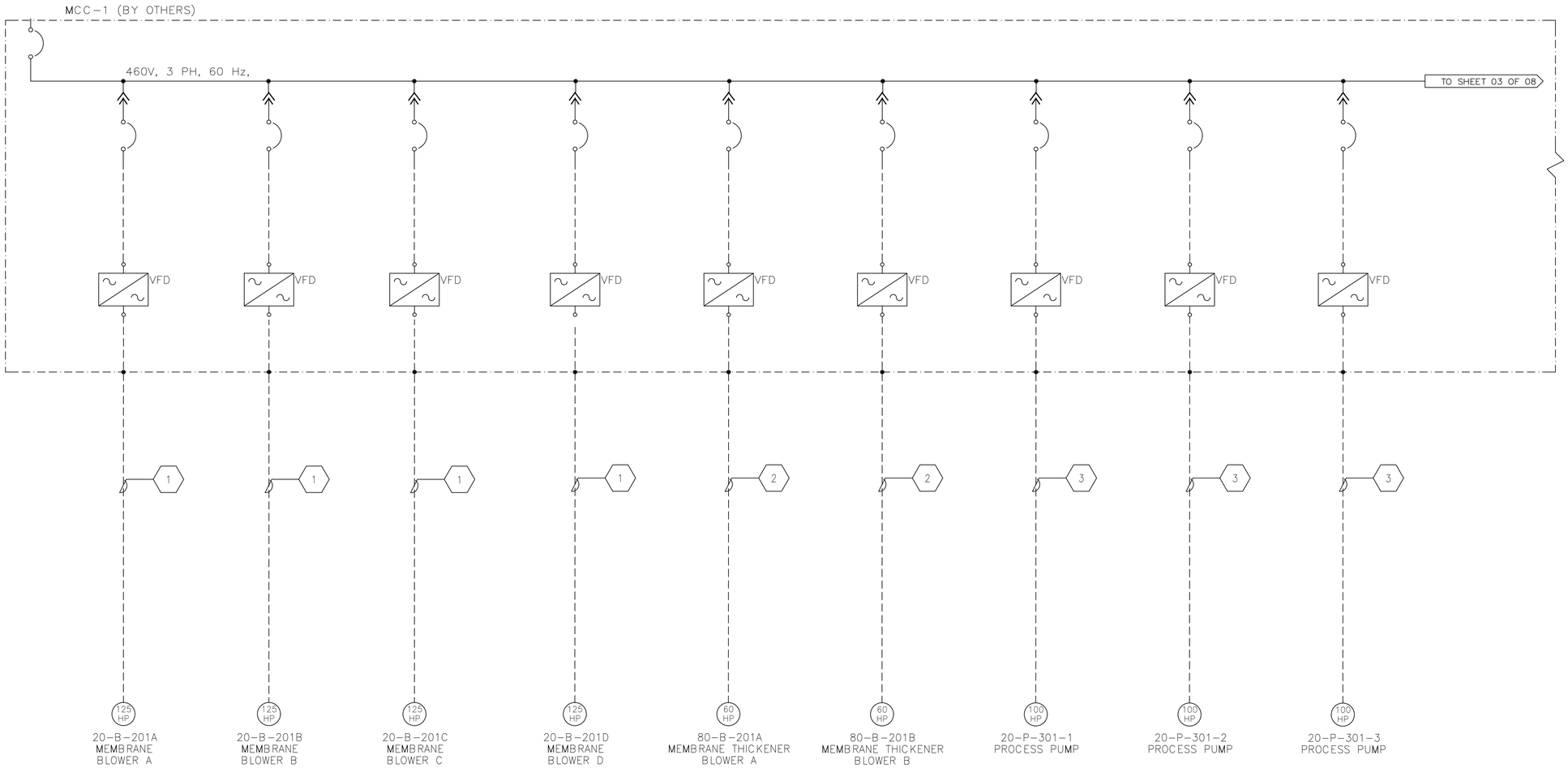

NOTES:

1. 460VAC,60HZ, 3 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
2. 120VAC,60HZ, 1 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
3. VFD/MOTOR STARTERS SUPPLIED BY OTHERS.

NOTES:

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	AH	JW	JW	-	03-FEB-26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

SITE

TITLE
SINGLE LINE DIAGRAM
460VAC/3 PH/ 60 HZ

DRAWING NUMBER	REVISION
639082-WTS-EL-SYS-EN23-DI-200	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	02 OF 08

LAST SAVED: Tuesday, February 3, 2026 9:33:27 PM

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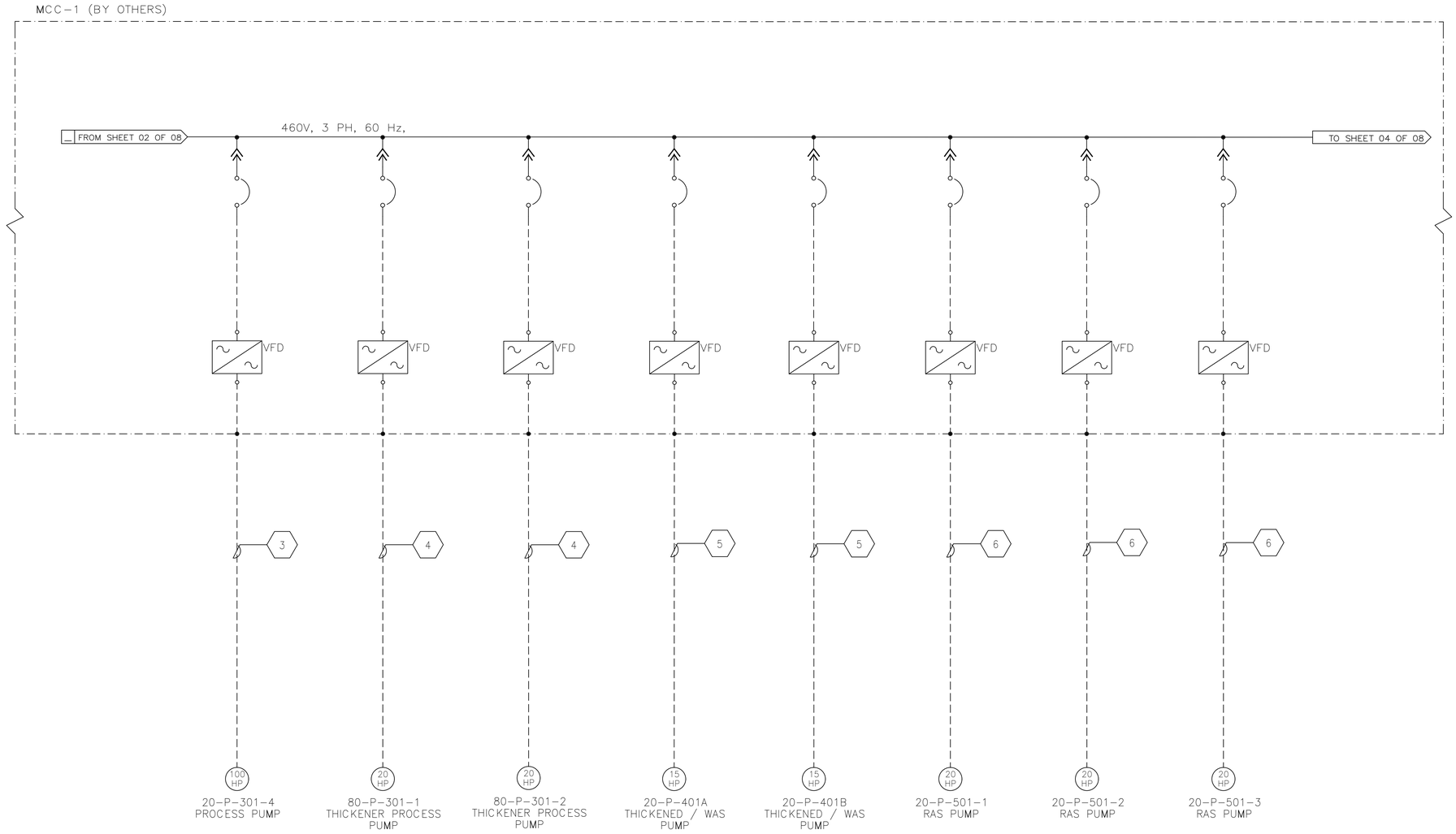

NOTES:

1. 460VAC,60HZ, 3 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
2. 120VAC,60HZ, 1 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
3. VFD/MOTOR STARTERS SUPPLIED BY OTHERS.

NOTES:

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A	INITIAL RELEASE	AH	JW	JW	-	03-FEB-26

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VEOLIA

CUSTOMER

EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

SITE

TITLE

SINGLE LINE DIAGRAM
460VAC/3 PH/ 60 HZ

DRAWING NUMBER	REVISION
639082-WTS-EL-SYS-EN23-DI-200	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	03 OF 08

LAST SAVED: Tuesday, February 3, 2026 9:33:28 PM

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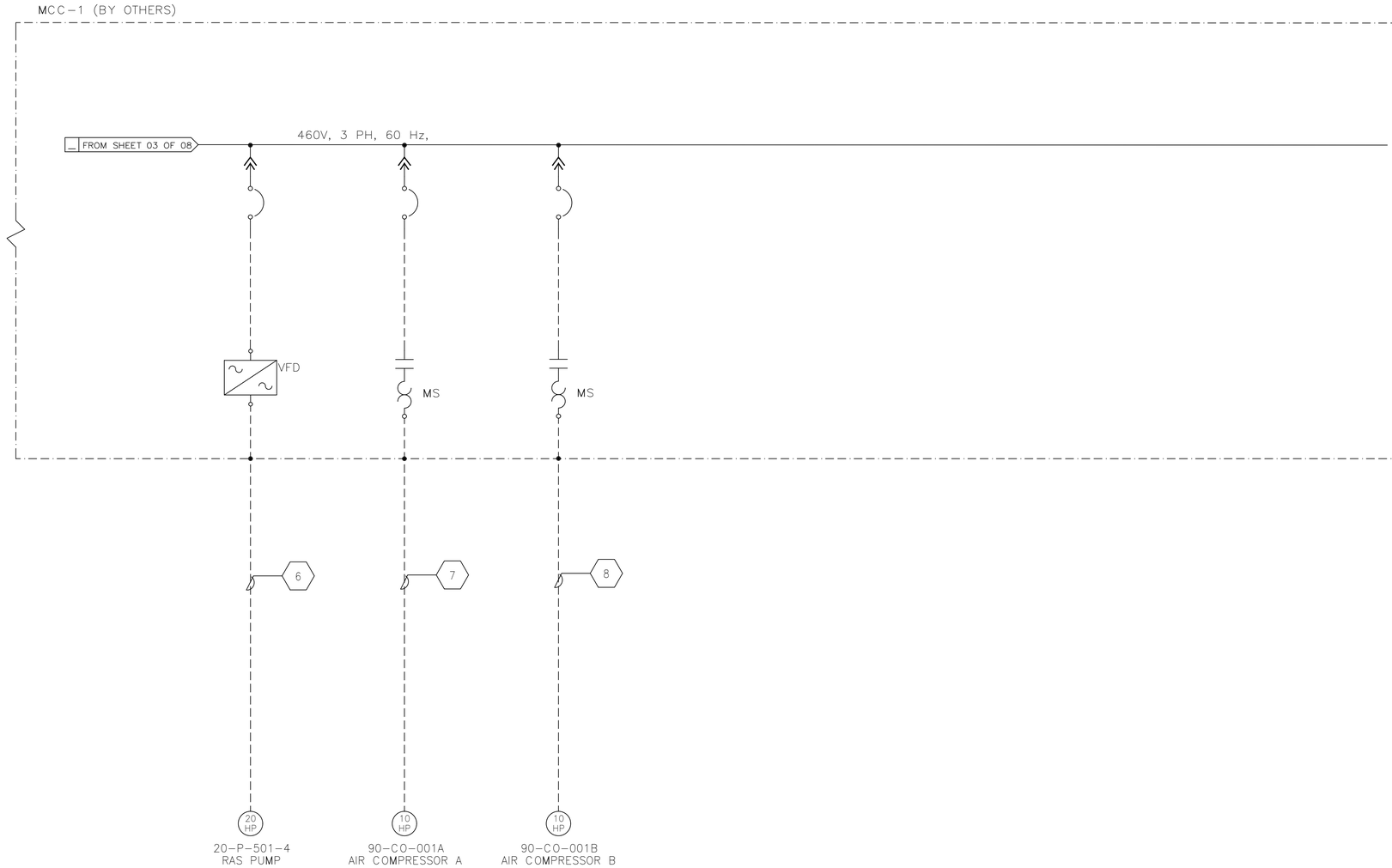

NOTES:

1. 460VAC,60HZ, 3 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
2. 120VAC,60HZ, 1 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
3. VFD/MOTOR STARTERS SUPPLIED BY OTHERS.

NOTES:

1. ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	AH	JW	JW	-	03-FEB-26

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VEOLIA

CUSTOMER

EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

SITE

TITLE

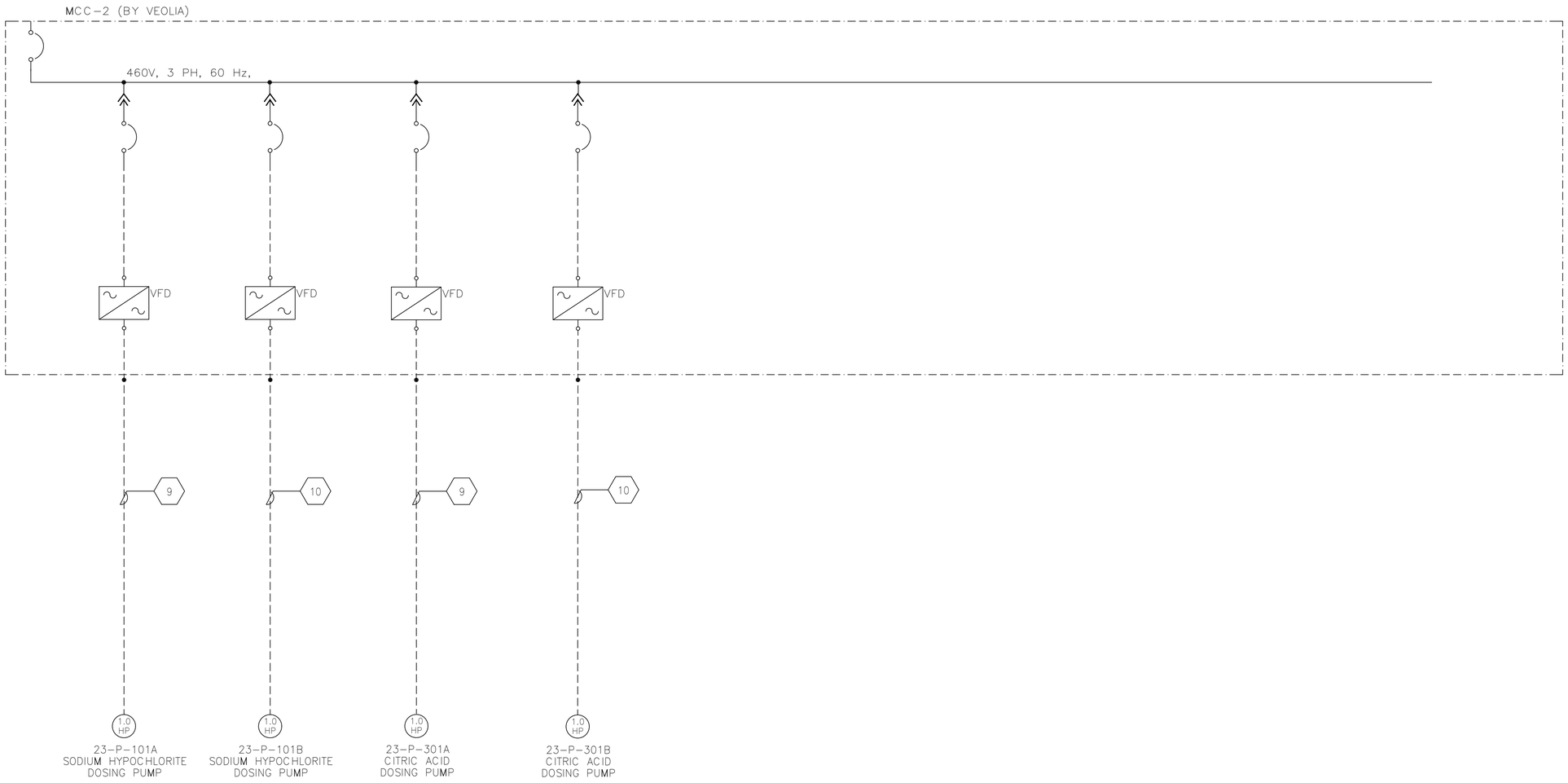
SINGLE LINE DIAGRAM
460VAC/3 PH/ 60 HZ

DRAWING NUMBER	REVISION
639082-WTS-EL-SYS-EN23-DI-200	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	04 OF 08

LAST SAVED: Tuesday, February 3, 2026 9:32:11 PM

FILE LOCATION: C:\Projects-2026\2026.01-30_EAGLE MOUNTAIN CITY (EMC) MEMBRANE FILTRATION SYSTEM-639082\Working\SLD\639082-WTS-EL-SYS-EN23-DI-200-04.dwg



NOTES:

1. 460VAC,60HZ, 3 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
2. 120VAC,60HZ, 1 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.
3. VFD SUPPLIED BY VEOLIA.

NOTES:

1. ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	AH	JW	JW	-	03-FEB-26

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VEOLIA

CUSTOMER

EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

SITE

TITLE

SINGLE LINE DIAGRAM
460VAC/3 PH/ 60 HZ

DRAWING NUMBER	REVISION
639082-WTS-EL-SYS-EN23-DI-200	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	05 OF 08

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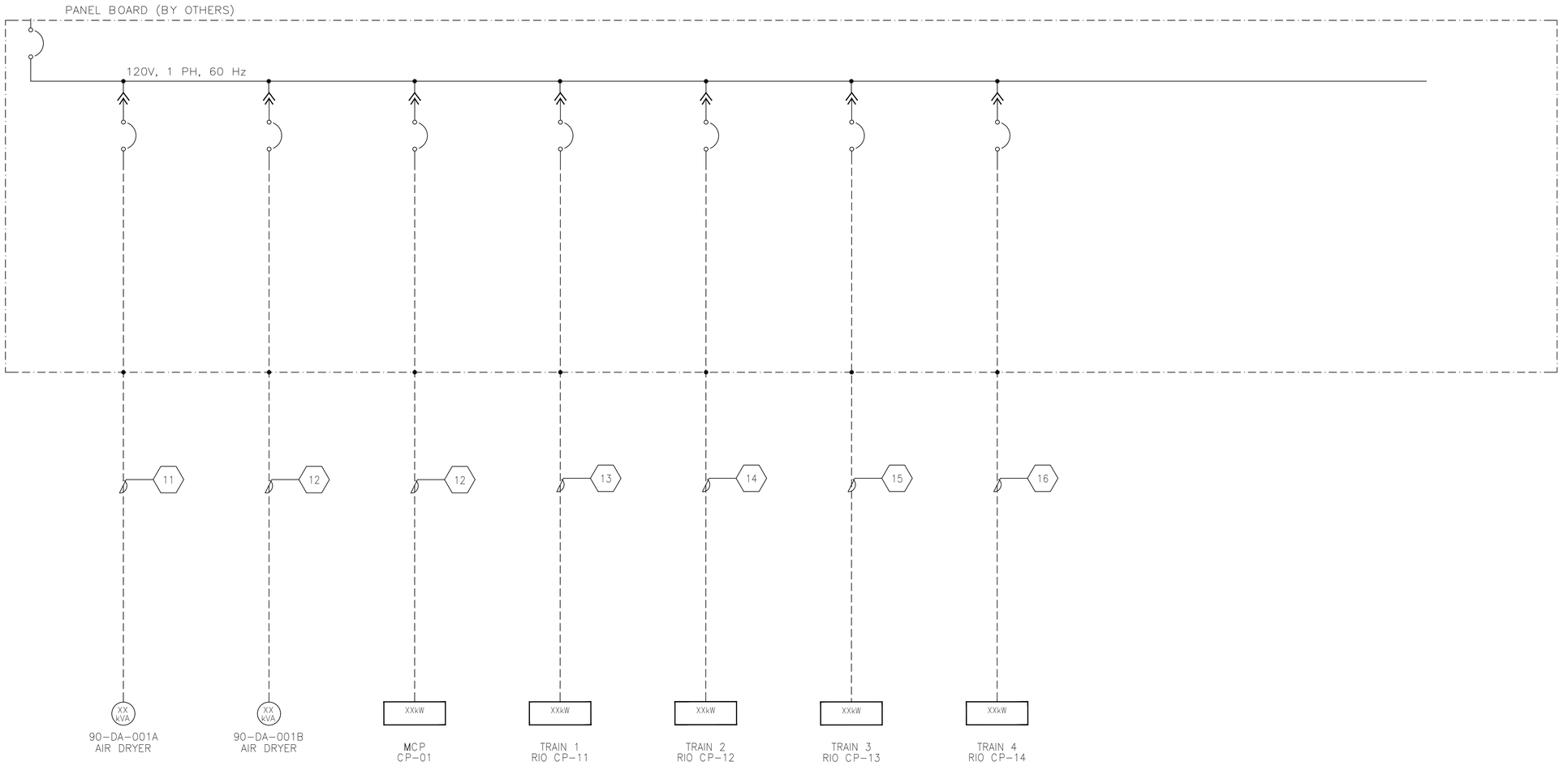

NOTES:

1. 120VAC,60HZ, 1 PHASE CIRCUIT BREAKER AND BRANCH CIRCUIT PROTECTION SUPPLIED BY OTHERS.

NOTES:

1. ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	AH	JW	JW	-	03-FEB-26

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VEOLIA

CUSTOMER

EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

SITE

TITLE

SINGLE LINE DIAGRAM
120VAC/1 PH/ 60 HZ

DRAWING NUMBER	REVISION
639082-WTS-EL-SYS-EN23-DI-200	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	06 OF 08

LAST SAVED: Tuesday, February 3, 2026 9:33:30 PM

FILE LOCATION: C:\Projects - 2026\2026.01.30_EAGLE MOUNTAIN CITY (EMC) MEMBRANE FILTRATION SYSTEM-639082\Working\SLD\639082-WTS-EL-SYS-EN23-DI-200-06.dwg

CIRCUIT INFORMATION

NO	TYPE	QTY	MCC LOAD DESCRIPTION	VOLTAGE	LOAD	FLA
1	BRN	4	MEMBRANE BLOWER A/B/C/D/E	460/3/60	125 HP	156 A
2	BRN	2	MEMBRANE THICKENER BLOWER A/B	460/3/60	60 HP	77 A
3	BRN	4	PROCESS PUMP 1/2/3/4	460/3/60	100 HP	124 A
4	BRN	2	THICKENER PROCESS PUMP 1/2	460/3/60	20 HP	27 A
5	BRN	2	THICKENED / WAS PUMP 1/2	460/3/60	15 HP	21 A
6	BRN	4	RAS PUM 1/2/3/4	460/3/60	20 HP	27 A
7	BRN	2	SODIUM HYPOCHLORITE DOSING PUMP A/B	460/3/60	1 HP	2.1 A
6	BRN	2	CITRIC ACID DOSING PUMP A/B	460/3/60	1 HP	2.1 A
7	BRN	2	AIR COMPRESSOR A/B	460/3/60	10 HP	14 A
8	BRN	2	AIR DRYER A/B	120/1/60	XX kW	XX A
9	BRN	1	MCP-01	120/1/60	XX kW	XX A
10	BRN	4	TRAIN-1/2/3/4 RIO CP-11/12/13/14	120/1/60	XX kVA	XX A

ABREVIATIONS" "NO" -CIRCUIT NUMBER; "QTY" - QUANTITY; "TERM TEMP" - TERMINAL TEMPERTURE RATING; "AMB. TEMP" - AMBIENT TEMPERATURE; "NA" - NOT APPLICABLE
CIRCUIT TYPES: "BRAN" - BRANCH; "FEED" *- "FEEDER; "SERV" - "SERVICE" "CTRL" - CONTROL; INST - "INSTRUMENTATION
ALL FIELD WIRING CONDUCTORS SHALL BE STRANDED COPPER ELECTRICAL DESIGN IS FOR NFPA 70 - NATIONAL ELECTRIC CODE

NOTES:
1. ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED.

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	AH	JW	JW	-	03-FEB-26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

SITE

TITLE
SINGLE LINE DIAGRAM
CIRCUIT SCHEDULE

DRAWING NUMBER	REVISION
639082-WTS-EL-SYS-EN23-DI-200	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	07 OF 08

LAST SAVED: Tuesday, February 3, 2026 9:31:57 PM

FILE LOCATION: C:\Projects-2026\2026.01.30_EAGLE MOUNTAIN CITY (EMC) MEMBRANE FILTRATION SYSTEM\639082-Working\SLD\639082-WTS-EL-SYS-EN23-DI-200-07.dwg

INSTALLATION INFORMATION

OVERCURRENT PROTECTION	CONTROLLER OR TRANSFORMER	TERM TEMP	AMB TEMP	WIRING	CONDUIT	LENGTH	NOTES

7.6. Process and Instrumentation Diagram (P&ID's)

EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

PIPING & INSTRUMENTATION DIAGRAMS

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
TITLE PAGE

DRAWING NUMBER				REVISION
639082-WTS-PR-SYS-EN21-DS-001				A
PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 1

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FILE LOCATION: C:\Users\13014315\AppData\Local\Temp\AcPublish_2000\639082-WTS-PR-SYS-EN21-DS-001.dwg

VALVE SYMBOLS

FILLED SYMBOL = NORMALLY CLOSED WHEN APPLIED

- THREE WAY VALVE
- FOUR WAY VALVE
- AIR RELEASE VALVE
- ANGLE VALVE
- AUTOMATIC PINCH VALVE
- BACK FLOW PREVENTER
- BALANCING VALVE
- BALL VALVE
- BALL CHECK VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- CLAMP PINCH VALVE
- DIAPHRAGM VALVE
- FOOT VALVE
- GENERIC VALVE
- GATE VALVE
- GLOBE VALVE
- INJECTION NOZZLE
- KNIFE GATE VALVE
- NEEDLE VALVE
- PLUG VALVE
- REGULATION VALVE
- PRESSURE RELIEF / SAFETY VALVE
- STRAIGHT RELIEF / BACK PRESSURE VALVE
- PENSTOCK / SLIDING GATE VALVE

VALVE ACTUATION

- DIAPHRAGM ACTUATOR
- PISTON ACTUATOR
- MOTORIZED ACTUATOR
- SOLENOID ACTUATOR
- FLOAT ACTUATOR
- INCLUDED MANUAL ACTUATOR
- PRESSURE REGULATING
- BACK PRESSURE REGULATING
- EXTERNAL PRESSURE REGULATING
- FX — FO - FAIL OPEN; FL - FAIL LOCKED; FI - FAIL INDETERMINATE; FC - FAIL CLOSED
- T-KEY ACTUATOR
- THREE PORT SOLENOID
- FIVE PORT SOLENOID
- E — EXHAUST PORT WITHOUT SPEED CONTROL
- E — EXHAUST PORT WITH INTEGRAL SPEED CONTROL
- PNEUMATIC SPEED CONTROL VALVE
- TRAVEL STOP

FITTINGS & CONNECTIONS

- FLANGE JOINT
- END FLANGE AND BOLTED
- PIPE CAP
- PLUG / END
- THREADED CAP
- THREADED CONNECTION
- SOCKET CONNECTION
- UNION JOINT
- SANITARY CLAMP (TRI-CLAMP)
- HOSE / TUBING CONNECTION
- HOSE
- REDUCER
- MECHANICAL COUPLING PLAIN END (STRAUB)
- MECHANICAL COUPLING GROOVE END (VICTAULIC)

SPECIALTY PIPING & ACCESSORIES

- EXPANSION JOINT
- STATIC MIXER
- SILENCER
- RESTRICTION ORIFICE
- ATMOSPHERIC VENT
- STRAINER
- SIGHT GLASS
- CONDENSATE TRAP
- AIR TRAP
- DEMISTER
- EJECTOR
- RUPTURE DISC
- DIAPHRAGM SEAL
- FOOT VALVE - FILTER
- VACUUM BREAKER
- SPRAY NOZZLES
- DRAIN / EVACUATION FUNNEL
- SPECTACLE PLATE (OPEN)
- SPECTACLE PLATE (CLOSED)
- FLAME ARESTOR
- PULSATION DAMPENER
- CALIBRATION COLUMN
- FILTER
- RESIN TRAP
- WASHING WATER PLUG
- DIFFUSER

PUMPS

- PUMP
- GEAR PUMP
- SCREW PUMP
- PISTON PUMP
- DIAPHRAGM PUMP
- CENTRIFUGAL PUMP
- ELECTROMAGNETIC PUMP
- PROGRESSIVE CAVITY PUMP
- INLINE PUMP WITH PRIMING PLUG
- MULTISTAGE PUMP
- VERTICAL / SUBMERSIBLE PUMP
- ROTARY PUMP

BLOWERS, COMPRESSORS & FANS

- COMPRESSOR
- ROTARY SCREW-TYPE COMPRESSOR / BLOWER
- ROTARY BLADE-TYPE COMPRESSOR / BLOWER
- PISTON DISPLACEMENT COMPRESSOR / BLOWER
- ROTARY PISTON DISPLACEMENT COMPRESSOR
- CENTRIFUGAL FAN / BLOWER
- AXIAL FAN / BLOWER
- FAN / BLOWER

MOTOR

- M — ELECTRIC MOTOR
- HYDRAULIC MOTOR
- PNEUMATIC MOTOR
- VFD — VARIABLE FREQUENCY DRIVE
- MS — MOTOR STARTER

FILTRATION

- SPIRAL WOUND MEMBRANE
- HOLLOW FIBER MEMBRANE

TANKS & VESSELS

- PRESSURE VESSEL
- TRAYS / PACKING — COLUMN
- CONICAL ROOF - STORAGE TANK
- DOME ROOF - STORAGE TANK
- OPEN ROOF STORAGE OR PREPARATION TANK
- CONE BOTTOM
- TOTE
- WATER LEVEL

EQUIPMENT

- SPEED REDUCTOR
- STIRRING DEVICE (AGITATOR)
- IMMERSED AGITATOR
- PLATE HEAT EXCHANGER
- SHELL & TUBE COOLING HX
- SHELL & TUBE HEATING HX
- ELECTRIC HEATER
- HORN
- HOIST WITH CARRIAGE
- SAFETY SHOWER AND EYEWASH
- CRANE WITH HOIST
- HYDROCYCLONE
- MICROSAND SAMPLE POT

PIPE LINES

- PROCESS LINES
- FUTURE OR OPTIONAL LINES
- BY OTHERS LINES
- DOUBLE CONTAINMENT LINES

PRIMARY, SECONDARY, UTILITY LINES - (THICK POLYLINE, 0.039")
AUXILIARY LINES - (THIN POLYLINE, 0.020")

ARROWS & CONTINUATION SYMBOLS

- CLASS-1 | CLASS-2 — PIPING CLASS CHANGE (IF NOT DESCRIBED BY LINE NUMBER)
- CUSTOMER / VEOLIA — SUPPLY LIMIT
- FLUID TYPE\SIGNAL TYPE; 000 P&ID NUMBER; CONNECTED DRAWING TITLE; CONNECTED TO/FROM — STANDARD OFF-PAGE CONNECTOR
- FLUID TYPE\SIGNAL TYPE; BY OTHERS; CONNECTED DRAWING TITLE; CONNECTED TO/FROM — OUTSIDE SUPPLY LIMIT OFF-PAGE CONNECTOR
- EQUIPMENT OR BOUNDARY LINE
- INTERRUPTION OF LINE
- FLOW ARROW
- Slope — SLOPE
- ABOVE GROUND / UNDERGROUND PIPE
- TP 01 — TIE IN PONT
- 00 — STREAM NUMBER
- 01 — KEYED NOTE

INSULATION

- INSULATED EQUIPMENT
- JACKETED EQUIPMENT
- COILED EQUIPMENT
- H — INSULATED LINE
  - A = Acoustical Insulation
  - C = Cold Conservation
  - H = Heat Conservation
  - I = Winterizing / Antifreezing
  - PP = Personnel Protection
- E — TRACED AND INSULATED LINE
  - E = Electrical Tracing
  - S = Steam Tracing

EQUIPMENT IDENTIFIER

ASSEMBLIES

AB	- ABSORPTION ASSEMBLY
ACF	- ACTIVATED CARBON FILTER
AD	- ADSORPTION ASSEMBLY
AER	- AERATOR
AN	- ANION EXCHANGER
BR	- BIOLOGICAL REACTOR
CAT	- CATION EXCHANGER
CLR	- CLARIFIER
CRY	- CRYSTALLIZER
CT	- COOLING TOWER
DA	- DEAERATOR
DAF	- DISSOLVED AIR FLOTATION
EDI	- ELECTRODEIONIZATION
EDR	- ELECTRODIALYSIS REVERSAL
EV	- EVAPORATOR
MB	- MIXED BED ION EXCHANGER
MBR	- MEMBRANE BIOREACTOR
MF	- MEDIA FILTER
NF	- NANOFILTRATION
OD	- OZONE DESTRUCT
OG	- OZONE GENERATOR
RO	- REVERSE OSMOSIS
SOF	- SOFTENER
U	- OTHER / MISC
UF	- ULTRAFILTRATION

DEVICES

B	- BLOWER
BO	- BOILER
C	- COMPRESSOR
COL	- COLUMN
CP	- CONTROL PANEL
DRY	- DRYER
ED	- EDUCTOR
F	- FILTER
FAN	- FAN
FP	- FILTER PRESS
GEN	- GENERATOR (POWER)
H	- HEATER
HX	- HEAT EXCHANGER
JB	- JUNCTION BOX
M	- MOTOR
MCC	- MOTOR CONTROL CENTER
MEM	- MEMBRANE
MS	- MOTOR STARTER
MX	- MIXER
P	- PUMP
PD	- PULSATION DAMPENER
PX	- PRESSURE EXCHANGER
R	- REACTOR
SCR	- SCREEN
SM	- SILENCER/MUFFLER
STR	- STRAINER
SU	- SUMP
TK	- TANK
TR	- TRAP
UV	- ULTRAVIOLET UNIT
V	- VESSEL
VFD	- VARIABLE FREQUENCY DRIVE

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
LEGEND & SYMBOLS

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-002	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 2

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ISA FORMAT INSTRUMENT IDENTIFICATION CODES

FUNCTION		ALARMS					CONTROLLERS		READOUT DEVICES		SWITCHES & SWITCH DEVICES						TRANSMITTERS			SOLENOIDS,RELAYS, COMMANDS, COMPUTING DEVICES	VALVES (ON/OFF)	VALVES CONTROL (MODULATING)	PRIMARY ELEMENT	WELL OR PROBE HOLDER	VIEWING DEVICE (GLASS)	SAFETY DEVICE
MEASURED VARIABLE	FIRST LETTER	GENERAL	HIGH	HIGH - HIGH	LOW	LOW - LOW	INDICATING	BLIND	RECORDING	INDICATING	GENERAL	HIGH	HIGH - HIGH	LOW	LOW - LOW	COMBINATION	RECORDING	INDICATING	BLIND							
ANALYSIS	A	AA	AAH	AAHH	AAL	AALL	AIC	AC	AR	AI	AS	ASH	ASHH	ASL	ASLL	ASHL	ART	AIT	AT	AY	AV	ACV	AE	AW	.	.
BURNER/COMBUSTION	B	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NOT ASSIGNED	C	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NOT ASSIGNED	D	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
VOLTAGE	E	EA	EAH	EAHH	EAL	EALL	EIC	EC	ER	EI	ES	ESH	ESHH	ESL	ESLL	ESHL	ERT	EIT	ET	EY	.	.	EE	.	.	.
FLOW	F	FA	FAH	FAHH	FAL	FALL	FIC	FC	FR	FI	FS	FSH	FSHH	FSL	FSLL	FSHL	FRT	FIT	FT	FY	FV	FCV	FE	.	FG	.
FLOW QUANTITY	FQ	FQA	FQAH	FQAHH	FQAL	FQALL	FQIC	FQC	FQR	FQI	FQS	FQSH	FQSHH	FQSL	FQSLL	FQSHL	FQRT	FQIT	FQT	FQY	FQV	FQCV	FE	.	.	.
FLOW RATIO	FF	FFA	FFAH	FFAHH	FFAL	FFALL	FFIC	FFC	FFR	FFI	FFS	FFSH	FFSHH	FFSL	FFSLL	FFSHL	.	.	.	FFY	FFV	FFCV	FE	.	.	.
NOT ASSIGNED	G	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
HAND	H	HA	.	.	.	.	HIC	HC	.	.	HS	.	.	.	.	.	.	.	.	.	HV	HCV	.	.	.	.
CURRENT	I	IA	IAH	IAHH	IAL	IALL	IIC	IC	IR	II	IS	ISH	ISHH	ISL	ISLL	ISHL	IRT	IIT	IT	IY	.	.	IE	.	.	.
POWER	J	JA	JAH	JAHH	JAL	JALL	JIC	JC	JR	JI	JS	JSH	JSHH	JSL	JSLL	JSHL	JRT	JIT	JT	JY	.	.	JE	.	.	.
TIME	K	KA	KAH	KAHH	KAL	KALL	.	.	.	KI	.	KSH	KSHH	KSL	KSLL	.	.	.	.	.	.	.	.	.	.	.
TIME QUANTITY	KQ	KQA	KQAH	KQAHH	KQAL	KQALL	.	.	.	KQI	.	KQSH	KQSHH	KQSL	KQSLL	.	.	.	.	.	.	.	.	.	.	.
LEVEL	L	LA	LAH	LAHH	LAL	LALL	LIC	LC	LR	LI	LS	LSH	LSHH	LSL	LSLL	LSHL	LRT	LIT	LT	LY	LV	LCV	LE	LW	LG	.
NOT ASSIGNED	M	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NOT ASSIGNED	N	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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PRESSURE/VACUUM	P	PA	PAH	PAHH	PAL	PALL	PIC	PC	PR	PI	PS	PSH	PSHH	PSL	PSLL	PSHL	PRT	PIT	PT	PY	*PV	PCV	PE	.	.	PSV , PSE
PRESSURE DIFF.	PD	PDA	PDAH	PDAHH	PDAL	PDALL	PDIC	PDC	PDR	PDI	PDS	PDSH	PDSHH	PDSL	PDSLL	PDSHL	PDRT	PDIT	PDT	PDY	PDV	PDCV	PE	.	.	.
QUANTITY	Q	QA	QAH	QAHH	QAL	QALL	QIC	QC	QR	QI	QS	QSH	QSHH	QSL	QSLL	QSHL	QRT	QIT	QT	QY	.	.	QE	.	.	.
RADIATION	R	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
SPEED/FREQUENCY	S	SA	SAH	SAHH	SAL	SALL	SIC	SC	SR	SI	SS	SSH	SSHH	SSL	SSLL	SSHL	SRT	SIT	ST	SY	.	.	SE	.	.	.
TEMPERATURE	T	TA	TAH	TAHH	TAL	TALL	TIC	TC	TR	TI	TS	TSH	TSHH	TSL	TSLL	TSHL	TRT	TIT	TT	TY	TV	TCV	TE	TW	.	TSE
TEMPERATURE DIFF.	TD	TDA	TDAH	TDAHH	TDAL	TDALL	TDIC	TDC	TDR	TDI	TDS	TDSH	TDSHH	TDSL	TDSLL	TDSHL	TDRT	TDIT	TDT	TDY	.	.	TE	TW	.	.
MULTIVARIABLE	U	UA	.	.	.	.	.	.	UR	UI	US	.	.	.	.	.	URT	UIT	UT	UY	.	.	.	.	.	.
VIBRATION / MACH. ANALYSIS	V	VA	VAH	VAHH	VAL	VALL	VIC	VC	VR	VI	VS	VSH	VSHH	VSL	VSLL	VSHL	VRT	VIT	VT	VY	.	.	VE	.	.	.
WEIGHT	W	WA	WAH	WAHH	WAL	WALL	WIC	WC	WR	WI	WS	WSH	WSHH	WSL	WSLL	WSHL	WRT	WIT	WT	WY	WV	WCV	WE	.	.	.
MISC.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
EVENT/STATE/PRESENCE	Y	YA	.	.	.	.	.	.	.	.	YS	.	.	.	.	.	.	.	.	YY	.	.	.	.	.	.
POSITION/DIMENSION	Z	*ZA	ZAH	ZAHH	ZAL	ZALL	ZIC	ZC	ZR	ZI	*ZS	ZSH	ZSHH	ZSL	ZSLL	ZSHL	ZRT	ZIT	ZT	ZY	.	.	ZE	.	.	.

NOTES:
1. THIS TABLE IS NOT ALL-INCLUSIVE.
2. "A" IS USED FOR ANALYTICAL VARIABLES NOT LISTED IN THE TABLE. EXAMPLE: O, H, CO, NO, CO, SO, pH, SMOKE, SP COND, CAT COND.
3. THIS TABLE IS DERIVED WITH CONTENT FROM ISA S5.1
* ZAC = CLOSE FAIL, ZAO = OPEN FAIL, ZSC = CLOSE STATUS, ZSO = OPEN STATUS.
* PVO = PNEUMATIC ACTUATOR RATE SET VALVE - OPENING, PVC = PNEUMATIC ACTUATOR RATE SET VALVE - CLOSING.

INSTRUMENT ELEMENT SYMBOLS

- XX — GENERAL SYMBOL; XX = INSTRUMENT IDENTIFICATION CODE
- XX — GENERAL SYMBOL IN-LINE ELEMENT; XX = FS, FG, FE, FT
- FIT / XXXX — GENERIC IN-LINE FLOW ELEMENT WITH INTEGRAL TRANSMITTER; XXXX = TYPE
- FIT / FE / XXXX — GENERIC IN-LINE FLOW ELEMENT WITH REMOTE TRANSMITTER; XXXX = TYPE
- RO — RESTRICTION ORIFICE
- FI — ROTAMETER
- FI — INTEGRAL VALVE ROTAMETER
- FLOW CONDITIONING DEVICE
- FSx — FLOW SWITCH; x = H/L
- FG — FLOW GLASS
- ORIFICE
- M — MAGNETIC FLOWMETER
- TURBINE OR PROPELER TYPE
- ULTRASONIC
- VORTEX SENSOR
- PITOT TUBE
- FLOW NOZZLE
- VENTURI
- POSITIVE DISPLACEMENT TYPE
- ORIFICE IN QUICK CHANGE FITTING
- PADDLE WHEEL
- CORIOLIS MASS FLOWMETER
- RADAR LEVEL

INSTRUMENT LINES

- CAPILLARY TUBING
- COMMUNICATION / SOFTWARE
- ELECTRICAL LINE
- HYDRAULIC SIGNAL
- PNEUMATIC
- WIRED ELECTROMAGNETIC
- WIRELESS ELECTROMAGNETIC

DEVICE AND FUNCTION SYMBOLS

HMI/SCADA OR BASIC PROCESS CONTROL SYSTEM	HARD WIRED I/O OR ALTERNATE CHOICE / SAFETY INSTRUMENTED SYSTEM	COMPUTER SYSTEMS AND SOFTWARE	DEVICE	LOCATION & ACCESSIBILITY
XXX / XXX	XXX / XXX	XXX / XXX	XXX / XXX / XXX	• LOCATED IN FIELD. • NOT PANEL, CABINET, OR CONSOLE MOUNTED. • VISIBLE AT FIELD LOCATION. • NORMALLY OPERATOR ACCESSIBLE.
XXX / XXX	XXX / XXX	XXX / XXX	XXX / XXX / XXX	• LOCATED IN OR ON FRONT OF CENTRAL OR MAIN PANEL OR CONSOLE. • VISIBLE ON FRONT OF PANEL OR ON VIDEO DISPLAY. • NORMALLY OPERATOR ACCESSIBLE AT PANEL FRONT OR CONSOLE.
XXX / XXX	XXX / XXX	XXX / XXX	XXX / XXX / XXX	• LOCATED IN REAR OF CENTRAL OR MAIN PANEL. • LOCATED IN CABINET BEHIND PANEL. • NOT VISIBLE ON FRONT OF PANEL OR ON VIDEO DISPLAY. • NOT NORMALLY OPERATOR ACCESSIBLE AT PANEL OR CONSOLE.

- I — INTERLOCK
- XXX / XXX — INDICATOR LIGHT OR BEACON, ON PANEL

INSTRUMENT CONVERTER ABBREVIATION

CONVERTER
X/X = INPUT/OUTPUT OF THE FOLLOWING

- A- ANALOG
- B - BINARY
- D - DISCRETE
- E - VOLTAGE
- H - HYDRAULIC
- I - CURRENT
- O - ELECTROMAG/SONIC
- P - PNEUMATIC
- R - RESISTANCE (ELEC)

GENERAL ABBREVIATIONS

- (A) - ABANDON IN PLACE
- AG - ABOVE GROUND
- ALK - ALKALINITY
- AMB - AMBIENT
- BL - BATTERY LIMIT
- BF - BLIND FLANGE
- BTL - BOTTOM TANGENT LINE
- BLDG - BUILDING
- CCO - CHEMICAL CLEAN OUT
- CIP - CLEAN IN PLACE
- CO - CLEAN OUT
- CW - CLOCKWISE
- C/W - COMPLETE WITH
- CA - COMPRESSED AIR
- CDA - COMPRESSED DRY AIR
- COND - CONDUCTIVITY
- CCW - COUNTER CLOCKWISE
- DIA - DIAMETER
- DO - DISSOLVED OXYGEN
- DBB - DOUBLE BLOCK & BLEED
- DWG - DRAWING
- EA - EACH
- ES - ELECTRIC SUPPLY
- EL - ELEVATION
- (E) - EXISTING
- EXT - EXTERNAL
- FOF - FACE OF FLANGE
- FC - FAIL CLOSED
- FI - FAIL INDETERMINATE
- FL - FAIL LAST
- FO - FAIL OPEN
- FF - FLAT FACE
- FP - FULL PORT
- FV - FULL VACUUM
- (F) - FUTURE
- HH - HAND HOLE
- HOA - HAND/OFF/AUTO
- HARD - HARDNESS
- HWL - HIGH WATER LEVEL
- HMI - HUMAN-MACHINE INTERFACE
- ID - INSIDE DIAMETER
- I/F - INTERFACE
- INT - INTERNAL
- KW - KILOWATT
- LC - LOCKED CLOSED
- LO - LOCKED OPEN
- MW - MANWAY
- MOC - MATERIAL OF CONSTRUCTION
- MAX - MAXIMUM
- MP - MEDIUM PRESSURE
- MIN - MINIMUM
- (N) - NEW
- NC - NORMALLY CLOSED
- NNF - NORMALLY NO FLOW
- NO - NORMALLY OPEN
- N - NOZZLE
- OD - OUTSIDE DIAMETER
- OAH - OVERALL HEIGHT
- OVHD - OVERHEAD
- ORP - OXYGEN-REDUCTION POTENTIAL
- PH - PHASE
- POS - POSITIONED
- PLC - PROGRAMMABLE LOGIC CONTROLLER
- QC - QUICK CONNECT
- RF - RAISED FACE
- RP - REDUCED PORT
- (R) - RELOCATE/REUSE
- REQD - REQUIRED
- RTD - RESISTANCE TEMPERATURE DETECTOR
- RES - RESISTIVITY
- SCH - SCHEDULE
- SP - SETPOINT or SAMPLE POINT
- SOP - SHUT OFF PRESSURE
- SLD - SIDE LIQUID DEPTH
- SLL - SIDE LIQUID LEVEL
- SPEC - SPECIFICATION
- STD - STANDARD
- SAS - START/AUTO/STOP
- SWL - STATIC WATER LEVEL
- SS - STRAIGHT SIDE
- SCADA- SUPERVISORY CONTROL AND DATA ACQUISITION
- SYM - SYMMETRICALLY PIPED
- T/T - TANGENT TO TANGET
- TCx - THERMOCOUPLE (TYPE x)
- THK - THICK
- TSO - TIGHT SHUT-OFF
- TBA - TO BE ANNOUNCED
- TOS - TOP OF SLUDGE
- TDH - TOTAL DISCHARGE HEAD
- TOC - TOTAL ORGANIC CARBON
- TR - TRIM
- TURB - TURBIDITY
- TYP - TYPICAL
- UG - UNDERGROUND
- UPS - UNINTERRUPTIBLE POWER SUPPLY
- UC - UTILITY CONNECTION
- VAC - VACUUM or VOLTS AC
- (V) - VENDOR FURNISHED
- V - VOLTS
- W - WATTS

FLUID CODES

- AF - ANTIFOAM
- AIR - COMPRESSED AIR
- ALCL - ALUMINIUM CHLORIDE
- ALUM - ALUMINIUM SULFATE (ALUM)
- AS - ANTISCALANT
- BG - BIOGAS
- BR - BRINE
- BSB - BIOLOGIC SLUDGE STABILIZED
- BW - BACKWASH WATER
- BWA - BACKWASH AIR
- BWS - BOILER WATER SAMPLING
- CA - CITRIC ACID
- CL2 - CHLORINE GAS
- CLO2 - CHLORINE DIOXIDE
- COAG - COAGULANT
- CONC - REJECT/CONCENTRATE
- COND - CONDENSATE
- CW - COOLING WATER
- DEG - CHEMICAL DRAIN
- DM - DEMINERALIZED WATER
- DSG - DIGESTED SLUDGE
- DWSL - DEWATERED SLUDGE
- EDE - SEWAGE
- FC - FERRIC CHLORIDE
- FLOC - FLOCCULANT
- FRS - FERROUS SULFATE
- FS - FERRIC SULFATE
- FW - FEED WATER
- H2O2 - HYDROGEN PEROXIDE
- H2SO4 - SULPHURIC ACID
- H3PO4 - PHOSPHORIC ACID
- HCL - HYDROCHLORIC ACID
- HNO3 - NITRIC ACID
- IA - INSTRUMENT AIR
- KMN - POTASSIUM PERMANGANATE
- LS - LIME SLURRY
- ME - METHANOL
- NAA - ACETIC ACID
- NAOCL - SODIUM HYPOCHLORITE
- NAOH - SODIUM HYDROXIDE (CAUSTIC)
- NH3 - AMMONIA
- O3 - OZONE
- PEC - LIME WATER
- POL - POLYMER
- PW - POTABLE WATER
- QCA - ACTIVATED CARBON
- ROP - RO PERMEATE
- RW - RAW WATER
- SBS - SODIUM BISULFITE
- SEA - SEAWATER
- SL - SLUDGE (GENERAL)
- SMS - MICROSAND
- SRA - ANIONIC RESIN
- SRC - CATIONIC RESIN
- ST - STEAM
- SVW - SERVICE WATER
- SW - SOFTENED WATER
- TAZ - NITROGEN
- TOX - OXYGEN
- TSL - THICKENED SLUDGE
- UFP - UF PERMEATE
- WW - WASTE WATER

TAGGING & CODES

PIPE TAGGING FORMAT

(OPTIONAL) — PIPE SPECIFICATION
AA-MMMPPPF-GGGG-BBB-DDDE-J-KLL
- AA - LINE SIZE
- MMM - PIPE MATERIAL CODE
- PPP - PIPE PRESSURE RATING CODE
- F - PIPE SERVICE MODIFIER
- GGGG - FLUID CODE
- BBB - AREA
- DDD - SEQUENCE IDENTIFIER
- E- SUB SEQUENCE IDENTIFIER
- J - MULTIPLE TRAIN IDENTIFIER
- K - INSULATION, TRACING, CONTAINMENT (AS NEEDED)
- L - INSULATION THICKNESS (AS NEEDED)

EXAMPLE PIPE TAG: 4-SS150A-FW-170-101A-1-E2

GENERAL TAGGING FORMAT

BBB-CCCDDDE- F
- BBB - AREA
- CCC - EQUIPMENT/COMPONENT TYPE
- DDD - SEQUENCE / LOOP IDENTIFIER
- E - SUB SEQUENCE / LOOP IDENTIFIER (OPTIONAL)
- F - MULTIPLE TRAIN IDENTIFIER (OPTIONAL)

EXAMPLE: 170-P105B-2
(AREA 170, PUMP , SEQUENCE 105, DEVICE B, TRAIN 2)

PIPING SPECIALITY: 170-SP / 105

EQUIPMENT: 170-P105

INSTRUMENT/ AUTO VALVE: 170-TI / 105 — NOTE: REFER TO ISA TABLE

MANUAL VALVE: ADDITIONAL INFORMATION; MANUAL VALVE CODE YYY, 4.BA.11.FA, 170-HV105 — MANUAL VALVE TAG

PIPE SPECIFICATIONS

PIPE MATERIAL CODES

- 6MO - 6% MOLY (AL6XN, 254SMO)
- A20 - ALLOY 20
- CI - CAST IRON
- CS - CARBON STEEL
- DI - DUCTILE IRON
- FRP - FRP
- GS - GALVANIZED STEEL
- HC - HASTELLOY C276
- PP - POLYPROPYLENE
- PPL - POLYPROPYLENE LINED
- PVC - UNPLASTICIZED POLYVINYL CHLORIDE UPVC/PVC
- RH - RUBBER HOSE
- SA - 304/304L
- SD - DUPLEX STAINLESS STEEL
- SS - 316/316L
- TL - TEFLON LINED
- XXX - CUSTOM
- CTS - COATED STEEL
- SDX - SUPER DUPLEX STAINLESS
- HC - HASTELLOY C276
- AL - ALUMINIUM
- CON - CONCRETE
- CPVC - CHLORINATED POLYVINYL CHLORIDE
- PVDF - POLYVINYLIDENE FLUORIDE
- PVDL - PVDF LINED
- HDPE - HIGH DENSITY POLYETHYLENE
- GRP - GLASS-FIBRE REINFORCED EPOXY
- GRE - GLASS REINFORCED EPOXY
- FPA - FLEXIBLE POLYAMIDE
- RIL - RILSAN/NYLON
- ECTFE - ETHYLENE-CHLOROTRIFLUOROETHYLENE
- COP - COPPER-NICKEL

PIPE PRESSURE RATING CODES

- 125 - 125#
- 150 - 150#
- 300 - 300#
- 600 - 600#
- 900 - 900#
- 1500 - 1500#
- S40 - SCH 40
- S80 - SCH 80
- SDR21 - SDR21, HDPE/PVC, PLASTIC PIPE
- SDR17 - SDR17, HDPE/PVC, PLASTIC PIPE
- SDR13.5 - SDR13.5, HDPE/PVC, PLASTIC PIPE
- SDR11 - SDR11, HDPE/PVC, PLASTIC PIPE
- TB - TUBING
- PN6 - EN/ISO PN6, LOW-PRESSURE METRIC
- PN10 - EN/ISO PN10, COMMON FOR PLASTICS/METRIC
- PN16 - EN/ISO PN16, COMMON FOR STEEL/PLASTICS/METRIC
- PN25 - EN/ISO PN25, HIGHER PRESSURE METRIC
- PN40 - EN/ISO PN40, HIGH-PRESSURE METRIC
- PN100 - EN/ISO PN100, SPECIALTY METRIC
- PN63 - EN/ISO PN63, SPECIALTY METRIC

MANUAL VALVE CODE FORMAT

(OPTIONAL) — X.AA.BB.CD
- X - SIZE
- AA - TYPE
- BB - SEQUENCE IDENTIFIER
- C - CONNECTION / END TYPE
- D - MODIFIER

EXAMPLE VALVE CODE: 4.BA.11.FA

TYPE
- AN- ANGLE VALVE
- BA - BALL VALVE
- BU - BUTTERFLY VALVE
- CK - CHECK VALVE
- DI - DIAPHRAGM VALVE
- FW - 4-WAY VALVE
- GA - GATE VALVE
- GL - GLOBE VALVE
- KN - KNIFE VALVE
- NV - NEEDLE VALVE
- PL - PLUG VALVE
- PV - PINCH VALVE
- TW - 3-WAY VALVE
- VS - SPECIAL VALVE

CONNECTION / END TYPE
- A - FLANGED (RF)
- B - FLANGED (FF)
- C - THREADED
- D - SOCKET WELD
- E - BUTTWELD
- F - WAFER
- G - LUGGED
- H - MECHANICAL JOINT
- J - TUBING COMPRESSION FITTING
- K - OTHER

MODIFIER
- A - VALVE BONNET EXTENSION
- B - 2" VALVE EXTENSION
- C - CHAIN OPERATOR WITH 15' CHAIN
- D - CHAIN OPERATOR WITH 30' CHAIN
- E - OPEN AND CLOSE LIMIT SWITCHES
- F - GEAR OPERATOR
- G - LEVER OPERATOR
- H - 100% ADJUSTABLE TRAVEL STOPS
- J - VACUUM SERVICE PACKING

NOTES

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF VEOLIA AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY VEOLIA AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.

VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
LEGEND & SYMBOLS

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-002	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	2 OF 2

FILE LOCATION: C:\Users\13014315\AppData\Local\Temp\AcPublish_2000\639082-WTS-PR-SYS-EN21-DS-001.dwg
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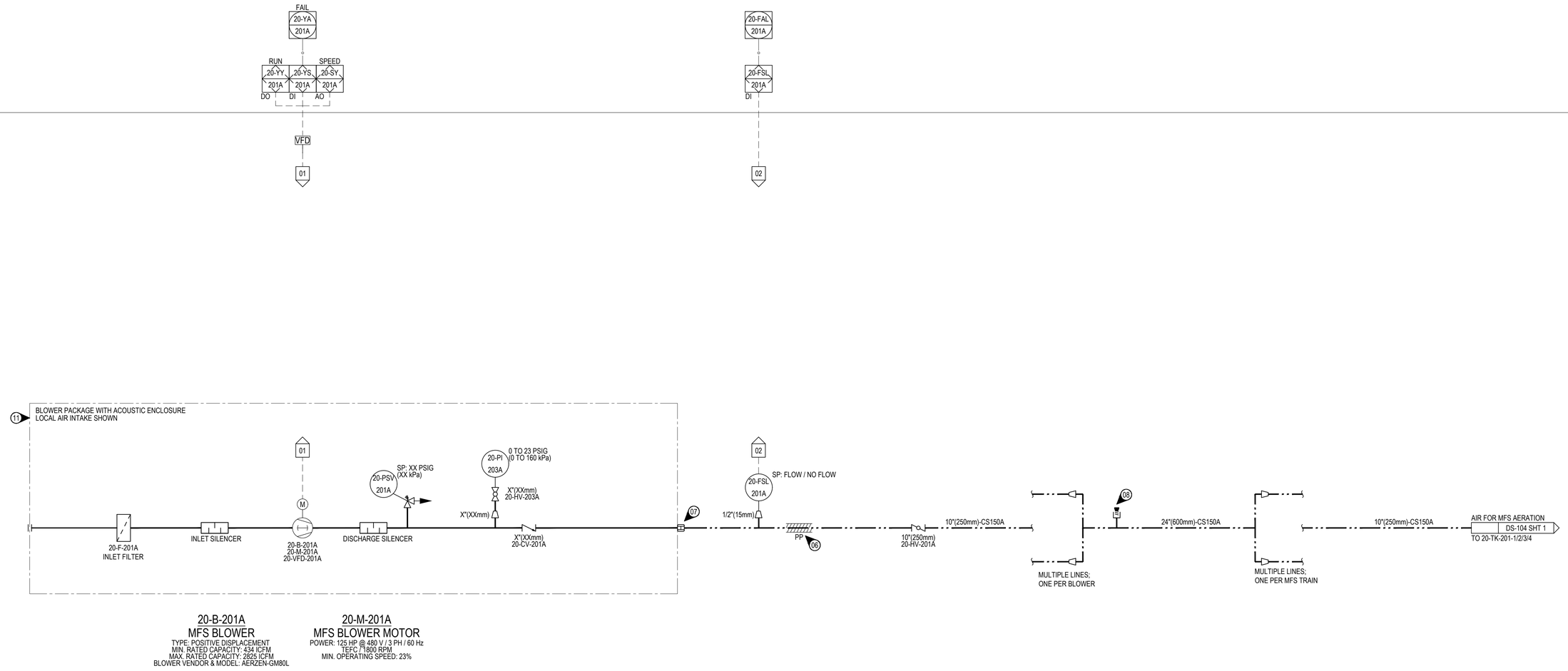

20-B-201A
MFS BLOWER
TYPE: POSITIVE DISPLACEMENT
MIN. RATED CAPACITY: 434 ICFM
MAX. RATED CAPACITY: 2825 ICFM
BLOWER VENDOR & MODEL: AERZEN-GM80L

20-M-201A
MFS BLOWER MOTOR
POWER: 125 HP @ 480 V / 3 PH / 60 Hz
TEFC / 1800 RPM
MIN. OPERATING SPEED: 23%

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
BLOWER PACKAGE	VEOLIA	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
VFD	OTHERS	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION SCOPE.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. DRAWING TYPICAL FOR EVERY TRAIN, WHERE-1 REPRESENTS TRAIN NUMBER, WITH EXCEPTION OF COMMON CHANNELS.
5. FOR POSITIVE DISPLACEMENT BLOWERS, OPERATION IS BASED ON CONSTANT VOLUMETRIC INLET FLOW RATE. SCFM WILL VARY WITH INLET CONDITIONS.
6. CLIENT IS RESPONSIBLE FOR BLOWER AIR PIPE INSULATION FOR PERSONNEL PROTECTION, AS APPLICABLE.
7. BLOWER DISCHARGE FLEXIBLE SLEEVE COMES WITH GEAR CLAMPS.
8. CAPPED CONNECTION FOR OPTIONAL PRESSURE TRANSMITTER.
9. CURRENT IS THE INITIAL SCOPE OF SUPPLY BY VEOLIA. BUILDOUT IS THE MAXIMUM MODULE SPACES AVAILABLE, NOT A DESIGN CASE.
10. DRAWING TYPICAL FOR EVERY MFS BLOWER, WHERE "A" REPRESENTS BLOWER NUMBER.
11. BLOWER AIR INTAKE DETAILS TO BE CONFIRMED BACK TO VEOLIA. PROTECTION FROM ENVIRONMENTAL FACTORS INCLUDING DEBRIS WILL BE REQUIRED FOR EXTERNAL PIPED AIR INTAKE.
12. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

MFS AERATION

NO. OF TRAINS OPERATING		1	2	3	4
LEAP-LO	NO. OF BLOWERS OPERATING	1	1	2	2
	FLOW PER BLOWER (ICFM)	775	1,550	1,163	1,550
LEAP-HI	NO. OF BLOWERS OPERATING	1	2	3	4
	FLOW PER BLOWER (ICFM)	1,550	1,550	1,550	1,550

08

BLOWER DESIGN CONDITIONS	CURRENT			BUILDOUT		
NO. OF DUTY BLOWERS	3			3		
NO. OF STANDBY BLOWERS	1			1		
LEAP LO, PER TRAIN	775 ICFM	at	4.4 - 5.2 PSIG	983 ICFM	at	4.4 - 5.2 PSIG
LEAP HI, PER TRAIN	1,550 ICFM	at	5.1 - 6.0 PSIG	1,966 ICFM	at	5.1 - 6.0 PSIG
MAX DISCHARGE TEMPERATURE	XX°C			XX°C		

REFERENCE ONLY
DO NOT USE FOR CONSTRUCTION

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
MFS BLOWERS
POSITIVE DISPLACEMENT TYPE

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-102	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 2

FILE LOCATION: C:_ADSKVault\NAM\HO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PID and P&ID\639082-WTS-PR-SYS-EN21-DS-102.SHT 1.dwg

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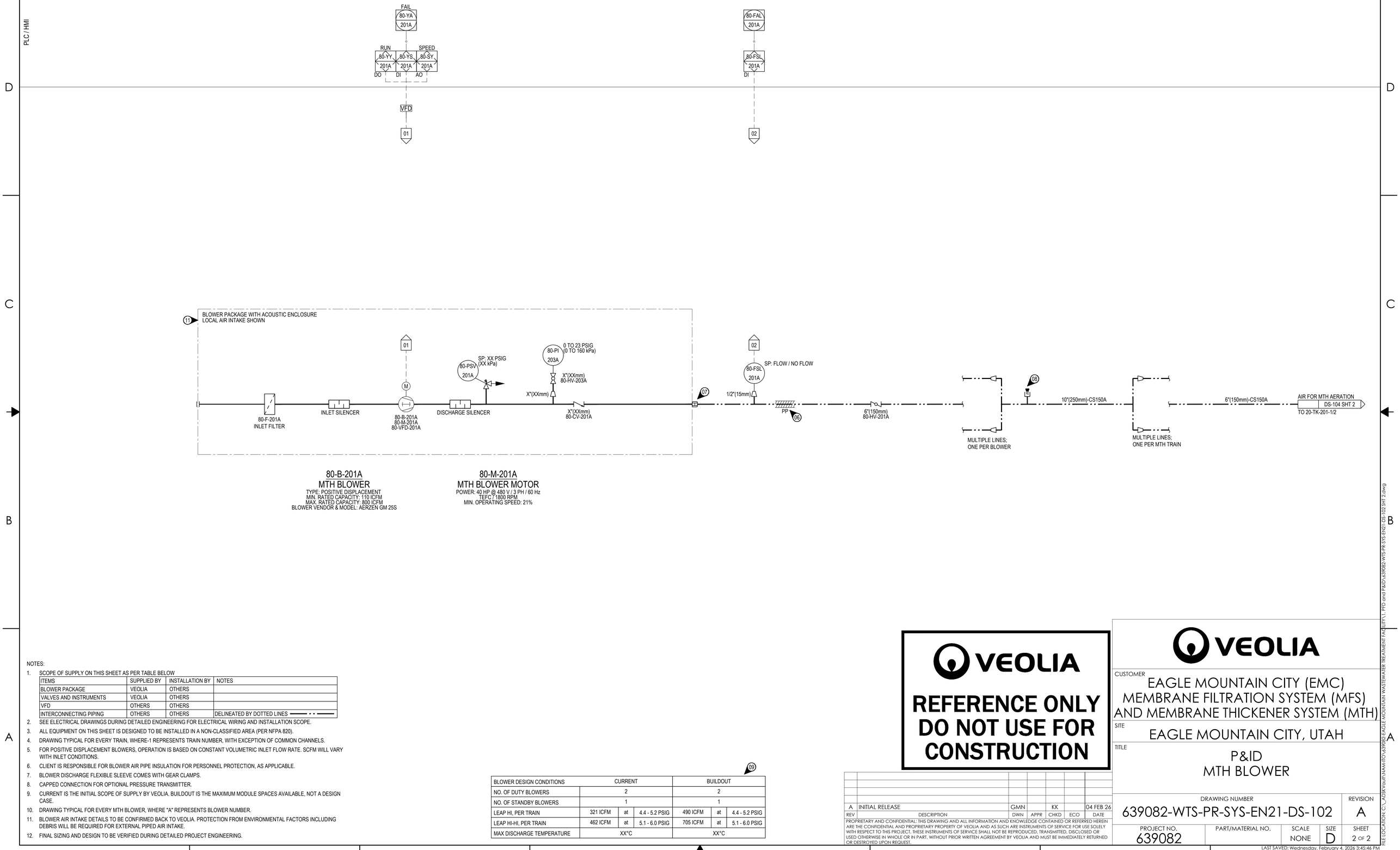

80-B-201A
MTH BLOWER
TYPE: POSITIVE DISPLACEMENT
MIN. RATED CAPACITY: 110 ICFM
MAX. RATED CAPACITY: 800 ICFM
BLOWER VENDOR & MODEL: AERZEN GM 2SS

80-M-201A
MTH BLOWER MOTOR
POWER: 40 HP @ 480 V / 3 PH / 60 Hz
TEFC/1800 RPM
MIN. OPERATING SPEED: 21%

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
BLOWER PACKAGE	VEOLIA	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
VFD	OTHERS	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION SCOPE.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. DRAWING TYPICAL FOR EVERY TRAIN, WHERE-1 REPRESENTS TRAIN NUMBER, WITH EXCEPTION OF COMMON CHANNELS.
5. FOR POSITIVE DISPLACEMENT BLOWERS, OPERATION IS BASED ON CONSTANT VOLUMETRIC INLET FLOW RATE. SCFM WILL VARY WITH INLET CONDITIONS.
6. CLIENT IS RESPONSIBLE FOR BLOWER AIR PIPE INSULATION FOR PERSONNEL PROTECTION, AS APPLICABLE.
7. BLOWER DISCHARGE FLEXIBLE SLEEVE COMES WITH GEAR CLAMPS.
8. CAPPED CONNECTION FOR OPTIONAL PRESSURE TRANSMITTER.
9. CURRENT IS THE INITIAL SCOPE OF SUPPLY BY VEOLIA. BUILDOUT IS THE MAXIMUM MODULE SPACES AVAILABLE, NOT A DESIGN CASE.
10. DRAWING TYPICAL FOR EVERY MTH BLOWER, WHERE "A" REPRESENTS BLOWER NUMBER.
11. BLOWER AIR INTAKE DETAILS TO BE CONFIRMED BACK TO VEOLIA. PROTECTION FROM ENVIRONMENTAL FACTORS INCLUDING DEBRIS WILL BE REQUIRED FOR EXTERNAL PIPED AIR INTAKE.
12. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

09

BLOWER DESIGN CONDITIONS	CURRENT			BUILDOUT		
NO. OF DUTY BLOWERS	2			2		
NO. OF STANDBY BLOWERS	1			1		
LEAP HI, PER TRAIN	321 ICFM	at	4.4 - 5.2 PSIG	490 ICFM	at	4.4 - 5.2 PSIG
LEAP HI-HI, PER TRAIN	462 ICFM	at	5.1 - 6.0 PSIG	705 ICFM	at	5.1 - 6.0 PSIG
MAX DISCHARGE TEMPERATURE	XX°C			XX°C		

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
MTH BLOWER

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-102	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	2 OF 2

FILE LOCATION: C:_ACSKVault\NAM-MTO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PID and P&ID\639082-WTS-PR-SYS-EN21-DS-102.SHT 2.dwg

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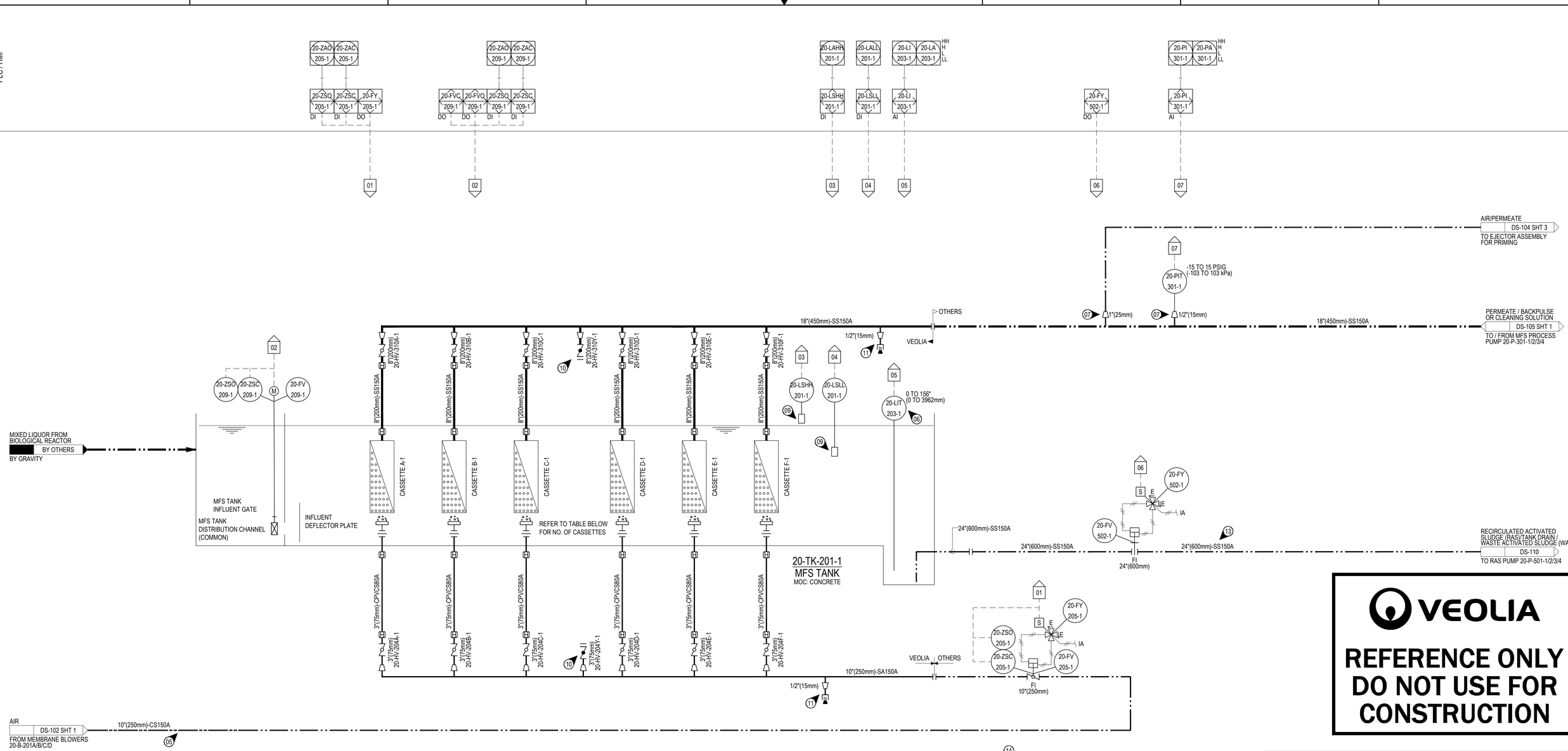

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
TANKS, CHANNELS, DEFLECTOR PLATES, TANK COVERS	OTHERS	OTHERS	SEE EQUIPMENT ARRANGEMENT DRAWING FOR DETAILS
MFS TANK INFLUENT GATE	OTHERS	OTHERS	
MFS CASSETTES AND MODULES	VEOLIA	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION SCOPE.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. DRAWING TYPICAL FOR EVERY MFS TRAIN, WHERE -1 REPRESENTS TRAIN NUMBER; WITH EXCEPTION OF COMMON CHANNELS.
5. A PORTION OF THE AIR LINE NEEDS TO BE ROUTED A MINIMUM OF 2 FT (610 MM) ABOVE MAXIMUM LIQUID LEVEL IN TANK BEING AERATED TO PREVENT WATER BACK FLOW.
6. LEVEL TRANSMITTER TO BE INSTALLED AS FAR AS POSSIBLE FROM PUMP SUCTION BUT STILL WITHIN DRAIN TRENCH AREA, ~2" (50 MM) ABOVE CONCRETE.
7. CONNECTION TO BE PROVIDED AT HIGHEST POINT ON PIPING BETWEEN PERMEATE HEADER AND PUMP. FOR THE AIR EJECTOR THE CONNECTION SHOULD BE AT THE TOP OF THE PIPE AND THE PRESSURE TRANSMITTER SHOULD BE ON THE SIDE OF THE PIPE.
8. ALL EQUIPMENT INSTALLED OUTDOORS NEEDS TO BE TEMPERATURE AND UV PROTECTED AS REQUIRED, BY OTHERS.
9. LSHH IS PLACED 1 FT(300mm) BELOW THE TOP OF THE TANK. LSLL IS PLACED AT THE SAME ELEVATION AS THE TOP OF THE MEMBRANE FIBERS.
10. CONNECTION FOR EMPTY CASSETTE SPACE.
11. SPARE CONNECTION FOR INSTRUMENTATION OR SAMPLING.
12. FALL PROTECTION SYSTEM IS NOT PROVIDED BY VEOLIA. TO BE PROVIDED BY OTHERS.
13. OPTIONAL MATERIAL PVCS80A.
14. CURRENT IS THE INITIAL SCOPE OF SUPPLY BY VEOLIA. BUILDOUT IS THE MAXIMUM MODULE SPACES AVAILABLE, NOT A DESIGN CASE.
15. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

MFS TANK DATA		
TAG NUMBERS	20-TK-201-1/2/3/4	
TANK MATERIAL	CONCRETE	
INTERNAL LENGTH	592	INCH
INTERNAL WIDTH	108	INCH
TOTAL DEPTH (AT SHALLOW END)	156	INCH
MAX OPERATING LIQUID LEVEL	118	INCH
MIN OPERATING LIQUID LEVEL	110	INCH
CLEANING LEVEL	100	INCH
TOP OF FIBERS (LSLL) LEVEL	97	INCH
VOLUME AT CLEANING LEVEL	27,675	US GAL

MFS DATA	CURRENT	BUILDOUT
INSTALLED NO. OF TRAINS	4	
CASSETTE & MODULE SERIES	ZW500EV T- 64M	
MODULE SURFACE AREA	535 FT2	
MAX NO. OF MEMBRANE MODULES PER CASSETTE	64	
NO. OF CASSETTE SPACES PER TANK	7	
NO. OF ROWS OF CASSETTES PER TANK	1	
NO. OF FULL CASSETTES	5	7
NO. OF FLEX CASSETTES	1	0
NO. OF MODULES PER FLEX CASSETTE	32	-
NO. OF EMPTY CASSETTE SPACES	1	0
TOTAL NO. OF MODULES INSTALLED PER TRAIN	352	448

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS) AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
MFS TANK

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-104	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 3

FILE LOCATION: C:_ADSKVault NAM\TO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1 - PFD and P&ID\639082-WTS-PR-SYS-EN21-DS-104.dwg

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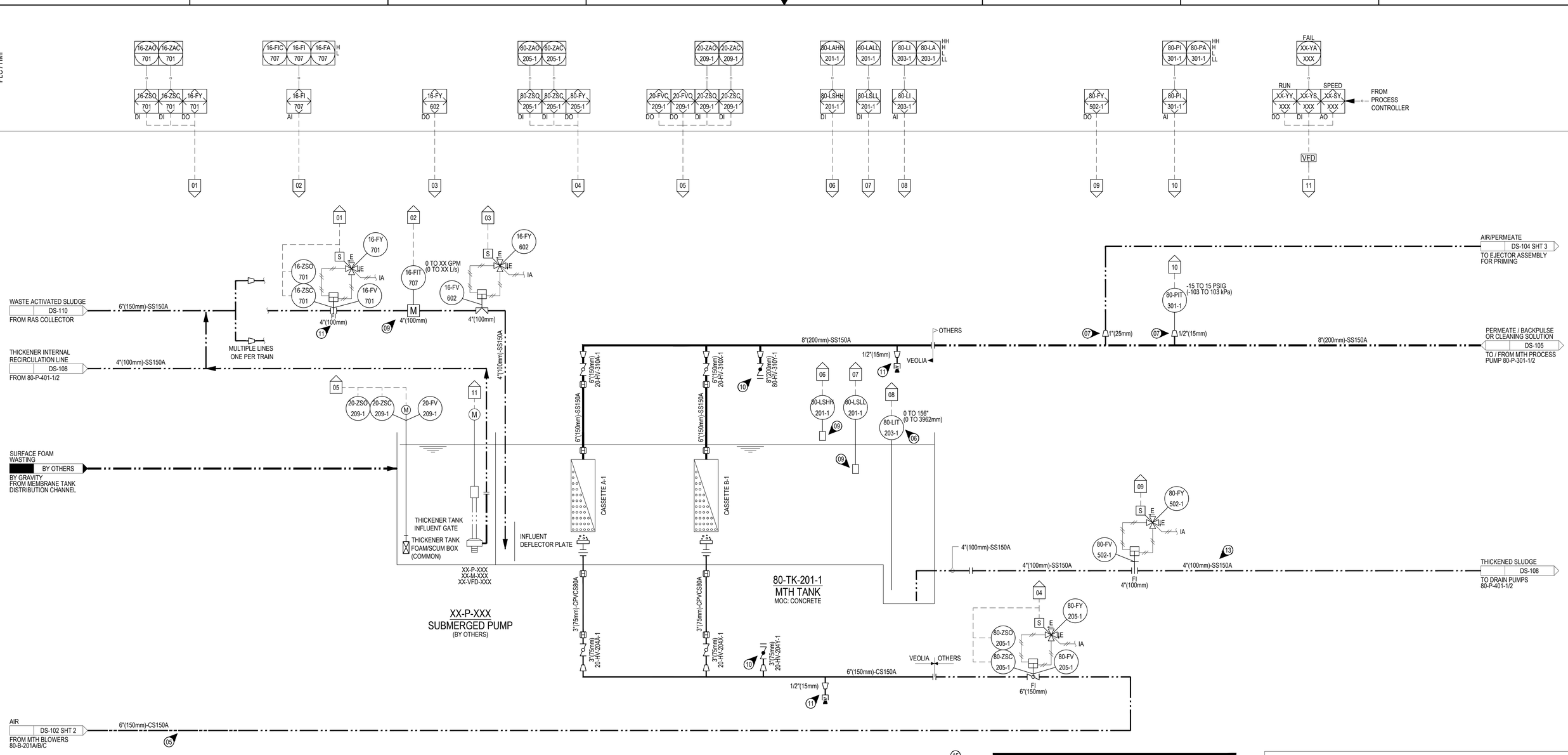

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
TANKS, FOAM/SCUM BOX, DEFLECTOR PLATES, TANK COVERS AND SUBMERSIBLE SURFACE FOAM WASTING PUMP OTHERS	OTHERS	OTHERS	SEE EQUIPMENT ARRANGEMENT DRAWING FOR DETAILS. SUBMERSIBLE PUMP CONTROLLED BY OTHERS.
SCUM/FOAM GATE	OTHERS	OTHERS	
MTH CASSETTES AND MODULES	VEOLIA	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION SCOPE.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. DRAWING TYPICAL FOR EVERY MTH TRAIN, WHERE -1 REPRESENTS TRAIN NUMBER; WITH EXCEPTION OF COMMON CHANNELS.
5. A PORTION OF THE AIR LINE NEEDS TO BE ROUTED A MINIMUM OF 2 FT (610 MM) ABOVE MAXIMUM LIQUID LEVEL IN TANK BEING AERATED TO PREVENT WATER BACK FLOW.
6. LEVEL TRANSMITTER TO BE INSTALLED AS FAR AS POSSIBLE FROM PUMP SUCTION BUT STILL WITHIN DRAIN TRENCH AREA, ~2" (50 MM) ABOVE CONCRETE.
7. CONNECTION TO BE PROVIDED AT HIGHEST POINT ON PIPING BETWEEN PERMEATE HEADER AND PUMP. FOR THE AIR EJECTOR THE CONNECTION SHOULD BE AT THE TOP OF THE PIPE AND THE PRESSURE TRANSMITTER SHOULD BE ON THE SIDE OF THE PIPE.
8. ALL EQUIPMENT INSTALLED OUTDOORS NEEDS TO BE TEMPERATURE AND UV PROTECTED AS REQUIRED, BY OTHERS.
9. LSHH IS PLACED 1 FT(300mm) BELOW THE TOP OF THE TANK. LSLL IS PLACED AT THE SAME ELEVATION AS THE TOP OF THE MEMBRANE FIBERS.
10. CONNECTION FOR EMPTY CASSETTE SPACE.
11. SPARE CONNECTION FOR INSTRUMENTATION OR SAMPLING.
12. FALL PROTECTION SYSTEM IS NOT PROVIDED BY VEOLIA. TO BE PROVIDED BY OTHERS.
13. OPTIONAL MATERIAL PVCS80A
14. FOLLOW MANUFACTURER'S RECOMMENDATION REGARDING INSTALLATION REQUIRMENTS, INCLUDING NUMBER OF STRAIGHT PIPE RUNS. PIPING MUST BE ARRANGED SO FLOWMETER IS ALWAYS FLOODED.
15. CURRENT IS THE INITIAL SCOPE OF SUPPLY BY VEOLIA. BUILDOUT IS THE MAXIMUM MODULE SPACES AVAILABLE, NOT A DESIGN CASE.
16. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

MTH TANK DATA		
TAG NUMBERS	80-TK-201-1/2	
TANK MATERIAL	CONCRETE	
INTERNAL LENGTH	186	INCH
INTERNAL WIDTH	108	INCH
TOTAL DEPTH (AT SHALLOW END)	156	INCH
MAX OPERATING LIQUID LEVEL	116	INCH
MIN OPERATING LIQUID LEVEL	108	INCH
CLEANING LEVEL	95	INCH
TOP OF FIBERS (LSLL) LEVEL	92	INCH
VOLUME AT CLEANING LEVEL	8,265	US GAL

MTH DATA	CURRENT	BUILDOUT
INSTALLED NO. OF TRAINS	2	
CASSETTE & MODULE SERIES	ZW500EV R-56M	
MODULE SURFACE AREA	460 FT2	
MAX NO. OF MEMBRANE MODULES PER CASSETTE	56	
NO. OF CASSETTE SPACES PER TANK	2	
NO. OF ROWS OF CASSETTES PER TANK	1	
NO. OF FULL CASSETTES	0	2
NO. OF FLEX CASSETTES	2	0
NO. OF MODULES PER FLEX CASSETTE	36	-
NO. OF EMPTY CASSETTE SPACES	0	0
TOTAL NO. OF MODULES INSTALLED PER TRAIN	72	112

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
MTH TANK

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-104	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	2 OF 3

FILE LOCATION: C:_ADSKVault\NAM-ITO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PFD and P&ID\639082-WTS-PR-SYS-EN21-DS-104.dwg

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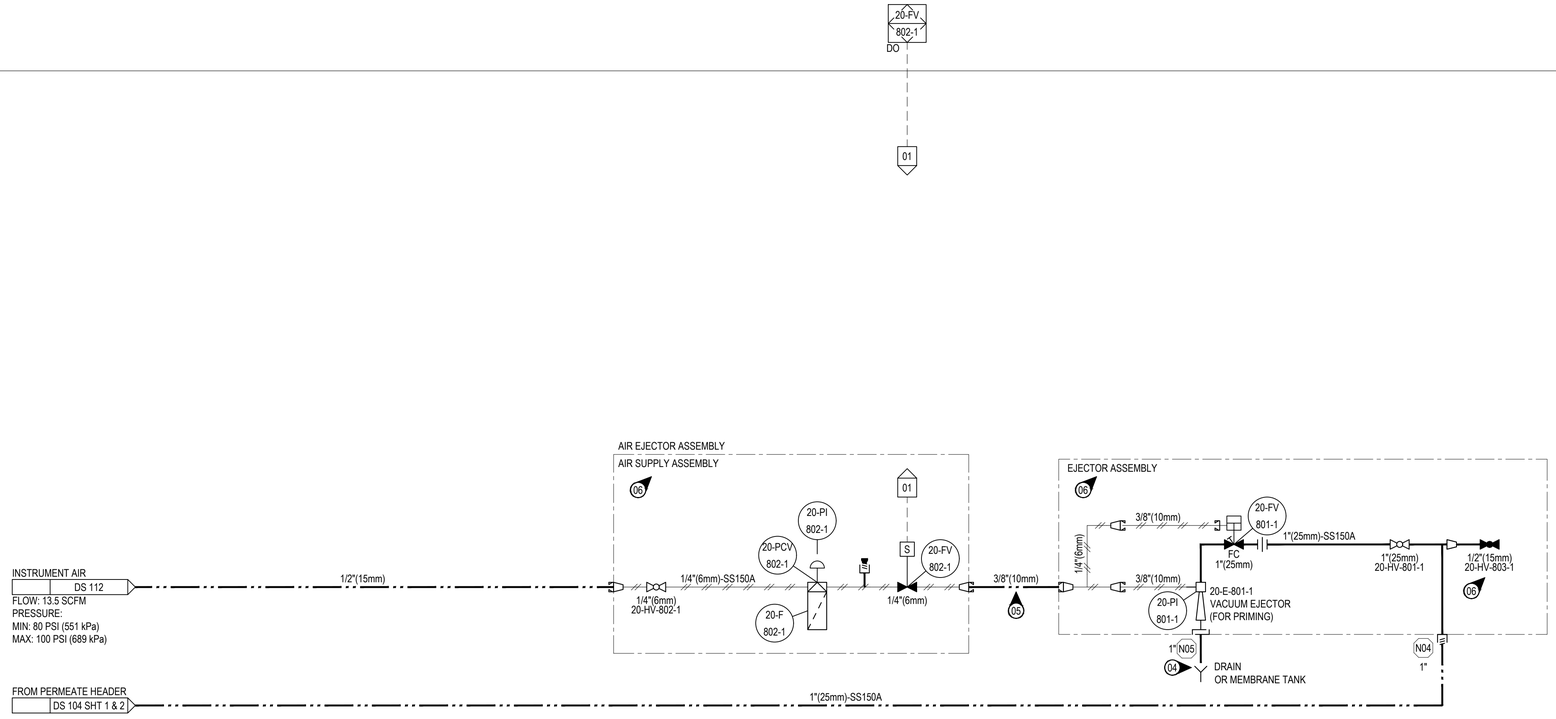

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
EJECTOR ASSEMBLY (2 PIECES)	VEOLIA	OTHERS	ASSEMBLED BY VEOLIA
VALVES AND INSTRUMENTS	VEOLIA	VEOLIA	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION.
3. DRAWING TYPICAL FOR EVERY TRAIN, WHERE "-1" REPRESENTS TRAIN NUMBER.
4. AIR GAP IS REQUIRED ON EJECTOR DISCHARGE LINE EXHAUST TO MEMBRANE TANK OR DRAIN.
5. THE 3/8" TUBING THAT CONNECTS THE TWO SPOOLS TOGETHER IS TO BE PROVIDED AND INSTALLED ONSITE BY OTHERS. PE OR NYLON TUBING IF USED SHOULD BE DARK COLOR FOR UV RESISTANCE IF LOCATED OUTDOORS.
6. 20-HV-803-X IS FOR MEMBRANE PRESSURE BUBBLE TESTING. VALVE TO REMAINED CLOSED AND LOCKED AT ALL OTHER TIMES.
7. ALL EQUIPMENT ON THIS SHEET ARE DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
EJECTOR

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-104	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	3 OF 3

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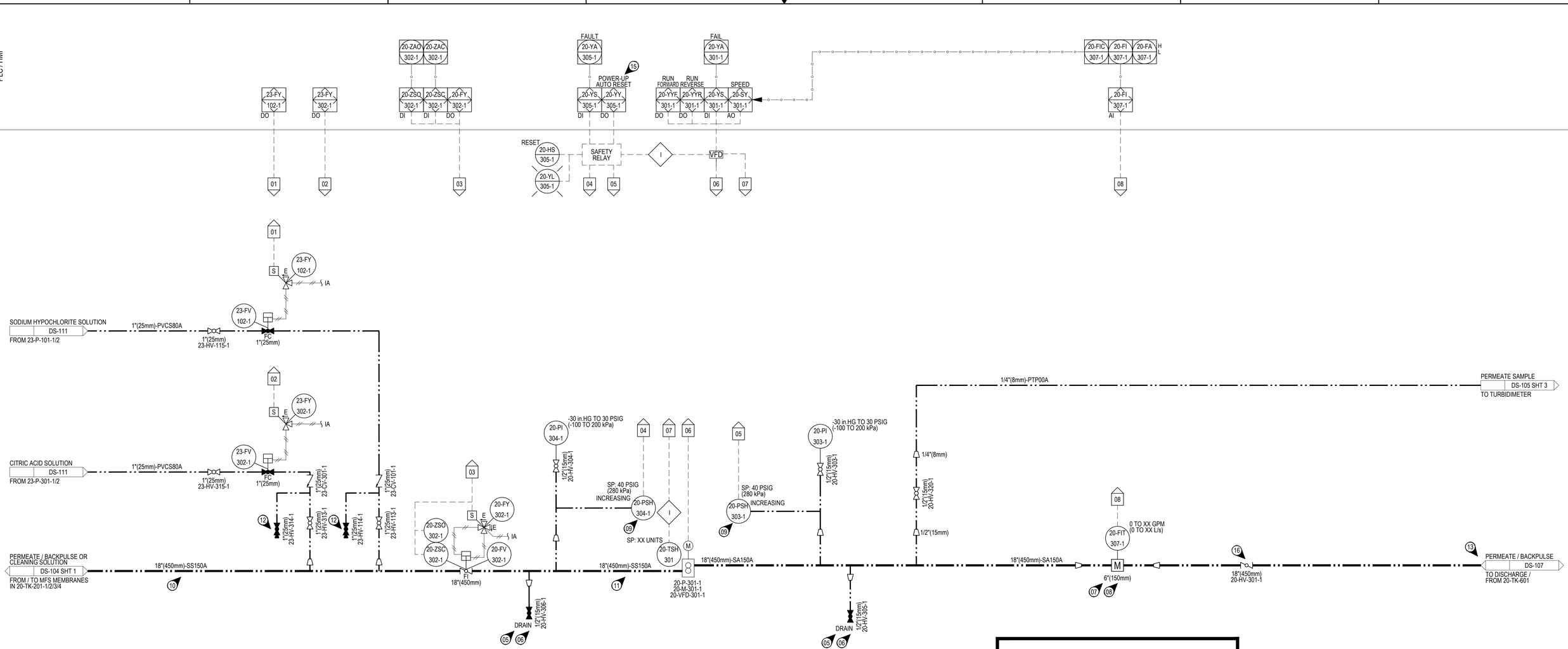

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
PROCESS PUMPS	VEOLIA	OTHERS	
VFD	OTHERS	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION.
3. ALL EQUIPMENT ON THIS SHEET ARE DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. DRAWING TYPICAL FOR EVERY MFS TRAIN, WHERE -1 REPRESENTS TRAIN NUMBER.
5. VALVE FOR DRAIN, SERVICE, OR SAMPLE. VALVE TO BE POSITIONED TO ALLOW FULL DRAINING TO FLOOR DRAIN OR BUCKET, BY GRAVITY.
6. FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
7. FOLLOW MANUFACTURER'S RECOMMENDATION REGARDING INSTALLATION REQUIREMENTS, INCLUDING NUMBER OF STRAIGHT PIPE RUNS. PIPING MUST BE ARRANGED SO FLOWMETER IS ALWAYS FLOODED. NOTE THE FLOW IS BIDIRECTIONAL, SO IDENTICAL STRAIGHT PIPE RUNS MUST BE PROVIDED ON BOTH SIDES OF THE INSTRUMENT.
8. DESIGN ENGINEER TO ENSURE MAGMETER AND PERMEATE COLLECTOR REMAIN FLOODED AT ALL TIMES.
9. CONNECT PRESSURE SWITCHES 20-PSH-303-1 AND 20-PSH-304-1 TO SAFETY RELAY IN VEOLIA CONTROL PANEL. RELAY CONTACTS MUST BE CONNECTED TO VFD SAFE TORQUE OFF INPUT AS HARD-WIRED INTERLOCK. HIGH PRESSURE AT EITHER SWITCH MUST SHUT DOWN VFD. REFERENCE ELECTRICAL SCHEMATIC DRAWINGS AND VFD PARAMETER SHEET, AND SET VFD AS INSTRUCTED.
10. ALTERNATE MATERIAL PVCS80A.
11. ALTERNATE MATERIAL SS150A OR PVCS80A.
12. BLEED VALVES TO BE INSTALLED TO ALLOW OPERATOR ACCESSIBILITY. DRAIN TO SAFE LOCATION. DRAINS FROM SODIUM HYPOCHLORITE SOLUTION AND ANY ACID SOLUTION SHOULD NOT BE COMBINED SINCE POISONOUS GASES MAY BE CREATED.
13. PROVIDE BACK PRESSURE IF REQUIRED TO FILL BACKPULSE TANKS AND ANALYZERS.
14. CURRENT IS THE INITIAL SCOPE OF SUPPLY BY VEOLIA. BUILDOUT IS THE MAXIMUM MODULE SPACES AVAILABLE, NOT A DESIGN CASE.
15. 20-YS-305-1 IS SAFETY RELAY STATUS INPUT WIRED TO PLC FOR PRESSURE ALARM. 20-YY-305-X IS RESET COMMAND FROM PLC ISSUED WHEN THE CONTROL PANEL IS POWERED UP. IF SAFETY RELAY FAULT OCCURS, OPERATOR TO PRESS RESET BUTTON LOCATED ON THE LOCAL CONTROL PANEL.
16. VALVE TO BE LOCKABLE IN OPEN POSITION. LOCKED OPE DURING PLANT OPERATION.
17. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

20-P-301-1
MFS PROCESS PUMP
TYPE: ROTARY-LOBE, REVERSIBLE
MIN. RATED CAPACITY: 350 GPM @XX FT TDH
MAX. RATED CAPACITY: 3500 GPM @XX. FT TDH
NO. OF DUTY PUMPS: ONE PER TRAIN
PUMP VENDOR AND MODEL : BOERGER EL3050

20-M-301-1
MFS PROCESS PUMP MOTOR
POWER : 100HP @ 480 V / 3 PH / 60 Hz
TEFC /1800 RPM
MIN. OPERATING SPEED: XX%

	CURRENT			BUILDOUT		
INSTALLED NO. OF TRAINS	4			4		
INSTANTANEOUS FLOW CONDITION	FLOW, GPM	TDH, FT		FLOW, GPM	TDH, FT	
	PER TRAIN	MIN	MAX	PER TRAIN	MIN	MAX
TYPICAL PERMEATE	1,115	TBD	45	1,115	TBD	45
MAX PERMEATE	3,396	TBD	45	3,396	TBD	45
BACKPULSE	3,396	TBD	45	3,396	TBD	45
CLEANING	1,569	TBD	45	1,997	TBD	45

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
MFS PROCESS PUMP

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-105	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 3

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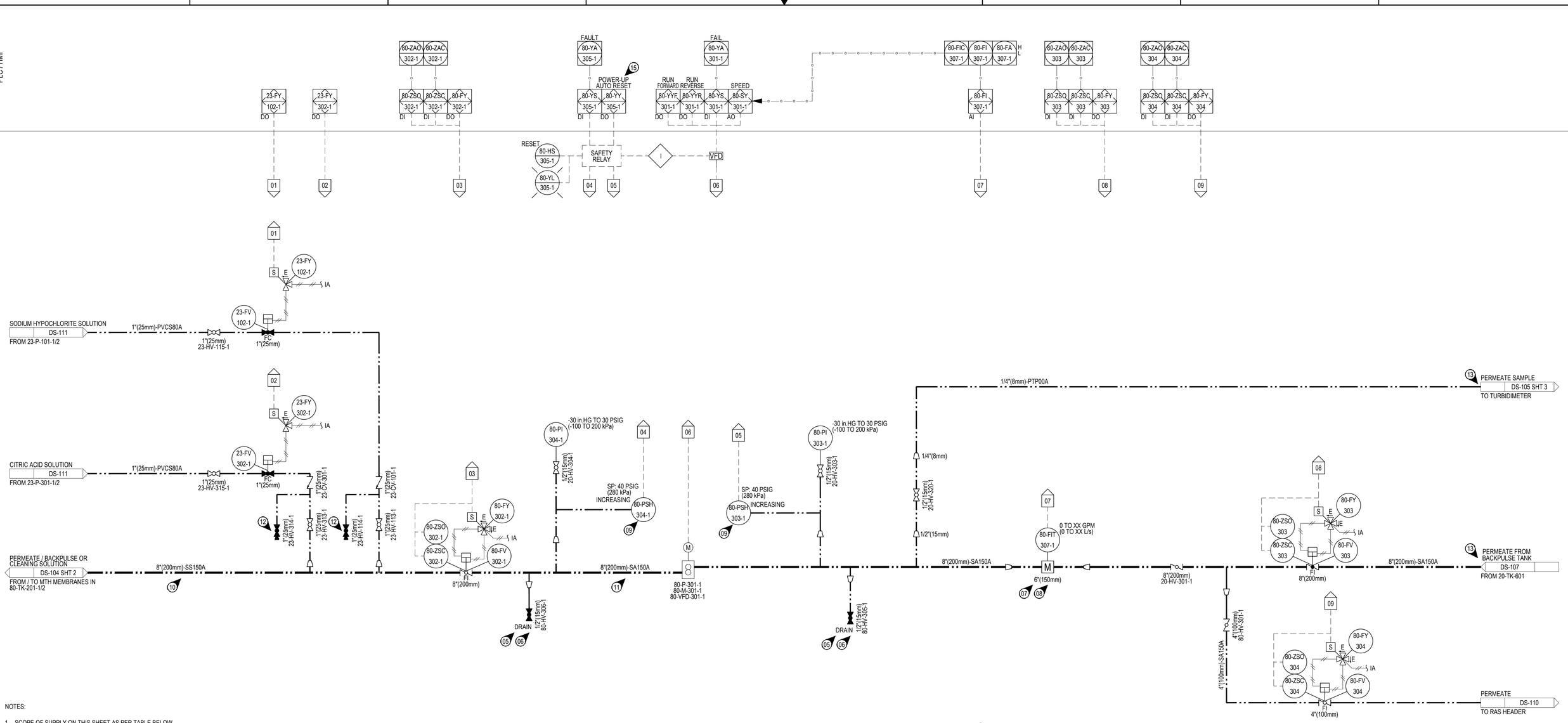


NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
THICKENER PROCESS PUMP	VEOLIA	OTHERS	
VFD	OTHERS	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION.
3. ALL EQUIPMENT ON THIS SHEET ARE DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. DRAWING TYPICAL FOR EVERY MTH TRAIN, WHERE -1 REPRESENTS TRAIN NUMBER.
5. VALVE FOR DRAIN, SERVICE, OR SAMPLE. VALVE TO BE POSITIONED TO ALLOW FULL DRAINING TO FLOOR DRAIN OR BUCKET, BY GRAVITY.
6. FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
7. FOLLOW MANUFACTURER'S RECOMMENDATION REGARDING INSTALLATION REQUIREMENTS, INCLUDING NUMBER OF STRAIGHT PIPE RUNS. PIPING MUST BE ARRANGED SO FLOWMETER IS ALWAYS FLOODED. NOTE THE FLOW IS BIDIRECTIONAL, SO IDENTICAL STRAIGHT PIPE RUNS MUST BE PROVIDED ON BOTH SIDES OF THE INSTRUMENT.
8. DESIGN ENGINEER TO ENSURE MAGMETER AND PERMEATE COLLECTOR REMAIN FLOODED AT ALL TIMES.
9. CONNECT PRESSURE SWITCHES 20-PSH-303-1 AND 20-PSH-304-1 TO SAFETY RELAY IN VEOLIA CONTROL PANEL. RELAY CONTACTS MUST BE CONNECTED TO VFD SAFE TORQUE OFF INPUT AS HARD-WIRED INTERLOCK. HIGH PRESSURE AT EITHER SWITCH MUST SHUT DOWN VFD. REFERENCE ELECTRICAL SCHEMATIC DRAWINGS AND VFD PARAMETER SHEET, AND SET VFD AS INSTRUCTED.
10. ALTERNATE MATERIAL PVCS80A.
11. ALTERNATE MATERIAL SS150A OR PVCS80A.
12. BLEED VALVES TO BE INSTALLED TO ALLOW OPERATOR ACCESSIBILITY. DRAIN TO SAFE LOCATION. DRAINS FROM SODIUM HYPOCHLORITE SOLUTION AND ANY ACID SOLUTION SHOULD NOT BE COMBINED SINCE POISONOUS GASES MAY BE CREATED.
13. PROVIDE BACK PRESSURE IF REQUIRED TO FILL ANALYZERS.
14. CURRENT IS THE INITIAL SCOPE OF SUPPLY BY VEOLIA. BUILDOUT IS THE MAXIMUM MODULE SPACES AVAILABLE, NOT A DESIGN CASE.
15. 20-YS-305-1 IS SAFETY RELAY STATUS INPUT WIRED TO PLC FOR PRESSURE ALARM. 20-YY-305-X IS RESET COMMAND FROM PLC ISSUED WHEN THE CONTROL PANEL IS POWERED UP. IF SAFETY RELAY FAULT OCCURS, OPERATOR TO PRESS RESET BUTTON LOCATED ON THE LOCAL CONTROL PANEL.
16. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

	CURRENT			BUILDOUT		
INSTALLED NO. OF TRAINS	2			2		
INSTANTANEOUS FLOW CONDITION	FLOW, GPM	TDH, FT		FLOW, GPM	TDH, FT	
	PER TRAIN	MIN	MAX	PER TRAIN	MIN	MAX
MINIMUM PERMEATE	46	TBD	45	46	TBD	45
MAX PERMEATE	184	TBD	45	184	TBD	45
BACKPULSE	460	TBD	45	650	TBD	45
CLEANING	276	TBD	45	429	TBD	45

80-P-301-1
MTH PROCESS PUMP
TYPE: ROTARY-LOBE, REVERSIBLE
MIN. RATED CAPACITY: 35GPM @XX FT TDH
MAX. RATED CAPACITY: 650GPM @XX FT TDH
NO. OF DUTY PUMPS: ONE PER TRAIN
PUMP VENDOR AND MODEL : BOERGER CL520

80-M-301-1
MTH PROCESS PUMP MOTOR
POWER : 20 HP @ 480 V / 3 PH / 60 Hz
TEFC / 1800 RPM
MIN. OPERATING SPEED: XX%

REFERENCE ONLY DO NOT USE FOR CONSTRUCTION

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF VEOLIA AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY VEOLIA AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.

VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

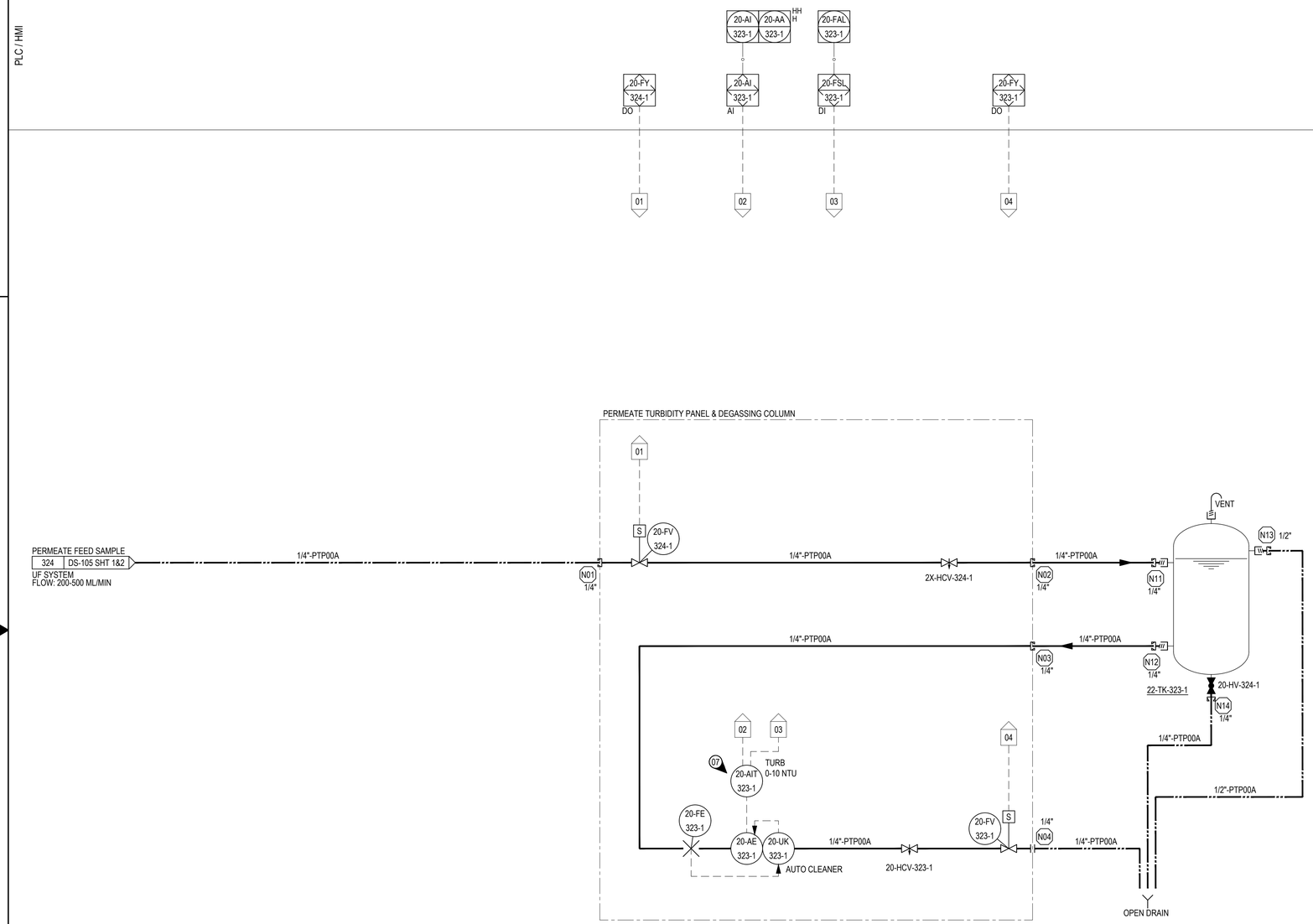
TITLE
P&ID
MTH PROCESS PUMP

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-105	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	2 OF 3

LAST SAVED: Wednesday, February 4, 2026 3:45:48 PM

FILE LOCATION: C:_ADSKVault\NAM-ITO-639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PFD and P&ID\639082-WTS-PR-SYS-EN21-DS-105 SHT 1.dwg



NOTES:
1. ALL DOTTED LINES\EQUIPMENTS BY OTHERS. "- - - - - -"
2. ALL DRAIN POINTS TO BE PLUMBED TO ATMOSPHERIC DRAIN (BY OTHERS).
3. REFER TO TIE POINTS ON EQUIMENT ARRANGEMENT DRAWINGS.
4. TURBIDIMETER TRANSMITTER MUST BE CONFIGURED TO FAIL HIGH.
5. ALL EQUIPMENT ON THIS SHEET IS SUPPLIED BY VEOLIA UNLESS OTHERWISE NOTED.
6. FLOW SET TO 3.3 GPH [210 ml/min].
7. TURBIDITY TRANSMITTER SHALL BE FIELD PROGRAMMED TO ALARM ON LOW SENSOR FLOW DURING COMMISSIONING. SETTINGS TO BE ADJUSTED FOR SPECIFIC PROJECT NEEDS.
8. TAGGING INFORMATION:
   TAGS STARTING WITH "2X"
   A) "20-" FOR IMMERSED UF MEMBRANES
   B) "22-" FOR PRESSURIZED UF MEMBRANES
   TAGS ENDING WITH "-1", REPRESENTS TRAIN NUMBER
   A) "-1" FOR TRAIN 1
   B) "-2" FOR TRAIN 2
   C) "-3" FOR TRAIN 3
   D) ETC

07

INITIAL TURBIDITY SETTINGS	
SOURCE	PERMEATE
PARAMETER	FLOW [L/min]
DATA VIEW	RELAY CONTACT STATUS
FUNCTION	ALARM
TRANSFER	RELAYS ARE DE-ENERGIZED
PHASE	DIRECT CONTROL
HIGH ALARM	9999 L/min (SET ABOVE USABLE VALUE)
LOW ALARM	0.150 L/min
HIGH DEADBAND	0.01 L/min
LOW DEADBAND	0.01 L/min

20-TK-323-1
DEGASSING COLUMN
VOLUME: 0.66 USgal (2490 mL)
MOC : PVC(CLEAR), SCH. 80
SEE EQUIPMENT ARRANGEMENT DRAWING
DIAMETER : 3" DIA X 24" SIDESHELL

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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REFERENCE ONLY
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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
TURBIDITY METER

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-105	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	3 OF 3

FILE LOCATION: C:_ADSKVault NAM\ITO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PID and P&ID\639082-WTS-PR-SYS-EN21-DS-105 SHT 2.dwg

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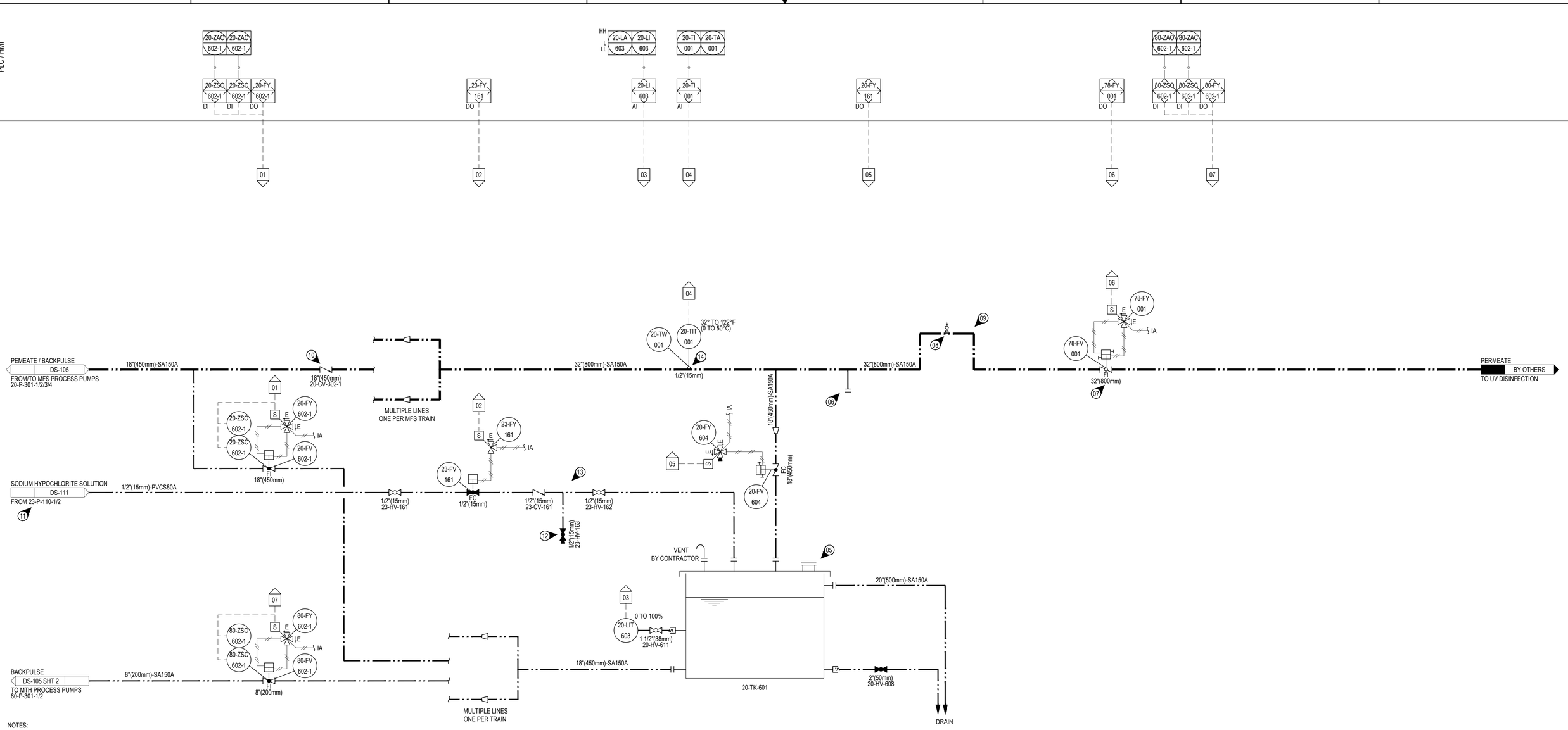

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
BACKPULSE TANK	OTHERS	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
5. WATER FOR START-UP TO BE ADDED TO TANK THROUGH MANWAY WITH HOSE.
6. CAPPED CONNECTION FOR RECIRCULATION BACK TO THE BIOREACTOR DURING START-UP. TEMPORARY PIPING IS PROVIDED BY OTHERS.
7. VALVE REQUIRED IF PERMEATE DISCHARGE POINT IS BELOW BACKPULSE TANK. THIS VALVE HAS TRAVEL STOPS AND SHOULD NEVER CLOSE BY MORE THAN X%.
8. TO BE INSTALLED AT THE HIGHEST LEVEL IN PIPING.
9. STAND-PIPE OR VALVE REQUIRED FOR AIR RELIEF AND VACUUM PROTECTION (BY OTHERS).
10. THIS VALVE MAY NEED TO CHANGE TO ACTUATED BUTTERFLY VALVE TO PREVENT WATER HAMMER BASED ON ELEVATED BACKPULSE TANK LEVELS.
11. SODIUM HYPOCHLORITE FOR BIO GROWTH PREVENTION.
12. BLEED VALVES TO BE INSTALLED TO ALLOW OPERATOR ACCESSIBILITY. DRAIN TO SAFE LOCATION. DRAINS FROM SODIUM HYPOCHLORITE SOLUTION AND ANY ACID SOLUTION SHOULD NOT BE COMBINED SINCE POISONOUS GASES MAY BE CREATED.
13. TANK CHEMICAL DOSING BLEED VALVES ARE ONLY REQUIRED IF TANK DOSING POINT IN BELOW LIQUID LEVEL.
14. ENSURE TEMPERATURE SENSOR IS ALWAYS SUBMERGED.
15. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

20-TK-601
BACKPULSE TANK

REQUIRED MIN. WORKING VOLUME: 17,800 GAL
MOC: CONCRETE
LOCATED BETWEEN TANKS 2 AND 3

BACKPULSE TANK DATA		
LENGTH	594	INCH
WIDTH	60	INCH
HEIGHT	156	INCH
WORKING VOLUME	17,800	US GAL

REFERENCE ONLY
DO NOT USE FOR CONSTRUCTION

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
BACKPULSE TANK

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-107	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 1

FILE LOCATION: C:_ADSKVault\NAM\TO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PFD and P&ID\639082-WTS-PR-SYS-EN21-DS-107.dwg

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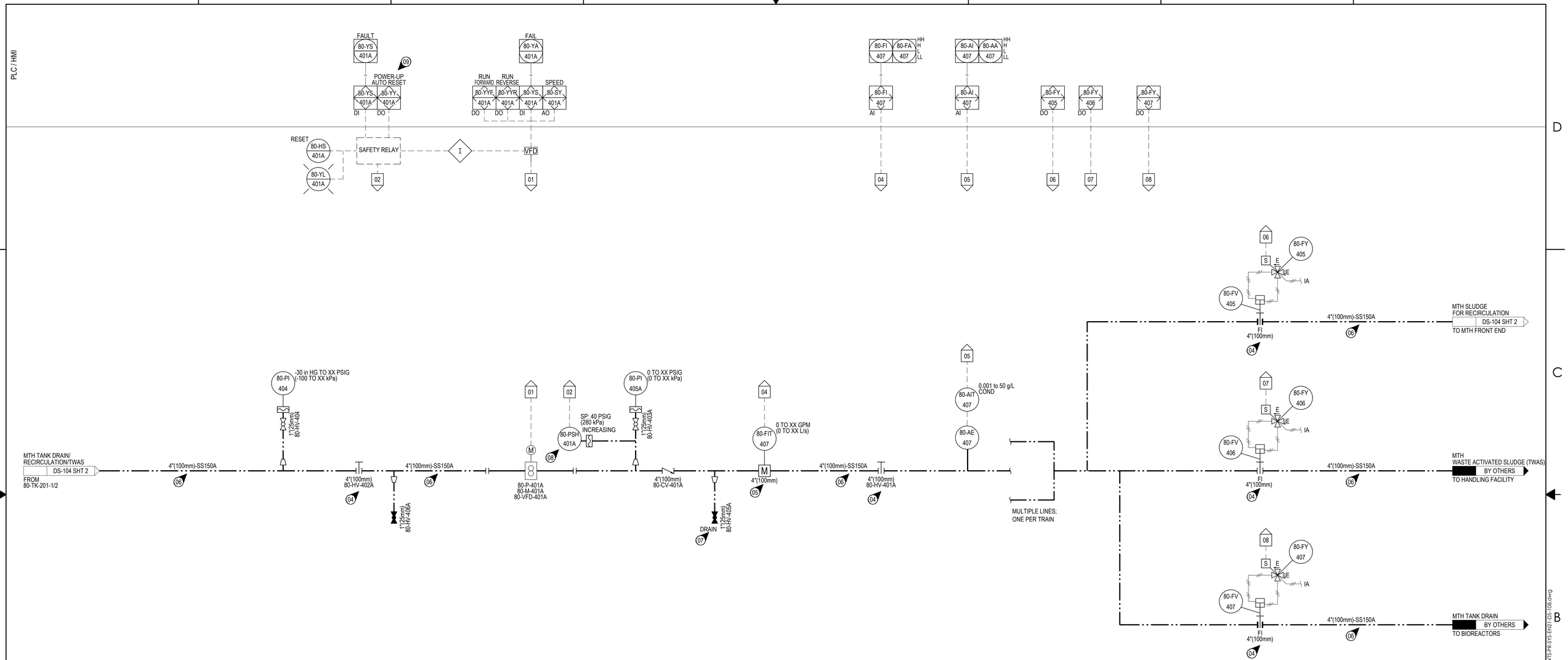

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
THICKENED/WAS PUMPS	VEOLIA	OTHERS	
VFDs	OTHERS	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. FOLLOW MANUFACTURER'S RECOMMENDATION REGARDING INSTALLATION REQUIREMENTS, INCLUDING NUMBER OF STRAIGHT PIPE RUNS. PIPING MUST BE ARRANGED SO FLOW METER IS ALWAYS FLOODED.
5. ALTERNATE MATERIAL PVCS80A.
6. VALVE FOR DRAIN, SERVICE, OR SAMPLE. VALVE TO BE POSITIONED TO ALLOW FULL DRAINING TO FLOOR DRAIN OR BUCKET, BY GRAVITY
7. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.
8. CONNECT PRESSURE SWITCHES 20-PSH-303-1 AND 20-PSH-304-1 TO SAFETY RELAY IN VEOLIA CONTROL PANEL. RELAY CONTACTS MUST BE CONNECTED TO VFD SAFE TORQUE OFF INPUT AS HARD-WIRED INTERLOCK. HIGH PRESSURE AT EITHER SWITCH MUST SHUT DOWN VFD. REFERENCE ELECTRICAL SCHEMATIC DRAWINGS AND VFD PARAMETER SHEET AND SET VFD AS INSTRUCTED.
9. 20-YS-305-1 IS SAFETY RELAY STATUS INPUT WIRED TO PLC FOR PRESSURE ALARM. 20-YY-305-X IS RESET COMMAND FROM PLC ISSUED WHEN THE CONTROL PANEL IS POWERED UP. IF SAFETY RELAY FAULT OCCURS, OPERATOR TO PRESS RESET BUTTON LOCATED ON THE LOCAL CONTROL PANEL.

80-P-401A/B
MTH DRAIN / RECIRCULATION / TWAS PUMP
TYPE: END-SUCTION CENTRIFUGAL
MIN. RATED CAPACITY: 55 GPM @ XX FT TDH
MAX. RATED CAPACITY: 700 GPM @ XX FT TDH
PUMP VENDOR AND MODEL: BOERGER FL518

80-M-401A/B
MTH DRAIN / RECIRCULATION / TWAS PUMP MOTOR
POWER: XX HP @ 480 V / 3 PH / 60 Hz
TEFC / XXX RPM
MIN. OPERATING SPEED : XX %

DESIGN DUTY POINTS				
NO. OF DUTY PUMPS	2			
DRAIN	313 GPM	at	XX FT	TDH
RECIRCULATION - MIN	46 GPM	at	XX FT	TDH
RECIRCULATION - MAX	184 GPM	at	XX FT	TDH
THICKENED WAS	313 GPM	at	XX FT	TDH

REFERENCE ONLY
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REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
MTH DRAIN / RECIRCULATION / TWAS PUMPS

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-108	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 1

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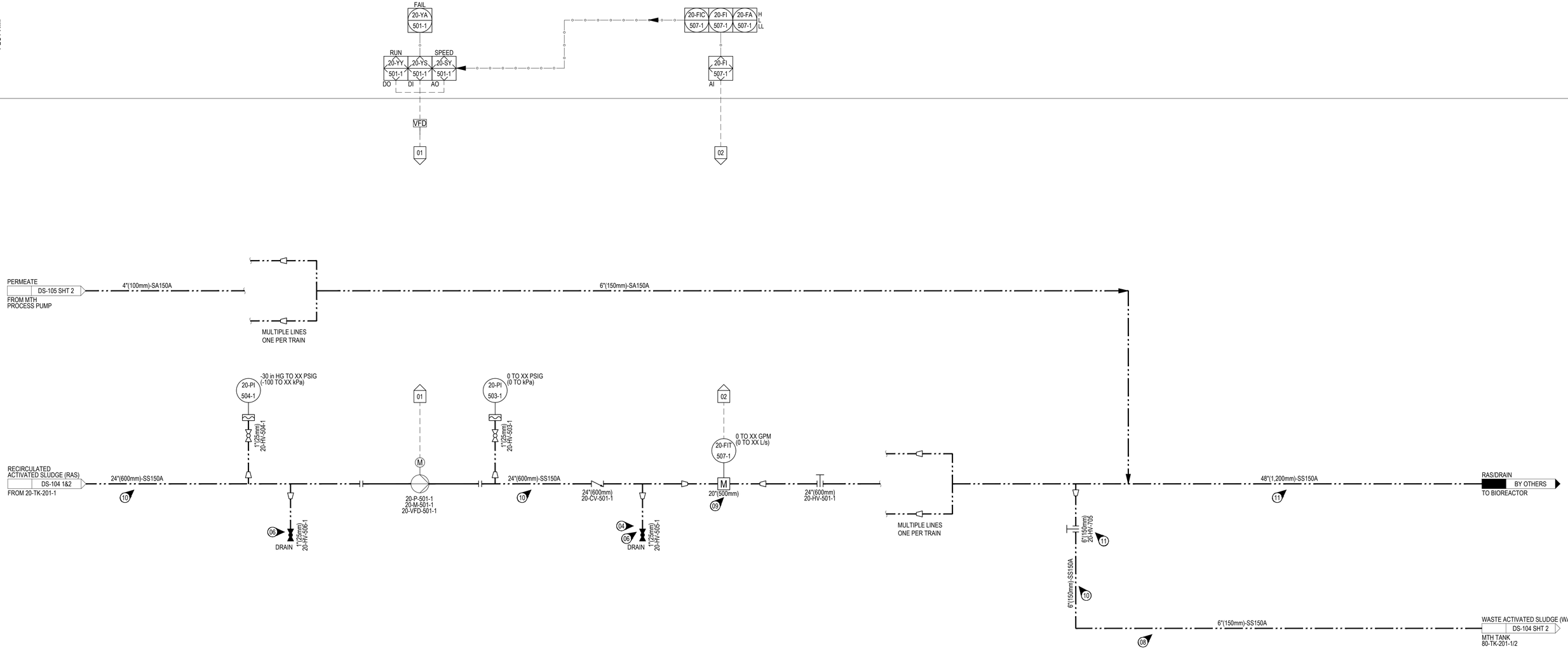

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
RAS/WAS/DRAIN PUMP	VEOLIA	OTHERS	
VFDs	OTHERS	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES ——— · · · ———

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. DRAWING TYPICAL FOR EVERY MFS TRAIN, WHERE-1 REPRESENTS TRAIN NUMBER.
5. VALVE FOR DRAIN, SERVICE, OR SAMPLE. VALVE TO BE POSITIONED TO ALLOW FULL DRAINING TO FLOOR DRAIN OR BUCKET, BY GRAVITY
6. FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
7. WHERE POSSIBLE IT IS BENEFICIAL TO USE LONG RADIUS ELBOWS IN LIEU OF SHORT RADIUS ELBOWS.
8. SUFFICIENT BACK-PRESSURE MUST BE AVAILABLE ON THE COMMON RAS LINE TO ALLOW FOR PREFERENTIAL FLOW TO WAS DESTINATION. IF REQUIRED, AN AUTOMATICALLY ACTUATED VALVE CAN BE ADDED TO THE COMMON RAS LINE FOR THIS PURPOSE.
9. FOLLOW MANUFACTURER'S RECOMMENDATION REGARDING INSTALLATION REQUIREMENTS, INCLUDING NUMBER OF STRAIGHT PIPE RUNS. PIPING MUST BE ARRANGED SO FLOWMETER IS ALWAYS FLOODED.
10. ALTERNATE MATERIAL PVCS80A OR SS150A.
11. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

20-P-501-1
RAS PUMP

TYPE: END-SUCTION CENTRIFUGAL
MIN. RATED CAPACITY: XX GPM @ XX FT TDH
MAX. RATED CAPACITY: XX GPM @ XX FT TDH
NO. OF DUTY PUMPS: ONE PER TRAIN
PUMP VENDOR AND MODEL: XXX

20-M-501-1
RAS PUMP MOTOR

POWER: XX HP @ 480 V / 3 PH / 60 Hz
TEFC / XX RPM
MIN. OPERATING SPEED : XX%

	CURRENT		
INSTALLED NO. OF TRAINS	4		
	FLOW, GPM	TDH, FT	
	PER TRAIN	MAX	MIN
MINIMUM FLOW	3,889	XX	TBD
AVERAGE DAILY FLOW	4,167	XX	TBD
MAXIMUM FLOW	6,667	XX	TBD

VEOLIA

REFERENCE ONLY
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REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
RAS/WAS/DRAIN PUMPS

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-110	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 1

FILE LOCATION: C:_ADSKVault\NAM\TO-639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PFD and P&ID\639082-WTS-PR-SYS-EN21-DS-110.dwg

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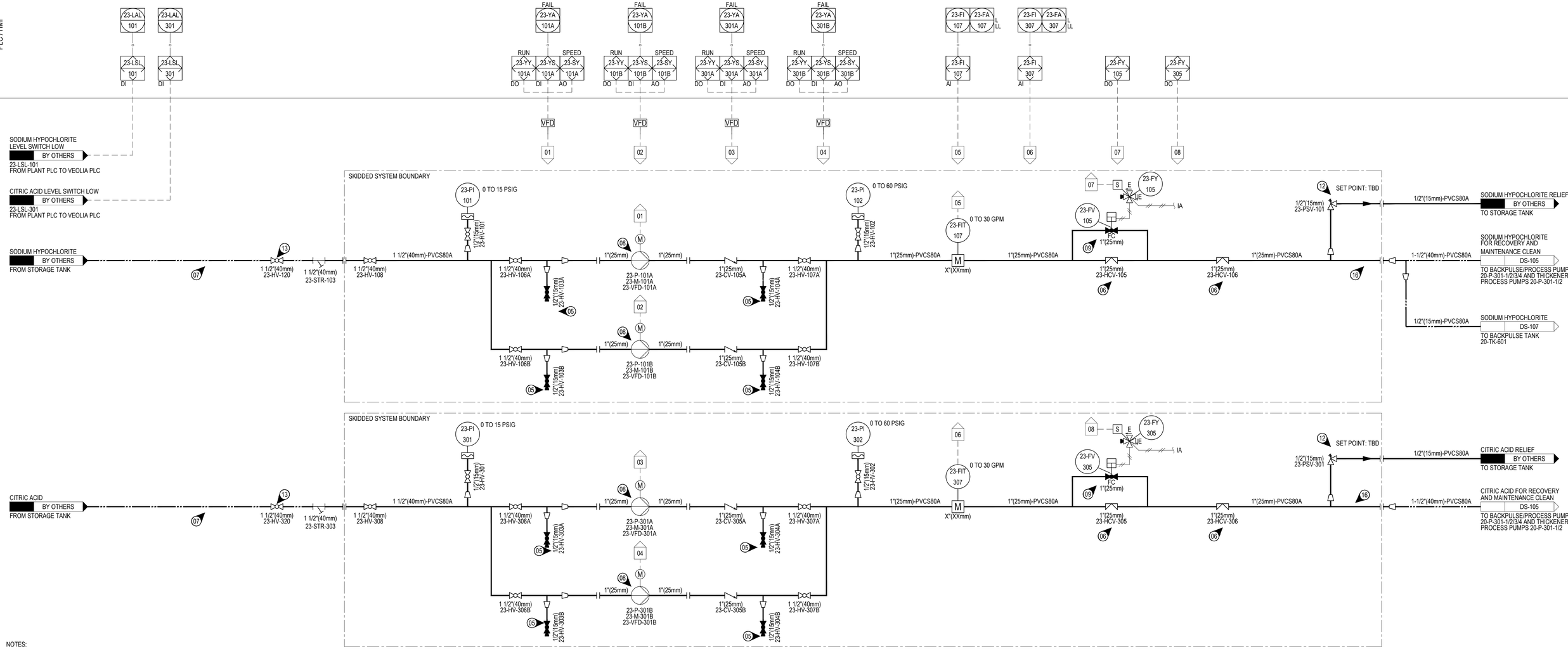

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
CHEMICAL PUMPS	VEOLIA	OTHERS	
VFDs	VEOLIA	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. INDIVIDUAL CHEMICALS OF DIFFERENT TYPES SHOULD NOT BE MIXED. CONTAINMENT SHOULD BE PUMPED, NOT DRAINED. DRAINS FROM SODIUM HYPOCHLORITE SOLUTION AND ANY ACID SOLUTION SHOULD NOT BE COMBINED SINCE POISONOUS GASES MAY BE CREATED.
5. FLOOR DRAINS TO BE PROVIDED AND PIPED INTO BY GENERAL CONTRACTOR, AS REQUIRED.
6. 23-HCV-105/305 TO BE ADJUSTED FOR MAINTENANCE CLEAN FLOW. 23-HCV-106/306 TO BE ADJUSTED FOR RECOVERY CLEAN FLOW. IF THERE IS ONLY RECOVERY CLEAN FLOW THEN 23-HCV-105/305 AND 23-FV-105/305 CAN BE REMOVED.
7. BOTTOM CONNECTION FROM THE TANK IS MANDATORY.
8. FLOODED SUCTION SET-UP REQUIRED FOR PUMP OPERATION.
9. VALVE TO OPEN ONLY FOR RECOVERY CLEANS.
10. TANK DESIGN, INCLUDING SECONDARY CONTAINMENT AND VENTING IF REQUIRED, IS NOT PROVIDED BY VEOLIA.
11. GASKETS AND HARDWARE SHOULD BE COMPATIBLE WITH SELECTED CHEMICAL, (NOT PROVIDED BY VEOLIA).
12. PSV IS SIZED FOR RELIEVING GAS BUILDUP IN THE LINE. IT IS NOT DESIGNED TO RELIEF FULL FLOW WHEN PUMP IS IN OPERATION.
13. VALVES TO BE INSTALLED AS CLOSE TO THE STRAINER AS POSSIBLE.
14. ALL PIPING OUTSIDE CONTAINMENT AREA TO BE INSTALLED WITH APPROPRIATE DOUBLE CONTAINMENT, AS REQUIRED.
15. ALL CHEMICAL TANKS/CONTAINMENT TO BE INSTALLED WITH A MINIMUM 24" CLEARANCE ON ALL SIDES FOR INSPECTION/36" CLEARANCE FOR OPERATION.
16. LINE SIZE DOWNSTREAM OF SKID TO INJECTION POINT TO BE VERIFIED DURING DETAIL PROJECT ENGINEERING.
17. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

SITE REQUIREMENT NOTES:

S1. DO NOT PERMIT INCOMPATIBLE CHEMICALS TO ENTER A COMMON FLOOR DRAIN.

S2. FRESH WATER TO BE AVAILABLE IN CHEMICAL HANDLING AREAS.

S3. EYEWASH AND SHOWER STATIONS IN ACCORDANCE WITH LOCAL REGULATIONS

23-P-101A/B
SODIUM HYPOCHLORITE DOSING PUMPS

TYPE: MAG DRIVE CENTRIFUGAL
MIN. RATED CAPACITY: 0.5 GPM @ 67 FT TDH
MAX. RATED CAPACITY: 20 GPM @ 50 FT TDH
NO. OF DUTY PUMPS: ONE
PUMP VENDOR AND MODEL: DB9V-R-FF-M219

GENERAL PUMP INFO	
SODIUM HYPOCHLORITE	12.0% w/v AND 10.3 % w/w
NO. OF DUTY PUMPS	1
NO. OF STANDBY PUMPS	1
TYPE OF PUMP	MAG DRIVE CENTRIFUGAL
TAG NUMBERS (INSTALLED)	23-P-101-A/B
SPEED CONTROL	VFD
ELECTRIC MOTOR	1.0 HP @ 3450 RPM
VOLTAGE	480 V / 3 PH / 60 Hz
PUMP MODEL	DB9V-R-FF-XX-M219

MFS	DESIGN FLOW	BUILDOUT	TDH, FT
MAINTENANCE CLEAN	2.08 GPM	2.64 GPM	XX
RECOVERY CLEAN	11.41 GPM	14.53 GPM	XX

MTH	DESIGN FLOW	BUILDOUT	TDH, FT
MAINTENANCE CLEAN	0.46 GPM	0.71 GPM	XX
RECOVERY CLEAN	4.21 GPM	6.54 GPM	XX

	DESIGN PRESSURE
MAX HEAD	67 FT

23-M-101A/B
SODIUM HYPOCHLORITE DOSING PUMP MOTOR

POWER: 1.0 HP @ 480 VAC / 3 PH / 60 Hz
TEFC / 3450 RPM
MIN. OPERATING SPEED: XX%

23-P-301A/B
CITRIC ACID DOSING PUMPS

TYPE: MAG DRIVE CENTRIFUGAL
MIN. RATED CAPACITY: 0.5 GPM @ 67 FT TDH
MAX. RATED CAPACITY: 20 GPM @ 50 FT TDH
NO. OF DUTY PUMPS: ONE
PUMP VENDOR AND MODEL: DB9V-R-FF-M219

GENERAL PUMP INFO	
CITRIC ACID	50% w/w
NO. OF DUTY PUMPS	1
NO. OF STANDBY PUMPS	1
TYPE OF PUMP	MAG DRIVE CENTRIFUGAL
TAG NUMBERS (INSTALLED)	23-P-301-A/B
SPEED CONTROL	VFD
ELECTRIC MOTOR	1.0 HP @ 3450 RPM
VOLTAGE	480 V / 3 PH / 60 Hz
PUMP MODEL	DB9V-R-E-FF-XX-M219

MFS	DESIGN FLOW	BUILDOUT	TDH, FT
MAINTENANCE CLEAN	5.06 GPM	6.44 GPM	XX
RECOVERY CLEAN	5.57 GPM	7.09 GPM	XX

MTH	DESIGN FLOW	BUILDOUT	TDH, FT
MAINTENANCE CLEAN	0.89 GPM	1.38 GPM	XX
RECOVERY CLEAN	1.63 GPM	2.54 GPM	XX

	DESIGN PRESSURE
MAX HEAD	67 FT

23-M-301A/B
CITRIC ACID DOSING PUMP MOTOR

POWER: 1.0 HP @ 480 VAC / 3 PH / 60 Hz
TEFC / 3450 RPM
MIN. OPERATING SPEED: XX%

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REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
MEMBRANE CLEANING CHEMICAL SYSTEMS
CENTRIFUGAL MAG DRIVE PUMP SKIDS

DRAWING NUMBER
639082-WTS-PR-SYS-EN21-DS-111

REVISION
A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 1

FILE LOCATION: C:\...ADSK\Vault\MAM\TO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1. PID and P&ID\639082-WTS-PR-SYS-EN21-DS-111.dwg

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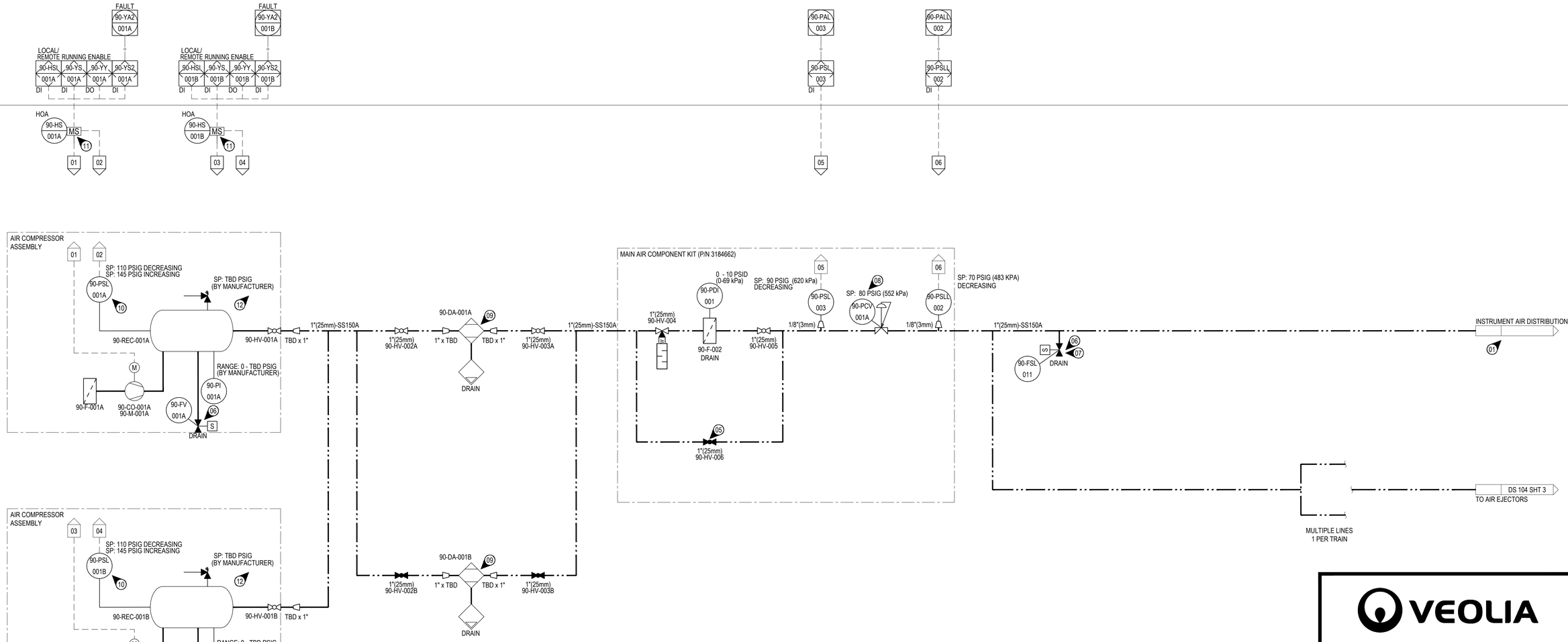

NOTES:

1. SCOPE OF SUPPLY ON THIS SHEET AS PER TABLE BELOW.

ITEMS	SUPPLIED BY	INSTALLATION BY	NOTES
AIR COMPRESSOR AND DRYER	VEOLIA	OTHERS	
MAIN AIR COMPONENT KIT	VEOLIA	OTHERS	
VALVES AND INSTRUMENTS	VEOLIA	OTHERS	
MOTOR STARTERS	OTHERS	OTHERS	
INTERCONNECTING PIPING	OTHERS	OTHERS	DELINEATED BY DOTTED LINES

2. SEE ELECTRICAL DRAWINGS DURING DETAILED ENGINEERING FOR ELECTRICAL WIRING AND INSTALLATION SCOPE.
3. ALL EQUIPMENT ON THIS SHEET IS DESIGNED TO BE INSTALLED IN A NON-CLASSIFIED AREA (PER NFPA 820).
4. INSTRUMENT AIR DISTRIBUTION NETWORK INCLUDING ISOLATION VALVES SUPPLIED BY OTHERS AS NEEDED. FIELD PIPING BY OTHERS. ENSURE SIZING AND ROUTING DESIGN ALLOWS FOR MINIMAL PRESSURE/VOLUME DROP SUCH THAT A MINIMUM OF 80PSI IS DELIVERED TO THE EQUIPMENT FOR OPERATION.
5. HANDLE FOR BYPASS VALVE TO BE REMOVED OR VALVE LOCKED IN CLOSED POSITION.
6. TIMED DRAIN VALVE SOLENOIDS CONNECT TO LOCAL 120VAC. ADJUST INTERVAL AND DURATION SETTINGS ON SOLENOID TO AMBIENT CONDITIONS.
7. LOW POINT DRAIN VALVE (SUPPLIED AND POWERED BY OTHERS) TO BE LOCATED AT LOW POINT IN PIPING WHERE MOISTURE MAY ACCUMULATE. ADDITIONAL VALVES MAY BE REQUIRED BASED ON PIPE ROUTING.
8. REGULATING VALVES TO BE SET IN THE FIELD BY VEOLIA FSR.
9. CONNECT AIR DRYER TO LOCAL 120 VAC. ONLY ONE DRYER TO OPERATE AT A TIME AND TO BE ROTATED MANUALLY ON A WEEKLY BASIS. IF ONLY ONE DRYER IS SUPPLIED A BYPASS LINE WITH MANUAL VALVE SHALL BE SUPPLIED.
10. CONTRACTOR TO WIRE AIR COMPRESSOR PRESSURE SWITCH TO MCC. VEOLIA FSR TO CONFIRM AND ADJUST PRESSURE SETPOINT DURING COMMISSIONING.
11. MOTOR STARTERS BY CUSTOMER IN CUSTOMER MCC. MOTOR HAND SWITCH BY CUSTOMER ON STARTER BUCKET.
12. PSV ARE NOT FIELD ADJUSTABLE AND SET POINT SHALL BE SET BELOW MAXIMUM OPERATING PRESSURE OF ALL SYSTEM COMPONENTS AND NOT HIGHER THAN 200 PSIG (1379kPa).
13. FINAL SIZING AND DESIGN TO BE VERIFIED DURING DETAILED PROJECT ENGINEERING.

90-CO-001A/B
AIR COMPRESSOR
RATED FLOW: 36 ICFM @ 175 PSIG
TYPE: PISTON
INCLUDES ACCESSORIES NOT SHOWN (AIR AFTERCOOLER, CHECK VALVE, RELIEF VALVE)

90-M-001A/B
AIR COMPRESSOR MOTOR
POWER: 10 HP @ 480 V / 3 PH / 60 Hz

90-REC-001A/B
RECEIVER
VOLUME: 120 GAL OR CU FT
MOC: CARBON STEEL

90-F-002
COALESCING FILTER
CAPACITY: XXX SCFM
CAPACITY: 53 CFM
DESIGN FLOW: XXX SCFM
MICRON RATING: 1um

90-DA-001A/B
AIR DRYER
DESIGN FLOW: 51 CFM
TYPE: REFRIGERANT
POWER: 375 WATTS @ 120 V / 1 PH / 60 Hz

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	GMN		KK		04 FEB 26

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CUSTOMER
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM (MFS)
AND MEMBRANE THICKENER SYSTEM (MTH)

SITE
EAGLE MOUNTAIN CITY, UTAH

TITLE
P&ID
SIMPLEX PISTON AIR COMPRESSORS

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN21-DS-112	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 1

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EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY (EMWWTF)

PROCESS FLOW DIAGRAM

REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	PB	KK			30JAN26

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CUSTOMER
EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY (EMWWTF)

SITE

TITLE
TITLE PAGE

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN11-DI-001	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 1

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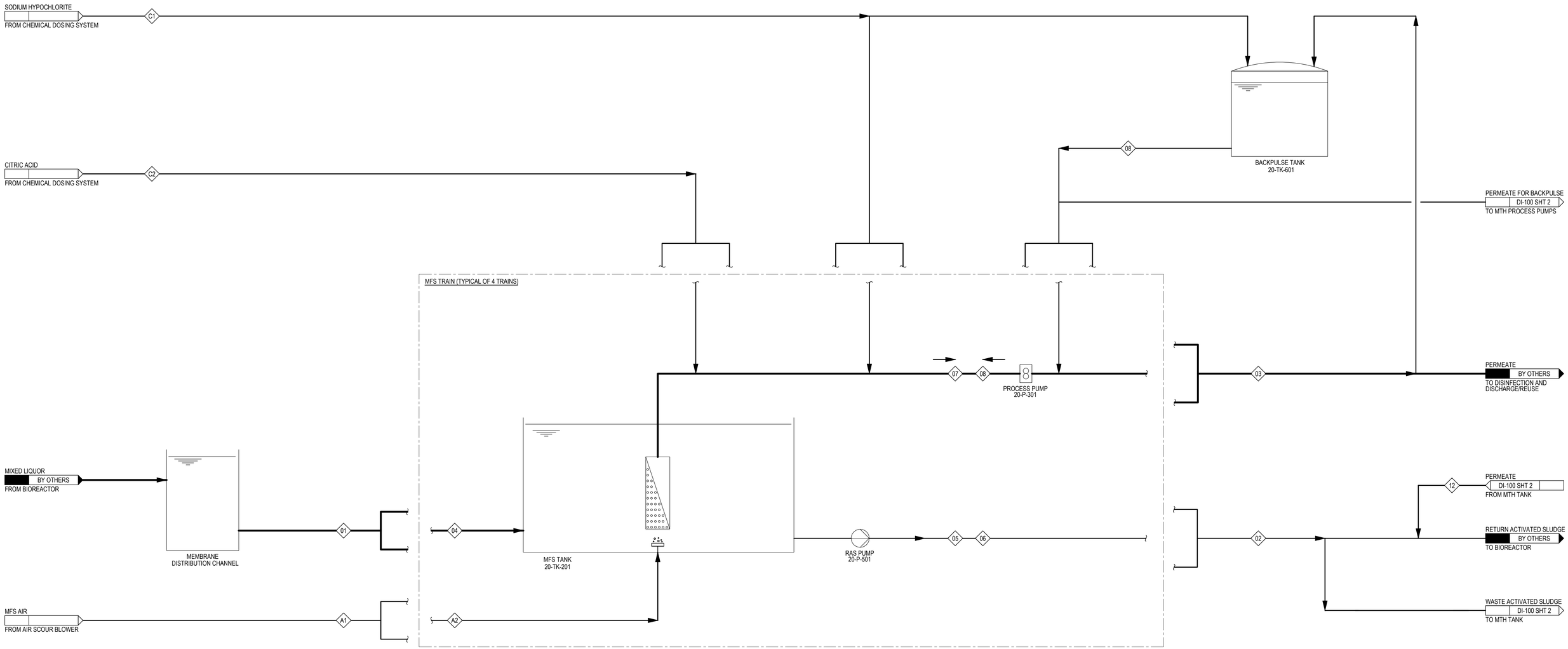
FILE LOCATION: C:_ADSKVault\MAM.ITO\639082-EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY\1 - PFD and P&ID\639082-WTS-PR-SYS-EN11-DI-100.dwg



NOTE:

1. PFD DOES NOT REPRESENT SPECIFIC EQUIPMENT NOR INDICATE SCOPE OF SUPPLY. FOR MORE INFORMATION REFER TO P&IDS.

REFERENCE ONLY
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REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	PB	KK			30JAN26

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CUSTOMER
EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY (EMWWTF)

SITE

TITLE
PROCESS FLOW DIAGRAM
MEMBRANE FILTRATION (MFS)

DRAWING NUMBER				REVISION
639082-WTS-PR-SYS-EN11-DI-100				A
PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	1 OF 4

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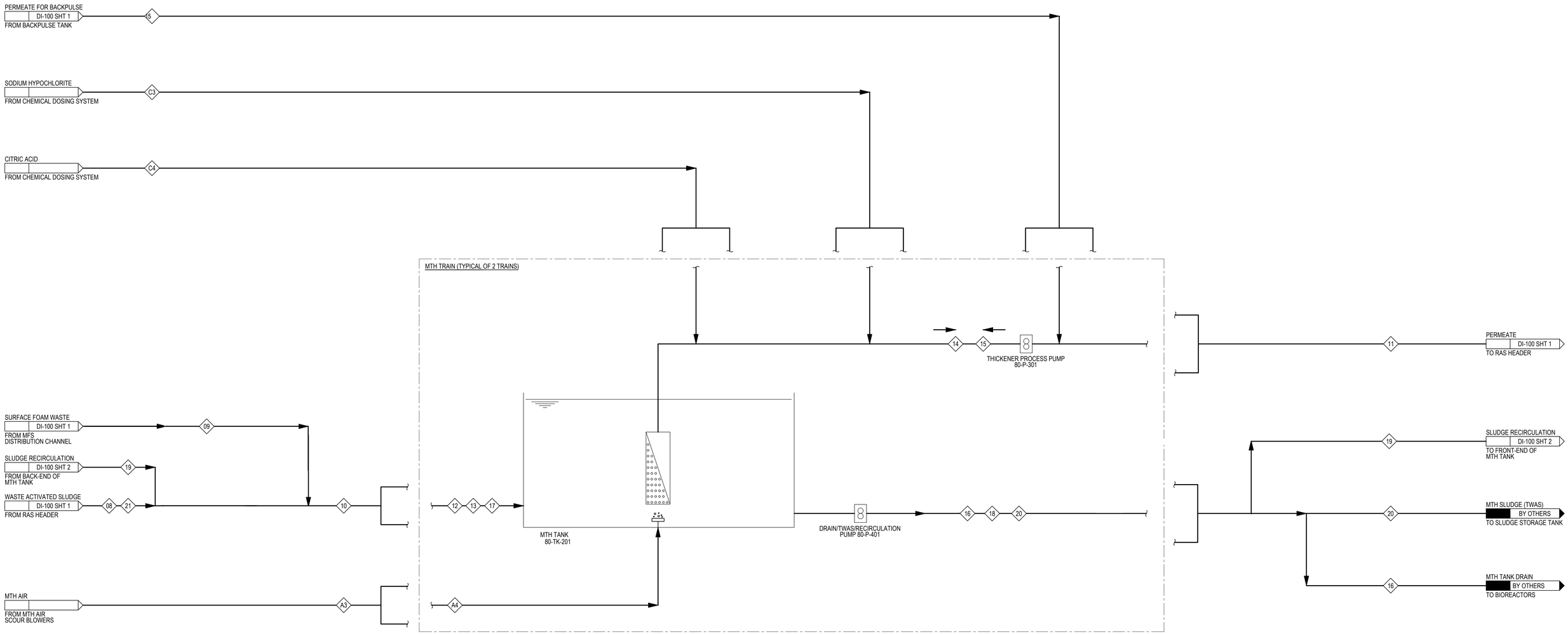

NOTE:

1. PFD DOES NOT REPRESENT SPECIFIC EQUIPMENT NOR INDICATE SCOPE OF SUPPLY. FOR MORE INFORMATION REFER TO P&IDS.

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REV	DESCRIPTION	DWN	APPR	CHKD	ECO	DATE
A	INITIAL RELEASE	PB	KK			30JAN26

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CUSTOMER
EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY (EMWWTF)

SITE

TITLE
PROCESS FLOW DIAGRAM
MEMBRANE THICKENER (MTH)

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN11-DI-100	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	2 OF 4

LAST SAVED: Friday, January 30, 2026 1:11:30 PM

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Stream ID	Stream Description		Type of Flow	Scope	Fluid Code	Units	MinDF Minimum Daily Flow	ADF Average Daily Flow	MMF Maximum Month Flow	MDF Maximum Day Flow	PHF Peak Hour Flow	ADF N-1 Average Daily Flow With One Train Offline	MMF N-1 Maximum Month Flow With One Train Offline	MDF N-1 Maximum Day Flow With One Train Offline	Equipment Sizing Minimum	Equipment Sizing Maximum
-	**Membrane System Design Capacity (Net)**					**MGD**	**4.20**	**6.00**	**7.20**	**10.20**	**16.30**	**6.00**	**7.20**	**10.20**	**--**	**--**
-	Number of membrane trains running		-	-	-	-	**3**	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**3**	**4**
-	Recirculation Ratio [R]		-	-	-	-	4.00	4.00	4.00	2.82	2.00	4.00	4.00	2.82	--	--
1	Membrane Feed Activated Sludge [(R+1) × Q]		Continuous	Total	AS	MGD	21.00	30.00	36.00	39.00	48.90	30.00	36.00	39.00	21.00	48.90
						gpm	14,583	20,833	25,000	27,083	33,958	20,833	25,000	27,083	14,583	33,958
2	Membrane Recirculated Activated Sludge (RAS) [R × Q]		Continuous	Total	RAS	MGD	16.80	24.00	28.80	28.80	32.60	24.00	28.80	28.80	16.80	32.60
						gpm	11,667	16,667	20,000	20,000	22,639	16,667	20,000	20,000	11,667	22,639
3	Permeate	Net [Q]	Continuous	Total	UFP	gpm	2,917	4,167	5,000	7,083	11,319	4,167	5,000	7,083	--	--
		Instantaneous	Continuous	Total	UFP	gpm	3,063	4,458	5,650	8,500	13,583	4,458	5,650	8,500	3,063	13,583
4	Membrane Feed Activated Sludge [(R+1) × Q]		Continuous	Per Train	AS	MGD	7	8	9	10	12	10	12	13	7	13
5	Membrane Recirculated Activated Sludge (RAS) [R × Q]		Continuous	Per Train	RAS	gpm	3,889	4,167	5,000	5,000	5,660	5,556	6,667	6,667	3,889	6,667
6	Membrane Tank Drain		Intermittent	Per Train	RAS	gpm	3,954								3,954	3,954
7	Permeate	Net [Q]	Continuous	Per Train	UFP	gpm	972	1,042	1,250	1,771	2,830	1,389	1,667	2,361	--	--
		Instantaneous	Continuous	Per Train	UFP	gpm	1,021	1,115	1,413	2,125	3,396	1,486	1,883	2,833	1,021	3,396
8	Backpulse	Backpulse	Intermittent	Single Stream	UFP	gpm	3,396								3,396	3,396
		Maintenance & Recovery Clean	Intermittent	Single Stream	CIPI	gpm	1,569								1,569	1,997

		Chemical Flows														
C1	Sodium Hypochlorite (12.5% w/w solution)	Maintenance Clean	Intermittent	Single Stream	HC	gpm	2.09								2.09	2.66
		Recovery Clean	Intermittent	Single Stream	HC	gpm	11.51								11.51	14.65
C2	Citric Acid (50% w/w solution)	Maintenance Clean	Intermittent	Single Stream	CIT	gpm	5.06								5.06	6.44
		Recovery Clean	Intermittent	Single Stream	CIT	gpm	5.57								5.57	7.09

		Air Flows														
A1	Membrane Air	Leap Low	Continuous	Total	BA	icfm	2,321	3,095	3,095	3,095	3,095	2,321	2,321	2,321	2,321	3,928
		Leap High	Continuous	Total	BA	icfm	4,641	6,188	6,188	6,188	6,188	4,641	4,641	4,641	4,641	7,854
A2	Membrane Air	Leap Low	Continuous	Per Train	BA	icfm	774								774	982
		Leap High	Continuous	Per Train	BA	icfm	1,547								1,547	1,963

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A	INITIAL RELEASE	PB	KK			30JAN26

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CUSTOMER
EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY (EMWWTF)

SITE

TITLE
PROCESS FLOW DIAGRAM
MASS BALANCE
MEMBRANE FILTRATION SYSTEM

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN11-DI-100	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	3 OF 4

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Stream ID	Stream Description		Type of Flow	Scope	Fluid Code	Units	ADF	MMF	Equipment Sizing	
							Average Daily Flow	Maximum Month Flow	Minimum	Maximum
-	Number of membrane thickener trains running		-	-	-	-	**2**		**2**	**2**
8	Influent WAS	Start of Batch	Intermittent	Total	WAS	gpm	368	368	92	368
		End of Batch	Intermittent	Total	WAS	gpm	92	92		
9	Surface foam/scum		Intermittent	Total	WAS	gpm	TBD		TBD	
10	Influent + Recycle Combined	Start of Batch	Intermittent	Total	WAS	gpm	736	736	460	736
		End of Batch	Intermittent	Total	WAS	gpm	460	460		
11	Permeate - Instantaneous	Start of Batch	Intermittent	Total	UFP	gpm	368	368	92	368
		End of Batch	Intermittent	Total	UFP	gpm	92	92		
12	Influent WAS	Start of Batch	Intermittent	Per Train	WAS	gpm	184	184	46	184
		End of Batch	Intermittent	Per Train	WAS	gpm	46	46		
13	Influent + Recycle Combined	Start of Batch	Intermittent	Per Train	WAS	gpm	368	368	230	368
		End of Batch	Intermittent	Per Train	WAS	gpm	230	230		
14	Permeate - Instantaneous	Start of Batch	Intermittent	Per Train	UFP	gpm	184	184	46	184
		End of Batch	Intermittent	Per Train	UFP	gpm	46	46		
15	Backpulse**	Backpulse	Intermittent	Single Stream	UFP	gpm	460		460	650
		Maintenance & Recovery Clean	Intermittent	Single Stream	CIPI	gpm	276		276	429
16	Membrane Tank Drain		Intermittent	Per Train	WAS	gpm	313		313	
17	Membrane Tank Fill		Intermittent	Per Train	WAS	gpm	313		313	
18	Recycle		Intermittent	Per Train	WAS	gpm	184		184	
19			Intermittent	Total	WAS	gpm	368		368	
20	Thickened WAS (TWAS)		Intermittent	Per Train	WAS	gpm	313		313	
21	Waste Activated Sludge (WAS)	Volume	Daily Average	Total	WAS	gpd	217,000	276,000	--	--
		Wasting Duration Per Day	-	-	-	hr	14.7	20.7	--	--

Chemical Flows**									
C3	Sodium Hypochlorite (12.5% w/w solution)	Maintenance Clean	Intermittent	Single Stream	HC	gpm	0.37	0.37	0.58
		Recovery Clean	Intermittent	Single Stream	HC	gpm	2.02	2.02	3.14
C4	Citric Acid (50% w/w solution)	Maintenance Clean	Intermittent	Single Stream	CIT	gpm	0.89	0.89	1.38
		Recovery Clean	Intermittent	Single Stream	CIT	gpm	1.00	1.00	1.56

Air Flows**									
A3	Membrane Thickener Air	Leap High	Continuous	Total	BA	icfm	643	643	981
		Leap High High	Continuous	Total	BA	icfm	924	924	1,410
A4	Membrane Thickener Air	Leap High	Continuous	Per Train	BA	icfm	321	321	490
		Leap High High	Continuous	Per Train	BA	icfm	462	462	705

**Maximum for equipment sizing is with all membrane spaces filled

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VEOLIA

CUSTOMER
EAGLE MOUNTAIN WASTEWATER TREATMENT FACILITY (EMWWTF)

SITE

TITLE
PROCESS FLOW DIAGRAM
MASS BALANCE
MEMBRANE THICKENER

DRAWING NUMBER	REVISION
639082-WTS-PR-SYS-EN11-DI-100	A

PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082		NONE	D	4 OF 4

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7.7. Summary Tabulation of connected electrical loads (HP)

7.7.1. Electrical Specifications

The table below details the electrical specifications, including voltage, phase, current draw, and horsepower (HP), for all equipment as required by RFP

Table 7-8: Electrical Specifications

Equipment	Voltage/Phase	Connected Motors	Duty Motors	Current Draw (Amps) each	Current Draw	Horse power
MFS Blower	460 V /3 PH	4	3	156	468	125 HP
MTH Blower	460 V /3 PH	2	2	77	154	60 HP
MFS Process Pump	460 V /3 PH	4	3	124	496	100 HP
MTH Process Pump	460 V /3 PH	2	2	27	54	20HP
MTH Drain / Recirculation / TWAS Pump	460 V /3 PH	2	2	21	42	15HP
RAS pump	460 V /3 PH	4	3	27	81	20 HP
Membrane Cleaning Chemical System	460 V /3 PH	4	2	2.1	4.2	1 HP
Air compressor	460 V /3 PH	2	1	14	14	10 HP

Note: We assumed a PF of 0.95

7.7.2. Test Data for Blowers and Pumps

Appendix B contains the pump and blower performance curves.

7.8. Complete list and description of accessory or optional equipment.

The scope of supply is detailed in Section 7.1. Veolia's proposal only covers the items explicitly listed in Section 7.1 and the corresponding pricing is included in the capital Bid form(provided separately). No other bid additives have been considered by Veolia.

7.9. Equipment Data sheets

Please refer to Appendix C for the data sheets for all equipment.

7.10. Membrane Integrity Testing

7.10.1. Turbidity Monitoring System

Veolia continues to recognize the requirement to maintain the highest standards of reliability for the EMC facility. During production, the integrity of each train is monitored with online turbidity meters. There are three turbidity alarms used to assist the operator in running the system.

Alarm 1: Used to detect a problem that is not a spike and immediately shuts down the train in production. For example, a train is shut down when the turbidity is above 0.2 NTU, for 2 minutes.

Alarm 2: Used to detect a spike in turbidity and sets all trains that are in backpulse to relax. For example, the alarm is active when the turbidity is above the setpoint, 3 NTU, for 10 seconds. The

alarm will also skip all scheduled maintenance cleans until the turbidity alarm no longer exists. After the turbidity alarm condition clears, the maintenance cleans are completed as scheduled, but the backpulse must be manually selected by the operators, if required.

Alarm 3: Used to also detect spikes but at a lower setpoint and is used to notify the operator of a potential problem which needs to be addressed. For example, the alarm is active when the turbidity is above the setpoint 0.5 NTU, for 60 seconds.

As the turbidity monitoring system is dedicated per membrane train, and results in a shutdown if exceeded, the operators will be able to quickly determine which train is causing the exceedance. The cassette that is the issue can then be manually isolated and the train can remain in operation.

7.10.2. Bubble Testing

During commissioning, a bubble test will be performed on all membrane cassettes to ensure that no damage has occurred to the fibers or headers during shipping or installation and to test the water-tightness of permeate connections that were completed during installation. The membrane tank is flooded with water to cover all the cassettes and fitting connections.

Oil-free compressed air is applied to the cassette and the system is inspected for leaks, which appear as air bubbles. Any leaks that require repair are located, logged and repaired. If a repair is made, another bubble test is completed to ensure that the leak has been correctly repaired.

7.10.3. Technical data and Laboratory testing data supporting ability of Membranes

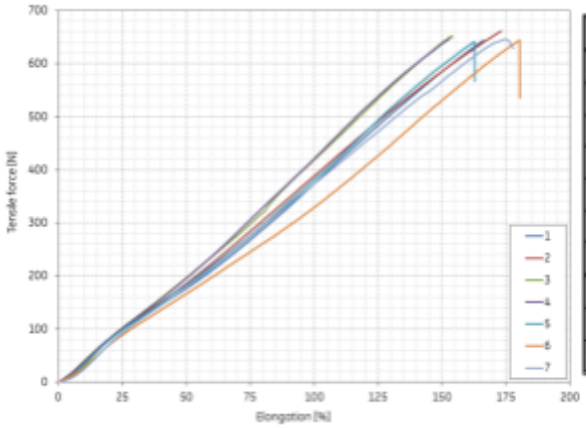
The immersed ZeeWeed membrane technology has been employed in MBR applications for 30 years. The first installations were commissioned in 1993, making ZeeWeed one of the earliest commercialized MBR membranes. Unlike many new MBR suppliers, Veolia designs and manufactures its own ultrafiltration membranes in world-class manufacturing facilities. The in-house R&D team continuously improves the ZeeWeed 500 series product to keep our customers at the forefront of innovation.

In MBR applications, membranes could be subjected to unique operating conditions including high solids loading and trash build-up if either upstream pre-treatment or downstream wasting systems fail to function correctly. While not common occurrences, it's important that the membrane product be designed to withstand these upset operating conditions as well as the normal forces from membrane aeration, membrane cleaning and occasional tank drains. One physical parameter that is important to consider when assessing the ability of a membrane product to withstand these forces, is tensile strength.

Hollow fiber membrane tensile strength can be measured using a modification of ASTM protocol (D 3822), which is a general method developed for fiber-like materials.

As HF membranes are different to a pure fiber (i.e. rope) the ASTM protocol is modified to suit the HF product. It is possible to perform a similar modification to test flat sheet membranes with the protocol as well. Veolia has an in-house laboratory capable of performing the test, and data from that test is presented below.

The ZeeWeed 500 MBR product is an extruded PVDF membrane coated onto a polyester support that provides additional robustness suitable for wastewater applications. The supported design of the ZeeWeed 500 membrane has allowed it to achieve the longest operating life of any hollow fiber product in the industry, averaging 15.5 years in municipal treatment applications. Several operating systems have achieved over 20 years of life for the Zeeweed membranes.



Sample	Tensile force [N]
1	643.9
2	661.5
3	651.9
4	647.4
5	641.4
6	644.2
7	646.4
Average	648.1
Standard deviation	6.8
Confidence @ 95%	5.0

Figure 1: Tensile Test Data on the ZeeWeed 500 Product

As demonstrated in the results, the tensile force at break for the ZeeWeed 500 Membrane Fiber is 648.1 ± 5.0N.

The ZeeWeed 500 series membrane has been the product of choice in hundreds of MBR projects globally due to its reinforced structure, outstanding performance, and high quality, resulting in the longest demonstrated module life in the industry.

The figure below shows the original ZW 500 series membranes installed at a customer site in Manitoba, Canada prior to the biannual recovery clean. These membranes have surpassed 20 years in operation, a testament to their quality.

Figure 2: ZW500 Membranes with Over 20 Years in Operation Prior to Biannual Recovery Clean

7.10.4. Veolia MBR Installations which Demonstrate Long Membrane Life

The table below highlights some of Veolia's MBR installations which demonstrate long membrane life. **This partial list illustrates 20 facilities which have achieved a 15 year life. There are over 75 ZeeWeed MBR facilities in North America which have demonstrated a membrane life greater than 10 years.**

Table 7-9: Demonstrated Long Membrane Life (Partial List)

Facility Name	State/ Province	ADF (MGD)	Commissioned	Demonstrated Membrane Life
Thetis Lake Campground WWTP	BC	0.01	1995	20 [2]
Ganges Pollution Control Centre	BC	0.26	1996	15 [2]
Westview WWTP	BC	0.92	1998	27
Anthem WWTP	AZ	4.0	1999	12 [2]
Cohasset WWTP	MA	0.45	2000	10 [2]
Port McNicoll WWTP	ON	0.51	2001	21[1]
Corona WWTP	CA	1.0	2001	16 [2]
American Canyon WWTP	CA	3.0	2002	13 [2]
Laguna County MBR	CA	0.5	2002	12 [2]
Rubes Creek WWTF	GA	2.0	2003	11 [2]
Redlands WWTP	CA	7.2	2004	16 [2]
Traverse City WWTP	MI	7.1	2004	14 [2]
Duvall WWTP	WA	1.0	2005	11 [2]
Mariposa WRF	NM	0.5	2005	14[2]
Cabezon WWTP	NM	1.0	2005	13 [1]
Crockery Township	MI	0.075	2005	15 [3]
Southshore WRF	AB	0.24	2005	16[2]
South Kitsap WRF	WA	1.7	2006	12 [2]
Rio Vista	CA	1.0	2006	14 [2]
Randolph Township	OH	0.3	2006	19
Riverdale WWTP	MO	0.15	2006	12[2]
Schofield Barracks WWTP	HI	4.2	2006	11 [2]
Marco Island WWTP	FL	5.0	2006	12-17 [2]
Village of Conifer	CO	0.1	2007	10 [2]
Wyndgate MBR	MO	0.4	2007	11 [2]
Donlin Creek	AK	0.01	2007	18
Sterling WWTP	NC	0.19	2007	18
North Lake	ID	1.0	2007	12-16 [2]
North Regional WWTP	AZ	3.5	2007	10 [2]
Lewes WWTP	DE	1.5	2007	13 [2]

Facility Name	State/ Province	ADF (MGD)	Commissioned	Demonstrated Membrane Life
Big Creek WWTP	CA	0.03	2007	11 [2]
Linwood WRF	GA	4.6	2007	11 [2]
Lake Quinault	WA	0.04	2007	18
Hutchinson MN	MN	0.72	2007	11 [2]
City of Odell WWTP	OR	0.42	2008	17
Broad Run WRF	VA	15.0	2008	14 [2]
Clear Lake WWTF	MN	0.36	2008	14-15[1]
North Liberty	IA	1.7	2008	12 [2]
Carnation WWTP	WA	1.0	2008	14[2]
Wolf Creek WRF	UT	0.4	2008	17
Butler Drive WRF	AZ	10.0	2008	10 [2]
Lake Tansi WWTP	TN	0.05	2008	14[2]
Dover WWTP	ID	0.2	2008	15[2]
Churchill County	NV	0.6	2008	13-15 [2]
North Kent Sewer Authority	MI	6.0	2008	10 [2]
Oxford WWTP	ON	3.6	2008	17
Whistler WWTP	BC	0.02	2008	13[1]
Front Range Airport	CO	0.025	2008	10 [2]
Rotonda WRF	FL	2.0	2008	15[1]

Note 1: Plant has undergone a partial membrane replacement (i.e., some original trains are still in operation).

Note 2: Plant has undergone a full membrane replacement in multiple phases

7.10.5. Membrane Cassette Access and Removal from Membrane Tanks

A summary of key procedures for installing ZeeWeed membranes including membrane removal is detailed below.

ZeeWeed 500 Lifting Procedure

Although rarely done, the typical removal of a single cassette requires two people and can be done within 30 minutes including pre-work and cassette drain time.

1. **Preparation of Work**

   If membrane cleaning is to be performed, the cassette should be aerated for 10-15 minutes without permeation prior to removal to assist in removing any accumulated solids from the fiber bundles. Prior to removal, thought should be given to where the cassette will be placed, where a clean water supply will come from and where water will run-off. Environmental conditions, such as excessive heat or cold, should also be considered.

Figure 7-1: Cassette preparation prior to removal

Membrane train covering should be prepared by removing any lockdown component (i.e. bolts, camlocks for ventilation piping as applicable etc.). Air and permeate isolation valves on the cassette should be closed prior to removal. Bolts on the permeate line Straub connector should be loosened to allow sliding of the connector onto the portion of the permeate spool attached to the cassette. Straub connections on the airlines should be cracked open to allow the pressurized air to be released slowly. Do not open both sides of the Straub or pull on the air line until the air has been released out of the connection and the "hissing" sound has stopped. For safety reasons, do not stand directly in front of the air line when removing it, to avoid any potential kickback from residual pressure while disconnecting the hose.

Any other potential obstacles in the cassettes lifting route should be cleared prior to any lifting such as ventilation pipes/hoses or valve actuators.

2. Safety

It is important that before any work begins, the necessary planning is done, and precautions are taken in order to ensure that the membrane removal can be carried out safely. This serves to ensure your safety and no damage to the cassettes or other equipment. Before any cassette can be moved, ensure that the lifting crane is in good operating condition and is rated for the load. While maneuvering the cassette, ensure that no one is in its path or out of sight of the crane operator. Never stand under the cassette.

It is crucial that fall arrest equipment be worn when working overtop the membrane tank. A fall arrest harness must be worn, and appropriate tie-off lanyards must be used while installing and/or working on a cassette.

3. Required Tools

The following tools are required to operate safety and ensure ease of cassette removal.

- Forklift with extended forks, rated for cassette weight; required to move the crate
- Certified traveling bridge crane (By Others); lifting hoist requirement for 56 module cassette is 10,000 lbs.
- ZeeWeed 500 Lifting Module (Veolia Scope of Supply), with hitch pins
- Four ¾" lifting safety hoist rings rated for 5,000 lbs
- Four slings
- Four-point spreader bar and two-point spreader bar
- Hardware
- Tools, as recommended by the Supplier, to remove the tank grating/cover (By Others)
- Gloves and PPE

4. **ZeeWeed 500 Lifting Frame**

The ZeeWeed 500 Lifting Module has been specially designed to aid in the movement (installation/removal) of ZeeWeed 500 membrane cassettes and has been included in Veolia's Scope of Supply for the Eagle Mountain City Water Filtration System.

The lifting frame is moved using the crane to the overtop of the membrane cassette. The pins at the four corners are slid into the hanger arms slotted hole on the inside of the cassette. The Lifting Module is secured to the cassette by passing the hitch pin through the lifting bracket. This ensures safe movement of the cassettes during installation and cassette maintenance.

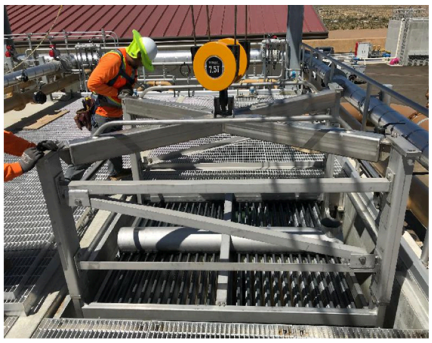


Figure 7-2: Attaching Lifting Module on cassette

5. **Lifting Procedure**

These steps outline how the ZeeWeed 500 cassette can be lifted safely out of the tank:

a. Connect the lifting bracket to the overhead crane using appropriate and certified equipment. Remove the tank covers only above the cassette you intend to lift and place them in an area that will not interfere with cassette removal or create a trip hazard.

b. Disconnect the cassette from the beam brackets and remove the hitch pins. Use the hitch pins to attach the lifting bracket to the cassette arms. Move the permeate and air connections as well as the ventilation piping out of the way as necessary so that they will not catch on the train headers as you lift the cassette.

c. Begin to lift the cassette upwards. If the crane has two speeds, the slower speed should be used for lifting cassettes. If necessary, gently (using low pressure) hose down the cassette while it is being lifted out of the tank. When the cassette has cleared the water surface in the tank, stop lifting and allow the cassette to drain for 10 minutes or until the water draining from the cassettes slows to a trickle.

d. Continue lifting until the bottom of the cassette is clear of the top of the tank or top of headers, as applicable. The cassette can now be moved to the membranes loading and maintenance area where the inspection or the maintenance can be conducted safely. It is recommended that a guide rope be tied to one bottom corner of the frame to assist in controlling movement. For safety reasons, the tank cover should be reinstalled while the cassette is out of the tank.

To return a cassette to the tank the movement requirements are the same as for cassette lifting (in reverse). Note that slow crane speed should be used at all times for the lowering of the cassette into its slot.

More detailed information regarding membrane fiber repair, cassette removal, and integrity testing is available in the ZW500EV MBR Sample IOM Manual which is attached in Appendix D.

8. Process Design and Calculations:

8.1. Bid Form - Attachment A

Please refer to Bid Form, Attachment A provided separately with Cost forms

8.2. Overview of ZeeWeed Membrane Filtration and Thickening System

The proposed ZeeWeed membrane filtration and membrane thickening system for the City of Eagle Mountain WWTF is designed to provide a flexible and reliable solution that ensures long-term performance in meeting/exceeding the permit effluent limits for reuse.

The biological system designed and supplied by Others gravity feeds nitrified mixed liquor to the common MFS tank distribution channel. Each MFS tank has a submerged sluice gate (supplied by Others, controlled by Veolia), used to split mixed liquor evenly into four (4) membrane trains. Within the MFS process, a series of ZeeWeed cassettes are immersed directly in mixed liquor within separate, and isolatable tanks. This series of cassettes are each connected to train-dedicated air and permeate headers. Each tank will have dedicated equipment, calling it a Membrane Train. Each train is connected to the suction side of a duty pump for permeation, which creates a vacuum in the permeate header to draw treated water from the outside in through the hollow fiber membranes, leaving the mixed liquor solids on the outside of the membrane.

Permeate is directed to downstream UV disinfection (provided by Others), with flow periodically being diverted to the common backpulse tank in an offline configuration. Coordination will be needed between Veolia and AE2S to better understand the minimum permeate flow to the downstream UV disinfection as the backpulse tank gets periodically filled.

When opting to Backpulse in lieu of Relax, or during chemical cleans, permeate will be drawn from the backpulse tank and reversed through the membranes, dislodging any foulants within the membrane fibers.

Return Activated Sludge (RAS) continuously recycles mixed liquor from the membrane tank to the bioreactors at a rate of 2-4Q (refer to Section 8.5.4.1.5 for RAS rates and associated MLSS concentrations). A small Waste Activated Sludge (WAS) stream is diverted from the common RAS header to the MTH system.

The MTH system will receive both Waste Activated Sludge (WAS) and surface foam wasting from the MFS system. The WAS is diverted from the common RAS header and individually piped into each MTH tank, to control the flow split between each tank. Foam will overflow from the MFS distribution channel into the dedicated MTH foam/scum tank, where a submersible pump (provided by Others) will transfer the surface foam wasting intermittently into each MTH tank. Further analysis on influent flow splitting within the MTH system will occur during development of plant hydraulics and detailed engineering.

Within the MTH process, a series of ZeeWeed cassettes are immersed directly in the waste activated sludge. Though traditionally thickeners only consist of one train, the EMWWTF will be equipped with two (2) duty thickeners, each operating at 50% capacity, as requested in the RFP. The series of cassettes are each connected to train-dedicated air and permeate headers. The MTH and MFS have separate duty equipment, and no common standby's. Only common plant equipment, such as chemical dosing skids, backpulse storage, and air compressors will be shared between the two systems. Each train is connected to the suction side of a duty pump for permeation, which creates a vacuum in the permeate header to draw treated water from the outside in through the hollow fiber membranes, leaving the mixed liquor solids on the outside of the membrane.

The MTH operates in a batch mode, with each batch beginning with a tank fill using the diverted WAS from the MFS. Thickening begins, with influent WAS fed into the MTH at the same rate that permeate is being drawn from the system, to maintain level in the MTH tank, and will continue for the duration of the batch. The initial production flux will decrease continuously as the solids concentration within the MTH tanks increases, until the target MLSS concentration of 2% is met. Once the target concentration has been met, permeation and feed WAS will stop and the contents of the tank will be drained to the downstream sludge storage tank. The two MTH trains will operate at the same time however they will be slightly staggered since some operating sequences can't take place at the same time.

Throughout the thickened sludge production, an internal recirculation line will continuously recirculate 1Q from the back-end of the MTH trains to the front end. This will reduce the solids gradient that develops along the length of the tanks, and therefore keep an even MLSS concentration distribution. When a drain (30 mins) is required to dump a thickened batch or drain during a recovery clean on one train, recirculation will be temporarily paused on the other train.

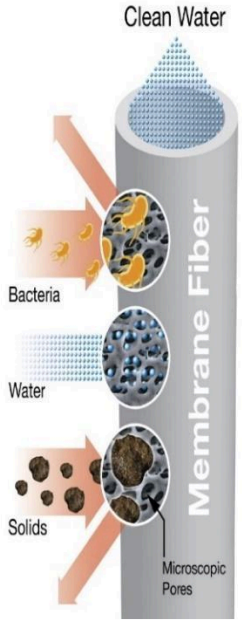
Permeate produced is directed to the MFS RAS header and circulated back through the plant to be re-treated before discharge. After a period of time permeating, MFS permeate will be drawn from the backpulse tank and reversed through the MTH membranes, dislodging any foulants within the membrane fibers. In a MTH, there is no Relax option available.

Both the MFS and MTH utilize the highly efficient LEAPmbr aeration used to scour the surface of the fibers and dislodge any solids that have accumulated during permeation.

The following sections detail Veolia's proposed Membrane Filtration System (MFS) and Membrane Thickening System (MTH) for the Eagle Mountain WWTF.

8.3. ZeeWeed Reinforced Fiber

At the core of both the MFS and MTH process is the ZeeWeed 500-series membrane, an outside-in reinforced PVDF hollow-fiber specifically designed for high solids applications. The ZeeWeed membrane consists of a polymeric membrane cast on the outer surface of a porous support fiber. The combination of this reinforced support fiber with the polymeric membrane layer is a key to our demonstrated long membrane life – providing a robust membrane with exceptional tensile strength as well as providing a highly permeable structure.



Air, in the form of large bubbles, is introduced below the bottom of the membrane modules, producing turbulence that scours the outer surface of the hollow fibers to keep them clean. LEAPmbr Aeration is a patented, specially designed, and highly efficient aeration system used to scour the surface of the membranes and move mixed liquor solids away from the membrane fibers. The LEAPmbr aeration system uses factory-installed LEAP aerators which are integrated into the base of each ZeeWeed 500 cassette simplifying installation.

Permeable membrane for longer life

The ZeeWeed 500 series membrane fiber has a nominal pore size of 0.04 µm and is classified as a true ultrafilter. The permeable PVDF membrane allows it to be highly resistant to chemicals, including acids, bases, and chlorine, allowing for flexible cleaning regimes. As a result of the reinforced core, the membrane does not experience deep pore fouling that is typically seen with "thicker" PVDF unsupported membranes. PVDF chemistry has been used since the early 1990s, proving its long-term performance. Veolia has optimized the chemistry formulation over the years to have a wastewater specific membrane. Veolia has focused on the membrane chemistry to be

very permeable which allows for greater throughput during operation and it stays permeable over a long period of time – which is important for membrane life.

A single ZeeWeed fiber has a tensile strength greater than 135 lbs., greatly exceeding other non-reinforced fibers in the industry. The strength of this reinforced fiber is paramount to a wastewater application so the membranes can handle high air scour stress, high MLSS concentrations and maintain operation during unexpected events without any manual cleaning or fiber repairs. Unsupported fibers are 10-60 times weaker than reinforced fibers. With this significantly reduced tensile strength, unsupported fibers lack robustness and are more susceptible to breakage, especially in the high solids and aeration intensive environment of an MBR.

Our patented reinforcement features a braid which is passed through the casting die and the membrane is extruded onto the braid. By design of the membrane casting solution and open structure of the braid, Veolia ensures that both a strong chemical bond and mechanical bonding of the membrane with the support braid is achieved. This eliminates any chance of delamination, the membrane separating from the braid, as the membrane is embedded into the braid.

PVDF chemistry has been used since the early 1990's, proving its long-term performance. Veolia has optimized the chemistry formulation over the years to have a wastewater specific membrane. We have focused on the membrane to be very permeable which allows for greater throughput during operation. Our membrane stays permeable over the entire duration of its life.

Veolia's automated membrane manufacturing processes ensure a consistent permeable membrane product that meets the highest standards of workmanship and quality. This exceptionally strong and reliable membrane forms the backbone of our ZeeWeed MBR systems, which consistently meet and exceed the toughest regulatory standards around the world with the longest membrane life in the industry.

Reinforced membrane for longer life

The ZeeWeed fiber has a tensile strength greater than 135 lbs, greatly exceeding other non-reinforced fibers in the industry. The strength of this reinforced fiber is paramount to a wastewater application so the membrane can handle high air scour stress, high MLSS concentrations and maintain operation during unexpected events without any manual cleaning or fiber repairs. Unsupported fibers are 10-60 times weaker than reinforced fibers. With this significantly reduced tensile strength, the unsupported fibers lack robustness and they are more susceptible to breakage, especially in the high solids and aeration-intensive environment of an MBR.

Our patented reinforcement features a braid which is passed through the casting die, and the membrane is extruded onto the braid. By design of the membrane casting solution and open structure of the braid, we ensure that we achieve both a strong chemical bond and mechanical bonding of the membrane with the support braid. This eliminates any chance of delamination, the membrane separating from the braid, as the membrane is embedded into the braid.

8.4. ZeeWeed 500 Series Membrane

The proposed ZeeWeed membrane filtration system for the Eagle Mountain City Water Filtration System is designed to ensure reliable long-term performance and to maximize operational flexibility. The ZeeWeed membrane has three decades of operational experience. While always keeping the same design, small manufacturing optimizations have been made over time to provide increased surface area without compromising our market leading performance. These incremental improvements are incorporated into the offering today.

- Improvement in potting materials and manufacturing.

- Wastewater-specific membrane chemistry.
- Optimized fiber material.
- Adaption to LEAPmbr aeration.
- Cassette design modifications to suit single air connection and optimized permeate connection.
- Cassette material durability and module access improvements.

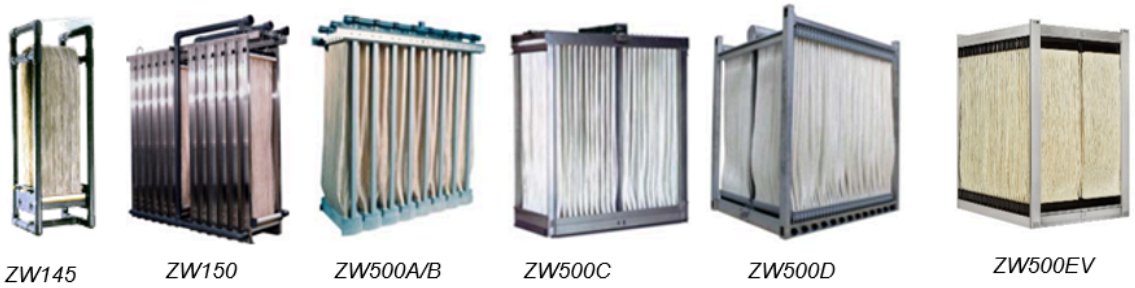


Figure 8-1: ZeeWeed Evolution

The membrane is manufactured and assembled into discrete units called modules or small membrane subunits. These are the basic building blocks of the membrane system that are connected to a manifold to create a cassette or large membrane subunit.

The latest generation ZeeWeed 500EV cassette combines over 30 years of membrane expertise and experience with direct feedback from our customers on the features and benefits that have the greatest impact on plant operation, to create and innovate the next ZeeWeed generation that:

- Reduces capital and installation costs associated with expanding capacity by achieving 50% more treatment capacity in the same product footprint. Added benefits to this include:
    - Less concrete and overall system footprint
    - Fewer cassette supports and tank covers to install
    - Shorter train headers and less pipe supports
    - Less cleaning chemicals
    - Shorter overhead crane span
    - Fewer cassette connections to install and maintain
- Reduces energy cost with improved LEAPmbr aeration, accounting for 20% energy savings from previous LEAPmbr aeration designs.
- Provides exceptional membrane reliability and longer product life.
- Simplifies product maintenance with 60% fewer parts to maintain and fewer handling features.

In addition to the above features, the ZeeWeed 500EV product provides enhanced flexibility for various flows with two different cassette sizes, making it an exceptional solution for the EMWWTF. For the MFS, Veolia will be utilizing the ZW500EV T-64M cassettes. Each cassette contains 64 modules, 535 ft^2 each, providing even greater treatment capacity in a smaller footprint. For the MTH, Veolia will be utilizing the ZW500EV R-56M cassettes. Each cassette contains 56 modules, 460 ft^2 each.

Features of both cassettes can be found in the datasheets provided in Appendix C of this proposal.

8.5. System Design and Calculations

8.5.1. Membrane Filtration System (MFS)

8.5.1.1. Design Basis

The influent design flows used for Veolia's proposed design of the Membrane Filtration System is based on the values summarized in the RFP Section 46 53 49 2.05B, as well as detailed in Section 13.1, Table 13-3 of this proposal.

The membrane filtration system influent characteristics used for this design are detailed in Section 13.1, Table 13-1 and 13-2 of this proposal. The membrane filtration system will be capable of meeting the effluent quality detailed in Section 13.1, Table 13-4 of this proposal.

8.5.1.2. Design Summary

Veolia has provided four (4) identical trains, each consisting of seven (7) cassette spaces able to treat the Phase 1 Flows. Major membrane and membrane tank characteristics are summarized in the table below.

Table 8-1: Membrane Filtration System Design for Phase 1

Design Parameter	Value	Units
Type of Cassette	ZW500EV T-64M	-
Type of Aeration	LEAPmbr	-
Total Number of Membrane Trains	4	-
Number of Cassettes Installed per Train	6	-
Number of Cassette Spaces per Train	7	-
Number of Fully Populated Cassettes per Train	5	-
Number of Modules per Full Cassette	64	-
Number of Flex Populated Cassettes per Train	1	-
Number of Modules per Flex Cassette	32	-
Number of Spare Cassette Spaces	1	-
Number of Modules Installed per Train	352	-
Number of Modules Installed per Plant	1,408	-
Module Surface Area	535	ft^2
Total Membrane Area per Train	188,320	ft^2
Total Membrane Area per Plant	753,280	ft^2
Spare Space	21.4	%

Phase 2 consists of adding additional three (3) more trains to the existing membrane system built in Phase 1. Each train will contain five (5) fully-populated cassettes and one (1) partially-filled cassette having 40 modules and one (1) empty space. In total, each membrane tank has 360 installed membrane modules, providing the system with 19.6% spare space.

Veolia has reviewed the drawing package and specifications included in the Contract Documents. Veolia's proposed solution maintains the overall intention of the AE2S preliminary design, but offers a number of enhancements based on decades of design and operational experience. The following section details these process adjustments that have been included in the Veolia-proposed solution.

1. **Dedicated RAS Pumps in lieu of a RAS Channel**

As referenced in:

- Attachment C Section 46 53 49, Item 2.02 A.2: RAS shall overflow to a common channel (RAS Channel). RAS pumps shall take suction from the common RAS Channel and discharge to the RAS Distribution Box.
- Attachment D.

Veolia's control method used in Membrane Filtration system designs involves level trim, which is used to determine the overall plant demand. Level trim prevents the tanks from overflowing or running the level too low. It is ultimately used in the overall plant demand calculation, which determines the number of trains required to permeate to meet the demand, the speed of the permeate and RAS pumps, and indirectly, the cycling of the membrane blowers and valves. Based on the level variations in the tank where the trim is applied, the permeate pumps will speed up or slow down to maintain a level setpoint within that tank. It is therefore important to get as much working volume between the minimum and maximum operating levels in the tank where proportional level trim is used.

As detailed in Attachment D, the membrane tanks sit at a lower hydraulic elevation than the bioreactor, requiring RAS to be pumped back to the bioreactor. When utilizing common RAS pumps with a RAS channel as shown in Attachment D, mixed liquor from each membrane tank will overflow into that channel, making it the lowest hydraulic level. In this scenario, Veolia's control strategy would require level trim to be calculated using the working volume in the RAS channel. If this channel is too small, the HRT is very short and will result in fast and abrupt level changes triggering erratic and unstable permeate pump control. To make this control more reliable, the channel working volume should be made as large as possible, with a minimum of 10 minutes HRT at the Average Daily Flow condition.

Most of Veolia's facilities utilize the preferred dedicated RAS pump design (one RAS pump per membrane train) as it offers a number of enhancements over a common RAS channel including:

- Removal of membrane tank effluent channel (RAS channel), which is often times very large resulting in high capital costs for concrete.
- Reduced use of influent gates, resulting in less gate wear.
- Removal of all effluent gates.
- Results in stable and reliable control of permeate pumps and RAS pumps, as well as membrane blowers since the number in operation is determined by how many trains are in operation.
- Requires only 4 RAS pumps (dedicated) with no standby.
- RAS pumps can be used to drain the membrane train as well as divert WAS flow.

As a result, Veolia strongly feels dedicated RAS pumps will provide an enhanced process design and solution for the Owner and is therefore provided in this proposal package.

2. **WAS Diverted from RAS Header in lieu of WAS Pumps**

As referenced in:

- Attachment C Section 46 53 49, Item 2.04 B.4.b.2): WAS pumps (variable speed) pulling suction from the common RAS channel and pumping to the membrane thickening tanks.
- Attachment D.

Veolia has proposed WAS being diverted from the common RAS header and individually piped into each MTH tank. The MTH tanks are located at the same elevation as the MFS, and are at a

hydraulic elevation lower than the common RAS header discharge to the Aerobic Basins, as detailed in the RFP. Due to this, the WAS should have preferential flow into the MTH tanks, and therefore would not require WAS pumps.

In order to receive the flow required to the MTH trains through the WAS pipe, Veolia has proposed adding a throttling diaphragm valve and flowmeter onto each dedicated WAS line.

8.5.1.3. Equipment Sizing Assumptions

In the preparation of this proposal, Veolia has carefully evaluated the RFP package and has selected and included various pieces of equipment, as detailed in Section 15 (Bid Form - Attachment D) of this proposal. As this project is still in development, Veolia has made a number of assumptions that could impact the selected equipment. These have been detailed below:

1. Process Pumps

Pump selection has been based on the following assumptions:

- Pump Center Line of 1.40 ft.
- Pumps are located at the bottom of the membrane tank at 4,858 ft elevation (per Attachment D). Membrane tanks have typical Minimum (110”) and Maximum (118”) water levels.
- Process pump will pump to the following locations:
    - Membrane Tank to Backpulse Tank: backpulse tank is located at the same floor elevation as the membrane tank (4,858 ft) and has Minimum (48”) and Maximum (96”) water levels.
        - The backpulse tank is assumed to have the inlet/outlet configured in such a way to prevent dead zones.
        - Backpulse tank inlet assumed to be submerged.
    - Membrane Tank to Type 1 Storage Reuse Ponds: Reuse Ponds are located at 4,856 ft elevation (per Attachment D).
        - Veolia has assumed 11.6 ft (5 psig) pressure drop for the downstream pressure UV.
    - Backpulse to Membrane Tanks: assumptions as stated above.
- Piping layouts and losses to be assumed. Total friction losses between 1-5 ft.
- The selected process pumps have an NPSHr of 16.5 ft.

2. RAS Pumps

Pump selection has been based on the following assumptions:

- Pump Center Line of 3.0 ft.
- Pumps are located at the bottom of the membrane tank at 4,858 ft elevation (per Attachment D). Membrane tanks have typical Minimum (110”) and Maximum (118”) water levels.
- RAS pump will pump to the following locations:
    - Membrane Tank to Aerobic Zone of Bioreactor (RAS): Bioreactor Aerobic zone is located at 4,868.39 (per Attachment D). Only this level was considered.

- Membrane Tank to Aerobic Zone of Bioreactor (Drain): Bioreactor Aerobic zone is located at 4,868.39 (per Attachment D). Only this level was considered. Minimum suction at a fully drained membrane tank was assumed to be located at 4,856.5 ft elevation (1.5 ft below the shallow end of the membrane tank).
- Membrane Tank to Membrane Thickener Tank (WAS): Membrane thickener tank is located at the same floor elevation as the membrane tank and operates at a water level of 108".

- Veolia has assumed that the design will provide sufficient backpressure for the proposed RAS pumps. Additional required TDH can be achieved with any of the following:
  - Reducing the 48" RAS Header size to increase pipe losses.
  - Creating a "Gooseneck" in the 48" RAS Header to increase the static head.
  - All above options (or others not listed) would be provided by Others, if required.
- Piping layouts and losses to be assumed. Total friction losses between 1-5 ft.

3. Membrane Blowers

Membrane Blower selection has been based on the following assumptions:

- Blower intake air piping unknown (indoors/outdoors).
- Ambient Air (as provided in the RFP): -17 to 43 Deg C.
- Atmospheric Relative Humidity: 60%

8.5.1.4. Calculations

8.5.1.4.1. Net Flux

The maximum net flow per membrane train is determined by accounting for permeate generated and adjusting for relaxation periods, backpulse cycles and any maintenance cleans. This flow dictates the total membrane surface area required per train. The ZeeWeed Membrane filtration system proposed has been designed using the net flux rates summarized in the table below. All the net fluxes at 10°C design temperature fall within the flux requirements as specified in the RFP, and are below Veolia's net flux design guidelines, adding additional conservatism to this plant's design. This conservative approach ensures trouble free operation and leads to extended membrane life.

The net flux for each flow condition is detailed below:

Table 8-2: Design Flux Table for Phase 1

Flow Condition	Flow Rate (US MGD)	Trains in Operation	Net Flux (gfd)	Flux Cap per Section 46 53 49 2.05G (gfd)
Minimum Day flow (Min DF)	4.2	3	7.4	10.6
Average Day Flow (ADF)	6.0	3	10.6	10.6
Maximum Monthly Flow (MMF)	7.2	3	12.7	12.7
Peak Day Flow (PDF)	10.2	3	18.0	18.0
Peak Hour Flow (PHF)	16.3	4	21.6	21.6

8.5.1.4.2. Membrane Sizing

The flux governing the required membrane surface area is MMF N-1, 12.7 gfd. At this flux the membrane sizing is calculated as follows:

$$Required\ Membrane\ Surface\ Area\ per\ Train\ =\ (\frac{7{,}200{,}000\ \frac{gallons}{d}}{12.7\ \frac{gallons}{\frac{ft^2}{d}}})/3\ =\ 188{,}976 ft^2$$

The ZW500EV TX12 module contains 535 ft^2 of membrane surface area, thus the required number of modules per train is:

$$Required\ ZW500EV\ TX12\ Modules\ per\ Train\ =\ \frac{188{,}976\ ft^2}{535\ \frac{ft^2}{module}}\ =\ 354\ modules$$

The largest ZW500EV cassette contains 64 modules. Therefore, the 354 ZW500EV modules required per train can be housed in 5 completely filled cassettes (64 modules x 5 cassettes = 320 modules) plus 1 partially filled cassettes with 32 modules. This configuration meets the minimum 20% spare space requirement, as defined as 100% minus the installed membrane capacity divided by the total membrane capacity in a full train.

$$Spare\ Space\ =\ 1\ -\ \frac{\left((5\ full\ cassettes)*\left(\frac{64\ modules}{full\ cassette}\right)+(1\ partially\ filled\ cassettes)*\left(\frac{32\ modules}{partially\ filled\ cassette}\right)\right)*(535\ \frac{ft^2}{module})}{(6\ cassette\ spaces)*\left(\frac{64\ modules}{cassette\ space}\right)*(535\ \frac{ft^2}{module})}$$

$$=\ 1\ -\ \frac{352\ \ modules\ (installed)}{448\ module\ spaces}\ *\ 100\%\ =\ 21.4\%\ Spare\ Space$$

8.5.1.4.3. Membrane Tank Sizing

The sizing of each membrane train is first and foremost dictated by the number of membrane cassettes that are required. Per the sizing calculations above, each train is sized to accommodate a total of seven (7) cassettes. Each ZW500EV TX12 cassette has fixed dimensions of 84.1” in length, 68.6” in width, and 107.7” in height.

Veolia’s ZW500EV TX12 membrane tank width is 9’ for a beamed design, and the tank length is calculated based on the number of cassettes in a row, with allowances for clearance distance from the wastewater deflector plate at the front end of the membrane tank and from the wall at the back end of the membrane tank. With six cassette spaces, the tank length is 592” (49.33’) to accommodate the cassettes, clearance between the cassettes, and 37” clearance to the front wall and 18” clearance to the back wall.

The Veolia membrane tank side-wall depth is 13’, with a maximum operating level of 118” and a minimum operating level of 110”. The operating setpoint is 114”. The total operating volume of each membrane tank at this operating level (excluding 2% slope and sump) is 31,552 gallons.

As requested in Attachment A, the volume calculation includes the tank 2% slope and sump. This contributes to approximately 1,840 gallons of additional volume. The sump design is outside of Veolia’s scope of supply however, for the purposes of Bid Form completion, Veolia has assumed a 3’ x 3’ x 3’ sump (sizing to be validated by Others).

8.5.1.4.4. Air Scouring Requirements

The Veolia system uses LEAPmbr coarse-bubble aeration to deliver scouring air to the membrane fibers. LEAP aerators are positioned in the spaces in between modules, and at the outside end of each row of modules. Under LEAP-Lo aeration, which is standard when the plant is operating at ADF, the total airflow required for each fully populated cassette is 105.6 cfm (1.65 cfm per module). Under LEAP-Hi aeration, which is enabled when the plant is operating at net

flux higher than the recommended MMF flux, the per-cassette aeration is doubled to 211.2 cfm (3.3 cfm per module) to ensure more effective scouring of extra solids away from the membrane surface. For the proposed MFS, the air scour blowers are sized to provide air for the initially installed condition of 5 full cassettes and 1 partially filled cassette per train, and for the possibility of filling the spare space such that there are 7 full cassettes per train. This ensures if membrane area is added in the future, the blowers are sized for that condition. Thus, the buildout condition dictates the maximum air scouring requirement as follows:

$$Total\ Delivered\ Scouring\ Air\ = (4\ trains) * \left(\frac{7\ full\ cassettes}{train}\right) * \left(\frac{211.2\ cfm}{full\ cassette}\right) = 5,913.6\ cfm$$

In order to convert the delivered airflow to standard conditions and an inlet flowrate to the membrane blowers, the design aerator discharge pressure and a temperature correction factor between the design operating temperature and standard conditions must be established. The aerator discharge pressure is calculated as the sum of site atmospheric pressure and water column static pressure. The EMWWTF site is located at roughly 4,850 FASL, atmospheric pressure is calculated as follows:

$$Site\ Atmospheric\ Pressure\ = 14.69\ - \left(\frac{FASL*0.4335}{1000}\right) = 14.69\ - \left(\frac{4850*0.4335}{1000}\right) = 12.59\ psi$$

The aerators are located 0.41' from the bottom of the membrane tank, and the membrane tank operating level setpoint is 9.5', therefore the static pressure is calculated as:

$$Static\ Pressure\ = \left(9.5^{'} - 0.41^{'}\right) = 9.09^{'}\ W.C. * \frac{12"}{1^{'}} * \left(\frac{0.0360912\ psi}{inch\ W.C.}\right) = 3.94\ psi$$

Aerator outlet pressure is (12.59 + 3.94) = 16.53 psi.

The design wastewater temperature was taken to be the following:

$$Temperature\ = (Max\ Temp\ -\ Min\ Temp) * TWF\ +\ Min\ Temp$$
$$Temperature\ = (24oC\ -\ 10oC) * 0.66\ +\ 10oC\ =\ 19.24oC\ (292.39\ K)$$

The design air temperature was taken to be the following:

$$Temperature\ = (Max\ Temp\ -\ Min\ Temp) * TWF\ +\ Min\ Temp$$
$$Temperature\ = (43\ -\ (-\ 17)) * 0.66\ +\ (-\ 17)\ =\ 22.6oC\ (295.75\ K)$$

The total inlet scouring air requirement is:

$$Total\ Inlet\ Scouring\ Air\ =\ Delivered\ Air\ Requirement\ * \left(\frac{Aerator\ Outlet\ Pressure}{Atmospheric\ Pressure}\right) * \left(\frac{Design\ Air\ Temp.}{Design\ Water\ Temp.}\right)$$
$$= 5,913.6\ cfm\ * \left(\frac{16.53\ psi}{12.59\ psi}\right) * \left(\frac{295.75\ K}{292.39\ K}\right) = 7,854\ icfm$$

The equivalent standard scouring air requirement per blower (3 duty + 1 standby) at the maximum conditions, provided by the membrane blower vendor after correction for pressure, humidity and temperature is 2,182 scfm.

8.5.1.4.5. Mixed Liquor Operating Ranges

Veolia designs the mixed liquor in the membrane tank to operate between 10-12 g/L, depending on the flow condition. It is important to remain below this threshold to reduce fouling and prolong the life of the membranes. The mixed liquor concentrations can vary depending on the flow condition, and duration. During normal flow events, the mixed liquor concentration within the membrane tanks should not exceed 10 g/L. During peak flow events, the mixed liquor in the membrane tanks can increase up to 12 g/L. The MLSS concentration and RAS rate for each flow condition has been detailed below.

The MLSS concentration entering Veolia's membrane tanks from the upstream biological treatment process is 8,000 mg/L, as indicated in the RFP. As shown in the figure below, at a RAS rate of 4*$Q_{INFLUENT}$, 8,000 mg/L of solids entering the membrane tank will concentrate by a factor of 1.25, reaching 10,000 mg/L. If the RAS rate is reduced to 2*$Q_{INFLUENT}$, the membrane tank MLSS will concentrate to 12,000 mg/L. Hence, a 4*$Q_{INFLUENT}$ RAS factor is applied during average day flow conditions at 8,000 mg/L, and a 2*$Q_{INFLUENT}$ RAS factor is applied during all peaking conditions of 24 hours or less in duration. (Lower RAS flows can be used when the bioreactor MLSS is lower.) This philosophy helps minimize the RAS pump size.

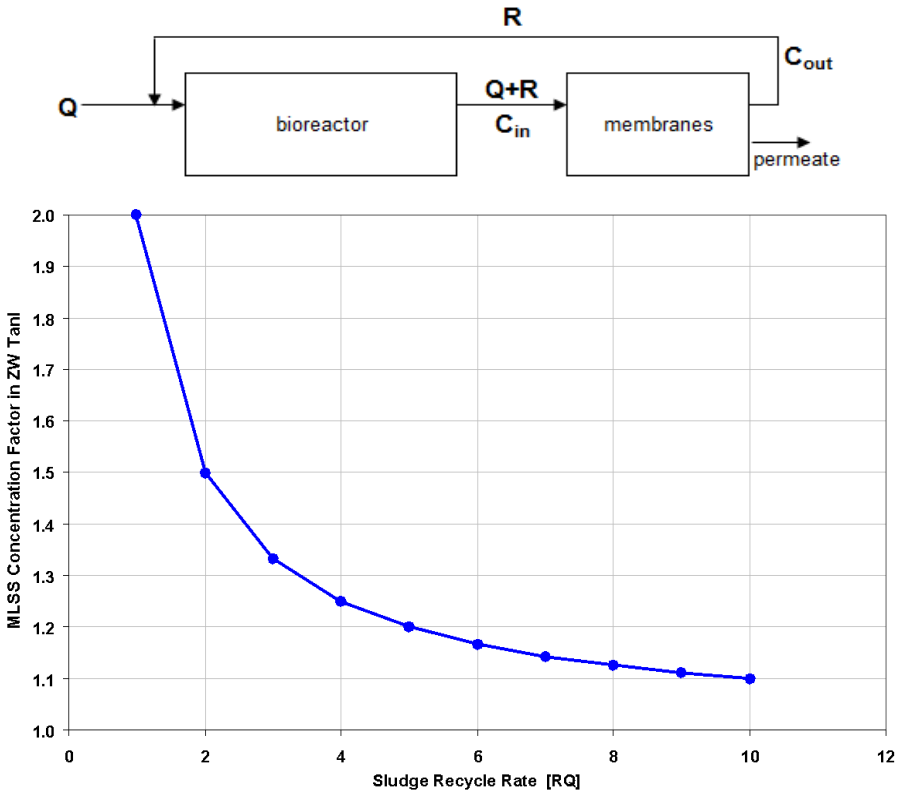


Figure 7-1: Impact of sludge recirculation rate on membrane tank MLSS

For the EMWWTF, Veolia has assumed an MLSS concentration of 8,000 mg/L entering the MFS, the table below summarizes the design RAS rates, and the resulting membrane tank MLSS concentrations.

Table 8-3: MLSS Concentrations for Phase 1

Flow Condition (MGD)	Min DF	ADF	MMF	PDF	PHF
	4.2	6.0	7.2	10.2	16.3
Trains in Operation	3	3	3	3	4
Duration	Longer than 30 Days	Longer than 30 Days	Less than 30 Days	Less than 24 hours	Less than 1 Hour
Bioreactor MLSS (mg/L)			8,000		
RAS Rate	4.0	4.0	4.0	2.8	2.0
MLSS Concentration in Membrane Tanks (mg/L)	10,000	10,000	10,000	10,833	12,000
Total RAS Flow (MGD)	16.8	24.0	28.8	28.8	32.6

8.5.2. Membrane Thickener System (MTH)

8.5.2.1. Design Basis

The influent design flows used for Veolia's proposed design of the Membrane Thickener System are based on the values summarized in the RFP Section 46 53 49 2.05D, Attachment D, as well as detailed in Section 13.2, Table 13-7 of this proposal. Please note, due to the discrepancy between Section 46 53 49 2.05D and Attachment D as it pertains to the Maximum MLSS Concentration (TWAS Solids), Veolia has designed the MTH to thicken up to 2% solids (20,000 mg/L), in alignment with Attachment D.

The membrane thickener system influent characteristics used for this design are detailed in Section 13.2, Table 13-5 and 13-6 of this proposal.

8.5.2.2. Design Summary

Veolia has provided two (2) identical trains, each consisting of two (2) cassette spaces, able to treat the influent WAS flow at ADF and MMF conditions. Major membrane and thickener tank characteristics are summarized in the table below.

Table 8-4: Membrane Thickener System Design

Design Parameter	Value	Units
Type of Cassette	ZW500EV R-56M	-
Type of Aeration	LEAPmbr	-
Total Number of Membrane Trains	2 at 50%	-
Number of Cassettes Installed per Train	2	-
Number of Cassette Spaces per Train	2	-
Number of Fully Populated Cassettes per Train	-	-
Number of Modules per Full Cassette	56	-
Number of Flex Populated Cassettes per Train	2	-
Number of Modules per Flex Cassette	36	-
Number of Spare Cassette Spaces	0	-
Number of Modules Installed per Train	72	-
Number of Modules Installed per Plant	144	-
Module Surface Area	460	ft^2
Total Membrane Area per Train	33,120	ft^2
Total Membrane Area per Plant	66,240	ft^2
Spare Space	35.7	%
Thickener Operation at MMF WAS ***Values representative of one (1) MTH train thickening 138,000 gpd (50% MMF WAS)***	**Value**	**Unit**
Average Flux - Instantaneous	4.96	gfd
Batch Length	3.0	Hours
Batch Time with Drain and Fill	4.0	Hours
Number of Batches per Day	5.20	Hours
Total Time Operating for all WAS to be Thickened per Day	20.75	Hours
TWAS Volume Produced per Train	48,500	Gallons

Veolia has reviewed the drawing package and specifications included in the Contract Documents. Veolia's proposed solution maintains the overall intention of the AE2S preliminary design, but offers a number of enhancements based on decades of design and operational experience. The following section details these process adjustments that have been included in the Veolia-proposed solution.

1. **MTH Tank Influent**

As referenced in:

- Attachment C Section 46 53 49
  - Item 1.06B: The MTH will thicken WAS wasted from the RAS system or MFS influent distribution box.
  - Item 2.02 A.3: Membrane thickening tanks will receive WAS as surface overflow from the MFS influent distribution box or the RAS channel or pumped from WAS pumps with suction from the RAS Channel.

As indicated in the MFS section, Veolia has proposed dedicated RAS pumps in lieu of a common RAS channel. In addition to simplification of the MFS system operation, this approach also provides simplification to the MTH system. Using a control valve, WAS would simply flow by gravity from the combined RAS pump discharge line to the thickener trains.

Foam/scum from the MFS will surface waste by gravity into the MTH Scum/Foam tank (instead of the MTH feed channel indicated in the RFP - not used in Veolia design). A duty submersible pump (provided and controlled by Others) within this tank will transfer the foam/scum to the MTH tanks. The foam/scum box width must be sufficient to accommodate a gate for the surface overflow. In addition, proper design involves the use of sprayers to move foam towards the gate. This can be further evaluated during detailed engineering.

2. **MTH Design Net Flux Rate**

As referenced in:

- Attachment C Section 46 53 49 2.05H: The design flux rate shall be selected to filter WAS produced during MMF conditions with one train out of service at the 10 oC.
- Attachment C Section 46 53 49 2.02G: Each membrane thickening tank shall receive a proportional percentage of the membrane system's average maximum monthly WAS production to thicken to the maximum % solids.

Veolia has designed the MTH with two (2) 50% trains at MMF WAS condition based on the last bullet above.

3. **Filtrate TSS and Performance Requirements**

Please refer to Section 13.2 for performance guarantees as it relates to the MTH. The performance will be proven out during the 14-day Performance test. As the MTH permeate (filtrate) will be returned to the bioreactors, Veolia has assumed the TSS filtrate limit for the thickener is not applicable.

8.5.2.3. Equipment Sizing Assumptions

In the preparation of this proposal, Veolia has carefully evaluated the RFP package and has selected and included various pieces of equipment, as detailed in Section 7.1.1 and P&IDs in

Section 7.6 of this proposal. As this project is still in development, Veolia has made a number of assumptions that could impact the selected equipment. These have been detailed below:

4. **Process Pumps:**

Pump selection has been based on the following assumptions:

- Pump Center Line of 1 ft.
- Pumps are located at the bottom of the membrane thickener tank at 4,858 ft elevation (per Attachment D). Membrane tanks operate at a water level of 108".
- Process pump will pump to the following locations:
    - Membrane Thickener Tank to Aerobic Zone of Bioreactor (RAS Header): Bioreactor Aerobic zone is located at 4,868.39 (per Attachment D). Only this level was considered.
- Piping layouts and losses to be assumed. Total friction losses between 1-2 ft.
- The selected process pumps have an NPSHr of 13.7 ft.

5. **Drain/Recirculation/TWAS Pumps:**

Pump selection has been based on the following assumptions:

- Pump Center Line of 1.15 ft.
- Pumps are located at the bottom of the membrane thickener tank at 4,858 ft elevation (per Attachment D). Membrane thickener tanks operate at a water level of 108".
- Drain/Recirculation/TWAS pump will pump to the following locations:
    - Membrane Thickener Tank Recirculation: Based on the membrane tank levels indicated above.
    - Membrane Thickener Tank to BNR Influent Channel (Drain): Assumed that MTH will drain back to the BNR Influent Channel located at 4,870.13 ft. (per Attachment D). Only this level was considered. Minimum suction at a fully drained membrane tank was assumed to be located at 4,857 ft elevation (1 ft below the shallow end of the membrane tank).
    - Membrane Tank to Solids Handling: The elevation of the solids handling facility has not been provided therefore, Veolia has assumed TDH and losses fit within the assumptions for this selected pump.
- Piping layouts and losses to be assumed. Total friction losses between 1-8 ft.
- The selected process pumps have an NPSHr of 11.1 ft.

6. **Membrane Blower**

Blower selection has been based on the following assumptions:

- Blower intake air piping unknown (indoors/outdoors).
- Ambient Air (as provided in the RFP): -17 to 43 Deg C.
- Atmospheric Relative Humidity: 60%

8.5.2.4. Calculations

8.5.2.4.1. Design Flux and Surface Area

Veolia's design philosophy for membrane thickeners is centered around a batch mode of operation. The duration of time available for the system to thicken the entire WAS volume is a key design parameter that will help to dictate the size of the MTH. For the EMWWTF, Veolia has assumed that the entire WAS volume will be thickened within a 24 hour period.

Unlike the MFS, which determines the net flux based on a specified flow condition and surface area in operation at that condition, the batch process design uses a set thickener production initial flux (at start of the batch) and final flux (at end of the batch). The batch will start thickening at this initial flux by permeating while feeding WAS at the same rate, maintaining a constant level within the tank. Throughout the batch time, solids in the membrane tank accumulate. The flux is designed to decrease linearly with increasing MLSS concentration in the MTH tank. The system will continue to feed WAS and permeate at the same time until the MLSS concentration within the MTH is 20,000 mg/L. This is referred to as a batch. Multiple batches will be completed to thicken the daily WAS volume.

The Start of Batch and End of Batch fluxes are set by Veolia process engineers based on best-practise design guidelines for membrane thickeners using the ZW500EV R56M cassettes. For this facility, the Start of Batch flux is 8 gfd, and the End of Batch flux is 2 gfd. These fluxes, in combination with the total desired time to thicken the entire WAS volume (per day), will determine the size and surface area requirements of the MTH.

As a result of this design philosophy, there is not one flux associated with the WAS volume at a specified flow condition as it is linearly decreasing throughout the entire batch. To fulfill the requirements of Bid Forms Attachment A, which specifies the net flux at various flow conditions, Veolia has provided the average flux over a batch of 5 gfd (at MMF WAS Volume) and 3.8 gfd (at ADF WAS Volume).

For the EMWWTF, 5.20 batches are required to thicken the entire volume of WAS within a 24 hour period, resulting in a membrane surface area of 33,120 ft^2 per train. Each batch is 3 hours in length. At some facilities, the time required to thicken the entire volume of WAS is constrained within a shorter time-frame, which would ultimately increase the size of the MTH tanks, and surface area requirement.

8.5.2.4.2. Membrane Thickener Tank Sizing

Each thickener train is sized to accommodate a total of two (2) cassettes. Each ZW500EV R56M cassette has fixed dimensions of 84.1" in length, 68.6" in width, and 100.8" in height.

Veolia's ZW500EV RX12 membrane tank width is 9', and the tank length is calculated based on the number of cassettes in a row, with allowances for clearance from the influent deflector plate at the front end of the membrane tank and from the wall at the back end of the membrane tank. With two cassette spaces, this results in a tank length of 186" (15.5'), accounting for the cassettes, clearance between the cassettes, and 21" clearance to the front wall and 18" clearance to the back wall.

The Veolia membrane tank side-wall depth is 13', with an operating level of 108". The total operating volume of each membrane tank at this operating level (excluding 2% slope and sump) is 9,400 gallons.

In Attachment A, the volume calculation includes the tank 2% slope and sump. This contributes to approximately 220 gallons of additional volume. The sump design is outside of Veolia's scope

of supply however, for the purposes of Bid Form completion, Veolia has assumed a 2' x 2' x 2' sump (sizing to be validated by Others).

8.5.2.4.3. Air Scouring Requirements

The MTH will operate using the same principles of LEAPmbr as described previously, with aeration being used to scour solids away from the membrane surface and minimize solids from settling. Due to the high solids environment, the scouring airflow required will be greater than that of the MFS. As the MTH has been designed to achieve a thickened WAS of 2%, the system will run using LEAP-Hi aeration. If additional scouring air is needed, the system can switch to LEAP-Hi-Hi, which will provide an additional 30% scouring airflow to membranes. In MTH systems, there is no provision for LEAP-Lo aeration. The total airflow required for each fully populated cassette at LEAP-Hi is 185.6 cfm (3.3 cfm per module). Under LEAP-Hi-Hi aeration, the per-cassette aeration is increased to 266.8 cfm (4.8 cfm per module). For the proposed MTH, the air scour blowers are sized to provide air for the installed condition of 2 partially filled cassettes per train, and for the possibility of filling the spare space such that there are 2 full cassettes per train. This ensures if membrane area is added in the future, the blowers are sized for that condition. Thus, the buildout condition dictates the maximum air scouring requirement as follows:

$$Total\ Delivered\ Scouring\ Air\ = (2\ trains) * \left(\frac{2\ full\ cassettes}{train}\right) * \left(\frac{266.8\ cfm}{full\ cassette}\right) = 1,067.2\ cfm$$

$$Site\ Atmospheric\ Pressure = 14.69 - \left(\frac{FASL*0.4335}{1000}\right) = 14.69 - \left(\frac{4850*0.4335}{1000}\right) = 12.59\ psi$$

The aerators are located 0.41' from the bottom of the membrane tank, and the membrane tank operating level setpoint is 9.33', therefore the static pressure is calculated as:

$$Static\ Pressure = \left(9.33^{'} - 0.41^{'}\right) = 8.92\ W.C. * \frac{12"}{1^{'}} * \left(\frac{0.0360912\ psi}{inch\ W.C.}\right) = 3.86\ psi$$

Aerator outlet pressure is (12.59 + 3.86) = 16.45 psi.

The design wastewater temperature was taken to be the following:

$$Temperature = (Max\ Temp\ -\ Min\ Temp) * TWF\ +\ Min\ Temp$$
$$Temperature = (24oC\ -\ 10oC) * 0.66\ +\ 10oC\ =\ 19.24oC\ (292.39\ K)$$

The design air temperature was taken to be the following:

$$Temperature = (Max\ Temp\ -\ Min\ Temp) * TWF\ +\ Min\ Temp$$
$$Temperature = (43\ -\ (-\ 17)) * 0.66\ +\ (-\ 17)\ =\ 22.6oC\ (295.75\ K)$$

The total inlet scouring air requirement is:

$$Total\ Inlet\ Scouring\ Air\ =\ Delivered\ Air\ Requirement * \left(\frac{Aerator\ Outlet\ Pressure}{Atmospheric\ Pressure}\right) * \left(\frac{Design\ Air\ Temp.}{Design\ Water\ Temp.}\right)$$

$$= 1,067.2\ cfm * \left(\frac{16.45\ psi}{12.59\ psi}\right) * \left(\frac{295.75\ K}{292.39\ K}\right) = 1,410\ icfm$$

The equivalent standard scouring air requirement per blower (2 duty + 1 standby) at the maximum conditions, provided by the membrane blower vendor after correction for pressure, humidity and temperature is 588.5 scfm.

9. Process Equipment

Veolia's ZeeWeed MBR systems are designed to utilize high-quality products whether through our own membrane modules made in house, or through our industry leading manufacturers of third-party equipment. The products used are designed around the tough environment of an MBR and are built to last.

Please refer to Bid form Attachment D for List of manufacturers and models along with Equipment data sheets attached in Appendix C.

10. Process Control System

10.1. Simplicity of Operations

Veolia's ZeeWeed MBR technology powers many of the world's largest membrane bioreactor installations due to its industry-leading simplicity and reliability. This operational simplicity results from continuous design advancement and refinement, featuring:

Streamlined Aeration System

- Simple aeration with no moving parts eliminates the need for air measurement or modulation
- Unlike competitors' complex control loops that continuously vary membrane air scour and require constant airflow monitoring, our system operates reliably without constant adjustment

Minimal Connection Points

- Fewest cassette connections in the industry – each cassette isolates with a single manual valve for both air and permeate connections
- Our design requires only 3 connections per train (significantly fewer than other vendors)
- Each train features automatic isolation valves on permeate and air headers that close automatically during low-flow standby conditions

Unmatched Reliability and Recovery

- True operational simplicity comes from day-to-day reliability and confidence in the market's most robust membrane system to recover from unexpected upsets and storm events. The most complex operational challenge is managing an MBR that cannot properly clean or shed solids during water quality fluctuations.

Superior Membrane Design

- Reinforced, flexible fiber combined with high-efficiency LEAP aeration creates the most sludge-resistant membrane system available
- Flexible fibers allow solids to escape, unlike rigid plate membranes
- Reinforced braided construction withstands aggressive aeration, unlike fragile monofilament fibers
- Hollow fiber design enables even distribution of cleaning chemicals across the entire membrane surface
- Ultra-permeable ZeeWeed fiber maintains cleanability and permeability for decades

Proven Recovery Capability

- Operational challenges are inevitable – from accidental screen bypasses to unplanned FOG events. Only Veolia's flexible, reinforced fiber provides multiple recovery options, as testified by our experienced operators worldwide.
  - *"The system works great – really runs itself. The usual maintenance is just keeping-the-lights-on stuff. One time we accidentally sent thousands of pounds of FOG from a sewer cleanout directly to the membranes. I would have expected*

them to be ruined, but they were strong enough that we could remove the FOG and put them back into service."
- **Keith Luecken, Lake Havasu**

- *"It is a REALLY forgiving plant – everyone loves it for that reason."*
  - **Dave Quimby, City of Surprise**
- *"The product has been robust and easy to operate, and the people and support have been just as good. I've been very happy with the performance of the MBR and the support we receive. I can definitely recommend the ZeeWeed MBR."*

  - **John Houlton, City of Abilene, Operations Leader**

10.2. System Automation and Operation Overview

The dedicated electrical and process controls engineer for this project will be responsible for the hardware and software design of the control system. Utilizing a proven design philosophy that capitalizes on the knowledge of technology experts, Veolia provides a system network architecture and integrated component design that is uniquely robust and reliably enables full automation of the plant.

Major system components responsible for controlling the system are as follows:

- Programmable Logic Controller (referred to as a PLC) provides automated control of the UF equipment. All programming for the control of the UF plant is stored in the PLC.
- Human Machine Interface (referred to as an HMI) allows human interface with the PLC for system control and data acquisition. The HMI will display the State, which is a series of steps the train follows to perform various operations (such as cleaning).
- Field devices gather information and transmit it to the PLC. When signaled by the PLC, these devices will respond.

All modes of operation are controlled automatically by the PLC, which monitors incoming flow to the plant and trims/adjusts based on increasing or decreasing level of the lowest hydraulic point.

MFS and MTH Train Operating Modes

Operating modes define how the transitions occur for a train from one operating state to another. Modes can only be selected by the operator, using pushbuttons on the HMI. The Semi-Auto mode button is available in all states. The Off-mode button is available in all states except the Off state. The Auto mode button is available in all states except Recovery Clean & Neutralization. The sequencing of each Train can be described by the mode and state of the Train. Each Train is in only one state and mode at any given time.

a) Auto Mode

- This is the normal mode of operation for a MFS Train to produce clean water
- This is the normal mode of operation for a MTH Train for production of thickened sludge

For the train equipment to operate automatically, the operator needs to have all related devices set to Auto and the train set to Auto. The operation of the train is automatic when in Auto, and there is minimal operator attention required unless an alarm is activated.

b) Off Mode

This mode immediately places the trains (MFS or MTH) to Off state and prevents the operator from manually selecting other states until the Train is placed in another mode. The operator may turn a train Off at any time. Pressing the Off button places the train into Off mode and state. It is

the responsibility of the operator to ensure that if the Off button is pressed when a train is in a clean, the tank's contents are suitable for a train to proceed to another mode. When the Off button is selected in a Recovery Clean, then the Neutralization state may be required. When the Off button is selected in a Maintenance Clean, then Backpulse state may be required to remove the cleaning chemical from the permeate header.

c) Semi-Auto Mode

This mode safely places the trains (MFS or MTH) to Off state but permits the operator to manually select other states such as a Prime, Backpulse, Maintenance Clean, and Recovery Clean/Neutralization. Upon completion, the train will return to the Off state and wait for further operator selection.

MFS and/or MTH Train States

States are a series of steps the train follows to perform various operations. The states available to each train are:

- MFS: Off, Prime, Standby, Production, Relax, Backpulse, Maintenance Clean, Recovery Clean and Neutralization.
- MTH: Off, Prime, Standby, Production, Backpulse, Waste, Maintenance Clean, Recovery Clean and Neutralization.

a) Prime

Priming refers to readying the membranes for production after the train (or system) has been in standby or offline. Any air that has accumulated inside the filtration piping must be extracted to ensure proper pump performance.

Each train is provided with an ejector, which uses compressed air to operate. The ejector primes the permeate piping in Prime and at the beginning of Backpulse, Relax (MFS only), Maintenance Clean, and Recovery Clean. The train's ejector compressed air valve opens which also opens the permeate header isolation valve. During this time, air in the permeate header is pulled up and out through the ejector, which pulls water into the membranes and permeate pump suction. Any water that is drawn into the ejector drains out of it by gravity.

The Prime state is used to remove air from the suction of the permeate pump. A train proceeds to Prime after the Auto button is pressed in the Off state. The ejector operates for typically 60 seconds, a longer duration than what is used for intermittent operation, and the duration is adjustable at the HMI. The operator can manually initiate Prime by pressing the Prime button at the HMI. The Prime button is available in Semi Auto mode and Off state.

b) Standby

When there is a reduced flow demand, some trains can be placed into standby mode where permeate, recirculation, and membrane aeration are stopped. When a train is in Standby, it is not required to treat flow but is capable of being brought online quickly.

The steps for the MFS Standby are:

1. Fill the membrane tank to a level above the membranes
2. While a train is in Standby intermittently, the ejector runs based on the Master Ejector Cycle timer. The membranes are aerated, and RAS is recirculated based on the frequency and duration aeration timers. The train remains in this step until one is active:
    a. A start trigger
    b. Train rotation trigger

c. Maintenance clean request with schedule

The steps for the MTH Standby are:

1. Fill membrane tank with WAS influent
2. While a train is in Standby intermittently, the ejector runs based on the Master Ejector Cycle timer. The membranes are aerated, and RAS is recirculated based on the frequency and duration aeration timers. The train remains in this step until one is active:

    a. A start trigger

    b. Maintenance clean request with schedule

MFS and MTH Trains are intermittently primed in Standby. The frequency of the priming is controlled by the Master Ejector Cycle timer. The Master Ejector Cycle timer operates when there is at least one train in Standby. There is a time assigned for each train when the ejector operates. The duration of the priming is controlled by an adjustable setpoint, typically 15 seconds. The duration of the Master Ejector Cycle timer is typically 8 minutes.

c) Production

In Production, the MFS and MTH trains are producing permeate by extracting water from the mixed liquor using dedicated process pumps. These pumps produce a vacuum on the membrane fibers to draw clean water from the mixed liquor across the outside of the membrane fiber surfaces and into the fiber lumen. The permeate collected from each MFS train is discharged into the train dedicated headers to the common permeate collector pipe, which is discharged into the concrete backpulse storage tank. The permeate collected from each MTH train is discharged into the RAS header.

Table 10-1: Filtration (Permeation)

Function	MFS Status	MTH Status
Permeation	YES	YES
Aeration	YES	YES
Sludge Recirculation	YES (MFS to Aerobic Zone)	YES (MTH Back-End to MTH Front-End) [1]
Sludge Wasting	YES	NO
Permeate Addition (backpulse)	NO	NO
Chemical Addition	NO	NO

Note 1: MTH production will be slightly staggered between trains 1 and 2 since some operating sequences can't take place at the same time. As a result, MTH recirculation on one train) will be temporarily paused while a tank drain occurs on the other.

MFS Production:

The permeate pump starts and runs until the production cycle timer triggers one of the following: Backpulse, Relax. Maintenance Clean can be triggered by the schedule.

The Production Cycle is the alternation of the train's states between Production and either Backpulse or Relax. The Production Cycle is controlled by a timer, with a typical duration of 12 minutes. The selection of either Backpulse or Relax for the Production Cycle does not affect the duration of this timer.

The Master Production Cycle timer starts when there are no trains in Production and one train is requested to start Production. The timer restarts every time it times out. There is a button to select either Backpulse or Relax for the Production Cycle. In Semi Auto, there is another button to manually initiate Backpulse from Off state.

With the Demand Override button not selected, the UF trains switch between Standby and the Production Cycle based on Start & Stop Train Triggers and train rotation triggers. The Start triggers' values are based on the Plant Permeate Flow Demand and are adjustable at the HMI.

When the supervisory flow setpoint is enabled, the process pump's flow setpoint is an operator entered value. When the auto flow setpoint is enabled, the process pump's flow setpoint is a calculated value.

MTH Production:

The Production Cycle is the alternation of the train's states between Production and Backpulse. The Production Cycle is controlled by a timer, with a typical duration of 10 minutes. In Auto, when a start trigger is active, the thickener proceeds from Standby to Production until the sludge is thickened to the required concentration. At this time, the thickener proceeds to Waste state to empty the thickened sludge.

The Operators have the ability to adjust and control the MTH system from the HMI including:

- Enable/disable wasting per day
- Start time for first batch of the day
- Number of batches per day
- Final concentration of batch per day
- Time between batches

d) Relax (Applicable only to MFS)

During relaxation (the mode of operation typically used), permeation stops, and the membranes are aerated to remove any accumulation of solids. Chemicals are not used during the relaxation cycle. The system automatically relaxes after the permeation cycle. After relaxation is complete, if there is a demand for the train to run, the train proceeds to permeation. If there is no demand for the train to run the train proceeds to standby. Under normal operating conditions, the system is operated on a 10 to 15-minute permeation cycle, followed by a 30-60 second relax mode with no flow through the system.

Table 10-2: Relaxation

Function	MFS Status	MTH Status
Permeation	NO	Relaxation is not available for MTH Systems
Aeration	YES	
Sludge Recirculation	YES	
Sludge Wasting	YES	
Permeate Addition	NO	
Chemical Addition	NO	

The steps for the Relax are:

1. Stop the process pump. When the backpulse duration timer times out, the train proceeds to the next step, typically 30 seconds.
2. After the Relax is complete, and if there is demand for the train to run, the train proceeds to Production. After the Relax is complete and if there is no demand for the train to run the train proceeds to Standby, typically 6 seconds.

Backpulse

Backpulse refers to a short period of time where the flow is reversed through the membranes. In a MFS, it is a tool that can be selected by operators in lieu of the normal energy-saving Relaxation mode. Backpulsing can remove cake layers which are sticky in nature and ensures

full utilization of the available membrane surface area. The backpulse flow is delivered to both the top and bottom of the module, which ensures flow across the length of the fiber and results in a more effective clean than backpulsing from one end.

Table 10-3: Backpulse

Function	MFS Status	MTH Status
Permeation	NO	NO
Aeration	YES	YES
Sludge Recirculation	YES	YES
Sludge Wasting	YES	NO
Permeate Addition (backpulse)	YES	YES
Chemical Addition	NO	NO

During Backpulse, treated water is periodically reversed back through the membranes to maintain stable transmembrane pressures.

MFS and MTH Backpulse:

The trains' Backpulse (or Relax) start trigger is based on time slots in this production cycle timer. The steps for Backpulse are:

1. Stop the process pump, typically 6 seconds.
2. Align the valves, typically 6 seconds.
3. Start the process pump and run it for the backpulse duration time, typically 30 seconds. The water is drawn from the backpulse permeate collector (or tank) and pumped through the membranes into the membrane tank.
4. Stop the process pump, typically 6 seconds. After Backpulse is complete and if there is demand for the train to run or the Demand Override button is enabled the train proceeds to Production. After Backpulse is complete and if there is no demand for the train to run the train proceeds to Standby.

The PLC controls the pump speed to backpulse the trains at a set flow rate per train up to a maximum TMP, using a pressure transmitter. This TMP limit provides membrane protection against over-pressurization and allows the PLC to vary the pump speed to maximize flow while avoiding excessive TMP across the membranes. All MFS and MTH trains in the plant share the same backpulse duration, production cycle duration, TMP setpoint and flow setpoint. In Semi Auto, the operator can initiate a Backpulse from the HMI for any train by pressing the Backpulse button. This button is disabled if any other train is in Backpulse.

e) Waste (Applicable to MTH Only)

The MTH cycles between Backpulse and Production until the measured TSS concentration is at the design wasting setpoint of 20,000 mg/L. At this point, the batch is considered complete and the thickener will proceed to Waste.

As previously mentioned, the thickener trains will have staggered operation. If one train is entering a Waste, the recirculation on the other train will be temporarily paused during that 30 minute Waste duration. After the Waste is complete, recirculation will resume.

The operator can manually initiate Waste in Semi-Auto mode and Off state with a button on the HMI. If manually initiated, the thickener proceeds to Waste without waiting for the membrane tank TSS trigger to be active.

The typical steps of Waste are:

a) Stop the process pump, typically 6 seconds

b) Align valves, typically 6 seconds.

c) Start Drain / Recirculation / TWAS pump and drain the MTH to the sludge storage tanks. The pumps run until a low-level trigger becomes active in the membrane tank.

d) Stop the Drain / Recirculation / TWAS pump, typically 6 seconds. If in Auto, the Thickener will proceed to the next step without operator confirmation. If in Manual, the Operator will “Confirm Tank Drain” prior to proceeding to the next step.

e) If a Maintenance Clean request is active, (a scheduled request), then the thickener proceeds to a Maintenance Clean, otherwise, the thickener proceeds to Standby. In Semi-Auto, the thickener proceeds to Off state.

f) Maintenance Clean

The membranes require cleaning to maintain peak performance. There are two types of cleaning methods. Maintenance Cleans, and Recovery Cleans.

Maintenance Clean is scheduled through the HMI and is automatically initiated by the PLC based on a 24-hour clock. The operator selectable options include:

- Day of week for cleaning
- Time of day for cleaning
- Sodium hypochlorite for cleaning solution
- Citric acid for cleaning solution

MFS Maintenance Cleans:

When it is time to carry out a Maintenance Clean, the PLC compares the current plant permeate flow demand with the available capacity of the plant if one train is not in service. If the plant permeate flow demand exceeds this capacity, then scheduled Maintenance Clean is skipped but the request remains active and is started when this demand is lower. When a Maintenance Clean is skipped or stopped, an alarm occurs to inform the operator.

If the plant's permeate flow demand does not exceed this capacity, when it is time to carry out a Maintenance Clean, the train completes its current production cycle before starting the cleaning procedure. If a train is in Standby, it goes directly to Maintenance Clean.

MTH Maintenance Cleans:

When it is time to carry out a Maintenance Clean and the thickener is in the Production Cycle, the thickener completes the Waste state before proceeding to the clean. If the thickener is in Standby, it goes directly to the Maintenance Clean.

The default steps for Maintenance Clean:

1. Stop permeation to the train and continue to aerate, typically 5 minutes to 10 minutes.
2. Stop the membrane aeration and recirculation to/from the membrane train. Align the valves for backpulse with cleaning chemicals.
3. The process pump pulses all cassettes with the selected cleaning solution (sodium hypochlorite or citric acid), typically for 2 minutes. The PLC stops the process pump and chemical pump. Relaxation period for all cassettes, typically for 4.5 minutes. Align the valves for backpulse with the cleaning chemical.
4. The process pump and the chemical pump pulses the cassettes with the cleaning solution, typically for 30 seconds. The PLC stops the process pump and the chemical pump. Relaxation period for the cassettes, typically for 4.5 minutes. This step is repeated for several iterations, typically 8 iterations. Align the valves for backpulse.

5. The process pump pulses the cassettes with permeate to remove the cleaning solution from the permeate header, typically for 2 minutes.
6. The membrane blower aerates the membranes, typically for 5 minutes.
7. The MFS or MTH train proceeds to Standby state in Auto mode and to Off state in Semi-Auto mode.

g) Recovery Cleans

Recovery Cleans can only be carried out for a train if it is in Semi-Auto. During a Recovery Clean there are several prompts which the operator must address. As a result, it is suggested to have the operator present during the Recovery Clean so that these prompts can be responded to in a timely manner.

Recovery Cleans can be done with citric acid or sodium hypochlorite depending on which cleaning chemical the operator selects.

1. Stop permeation to the train and continue membrane aeration and recirculation flow, typically 5 minutes to 1 hour.
2. Valve alignment, typically for 6 seconds with the membrane tank inlet gate closed. Shut off the aeration and mixed liquor recirculation.
3. Drain the membrane tank. Transfer mixed liquor back to the bioreactor.
4. Fill the membrane tank with permeate from storage. Backpulse the membranes with permeate. If the level in the backpulse tank is low, Relax the cassettes until there is sufficient water in the backpulse tank.
5. Aerate the membrane tank for a defined duration, typically for 5 minutes to 1 hour.
6. Wash down and drain the membrane tank. Stop the drain pump demand. Repeat steps 4-6 until there is clean water in the tank.
7. Backpulse the membranes with a cleaning solution.
8. Add permeate to the tank by backpulsing the membranes to completely submerge the membrane fibers to 100% of the cleaning level.
9. Final, extended relaxation period with intermittent aeration, typically six hours.
10. The operator selects the Neutralization button to proceed to the Neutralization state.

h) Neutralization

The Neutralization button is available in Semi Auto mode and Off state and in all steps of Recovery Clean The neutralization is initiated by the operator after the extended chemical soak step of the Recovery Clean. The default steps for Neutralization are:

1. Fill the membrane tank to defined level with feed. Aerate the membrane tank, typically for 1 minute.
2. Relaxation period for all cassettes for a defined duration typically 900 seconds and then proceed to the next step.
3. Backpulse the membranes to flush the permeate header.
4. The operator checks the chlorine concentration and the pH. If the free chlorine and pH are within permitted limits, then press the Confirm Neutralization button and proceed to Off state. Otherwise press the Resume Neutralization button and proceed to the next step.
5. Add mixed liquor for a defined duration typically 1 minute, and then repeat step 4.

10.3. Air Scour Operation

LEAPmbr aeration is Veolia's technology advancement which incorporates a dramatically simplified, more efficient aeration system that offers significant savings in operational costs. LEAPmbr aeration has been the basis of our aeration systems for the past 15 years. All of our installations sold in this time period utilize this type of aeration.The operating LEAPmbr aeration rate depends on the depth of the tank and operating water level, temperature, humidity and actual operating conditions.

LEAPmbr aeration is a specially designed, highly efficient aeration system used to scour the outside surface of the membranes and move mixed liquor solids away from the membrane fibers. Veolia's patented LEAPmbr aeration system uses factory installed LEAP aerators which are integrated into the base of each ZeeWeed 500EV cassette. Each LEAPmbr aeration device releases large air bubbles which create higher scouring forces along the surface of the membrane fiber, therefore having more effective solids removal capability than smaller bubbles. The reinforced core of the membranes provides the strength to withstand the scouring force without damaging the membrane.

The principle of operation for LEAP MBR aerations is simple as shown in the figure below.

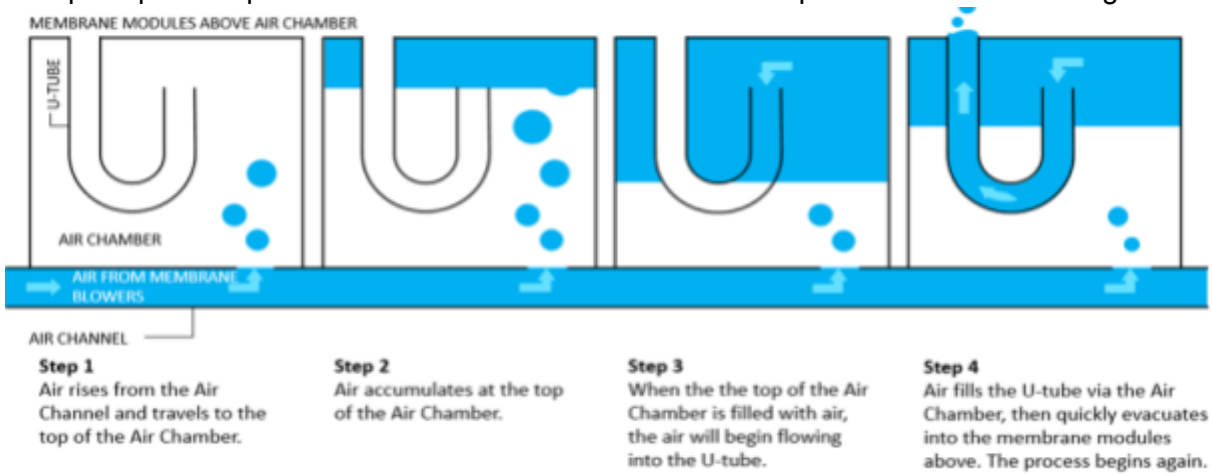


Figure 10-1: LEAPmbr Principle of Operation

Since the large mushroom-cap bubbles generated are so effective compared to the smaller spherical cap bubbles used in sequential (cyclic) aeration, a significantly lower volume of air is required to achieve the same amount of solids removal, as shown below.

10.4. Chemical Cleaning Operations

Veolia's membrane system will use two types of clean-in-place (CIP) operations. The cleaning chemicals used for ZeeWeed Membranes remain to be Sodium Hypochlorite for the removal of organic foulants and Citric Acid for the removal of inorganic contaminants. All cleaning will remain in-situ; membranes do not need to be removed from the tank.

Maintenance Cleaning

The goal of regularly scheduled maintenance cleaning is to maintain sustainable operating TMP and therefore increase the interval between recovery cleanings. The maintenance clean is performed with a low chemical concentration over a short duration, without any need to drain mixed liquor from the membrane tanks. The maintenance cleaning procedure is entirely automated and typically scheduled to occur during off-peak hours of the day. The operator can set it to be performed when they prefer. The system is designed to be able to perform either

chemical (sodium hypochlorite or citric acid). The frequency and duration of this procedure can be optimized in response to operating conditions and sludge characteristics.

When performing the maintenance cleaning procedure, the feed to the membrane tank is stopped and the train is aerated for five minutes. Over a series of pulse and relax cycles, the chemical solution is backpulsed through the membranes for ~45 mins total. There is a final backpulse for 2 minutes with permeate only to flush the headers and membranes, followed by 5 minutes of aeration. When the maintenance cleaning procedure is completed, the isolation valves are opened, and the train is brought back into service.

Recovery Cleaning

Recovery cleans are performed at higher concentrations of chemicals with longer soak durations to restore the permeability of the membrane. The cassettes are cleaned in-situ, one train at a time so that the remaining trains can meet plant capacity requirements. The train to be cleaned is isolated from the rest of the system, permeation from that train is suspended, but aeration is continued for a short period to remove solids away from the membrane surface. The mixed liquor in the membrane tank represents a small portion of the total mixed liquor volume and is transferred to the front of the treatment plant (bioreactor).

The clean is operator initiated. The membrane tank is drained (MLSS is sent back to the bioreactor), filled with permeate and drained again to wash residual solids from the tank. Cleaning chemicals are pumped into the membrane tank through the membranes, and permeate is used to top up the membrane tank to fully submerge the fibers. The membranes are then soaked in the cleaning solution for a period of 6-12 hours. After the soak period, the tank contents are neutralized by the mixed liquor and aerated briefly for mixing before the train is brought back into service.

10.5. Valve Actuation Methodology

Veolia is supplying pneumatic actuated valves for the Eagle Mountain Membrane filtration system. All automated valves use pneumatic actuators powered by a centralized instrument air system (80-100 PSI, clean, dry air) which includes dryers, filters, and regulators for quality control. Actuators are sized appropriately, featuring fail-safe spring-return or double-acting mechanisms as required. Control is managed through solenoid valves integrated with the plant's SCADA/PLC system for automated operation and real-time feedback. Key benefits of using pneumatic actuation include intrinsic safety in wet environments, high force output, faster response time than electric, reliable fail-safe operation during power or air loss, and simple maintenance.

10.6. I/O Point List for MFS and MTH Control

This section details the required Input/Output (I/O) points. This includes inputs necessary for the control of the membrane system components and outputs for controlling other Wastewater Treatment Facility (WWTF) processes.please read this in conjugation with P&IDs provided in section 7.6 and single line diagram in section 7.5

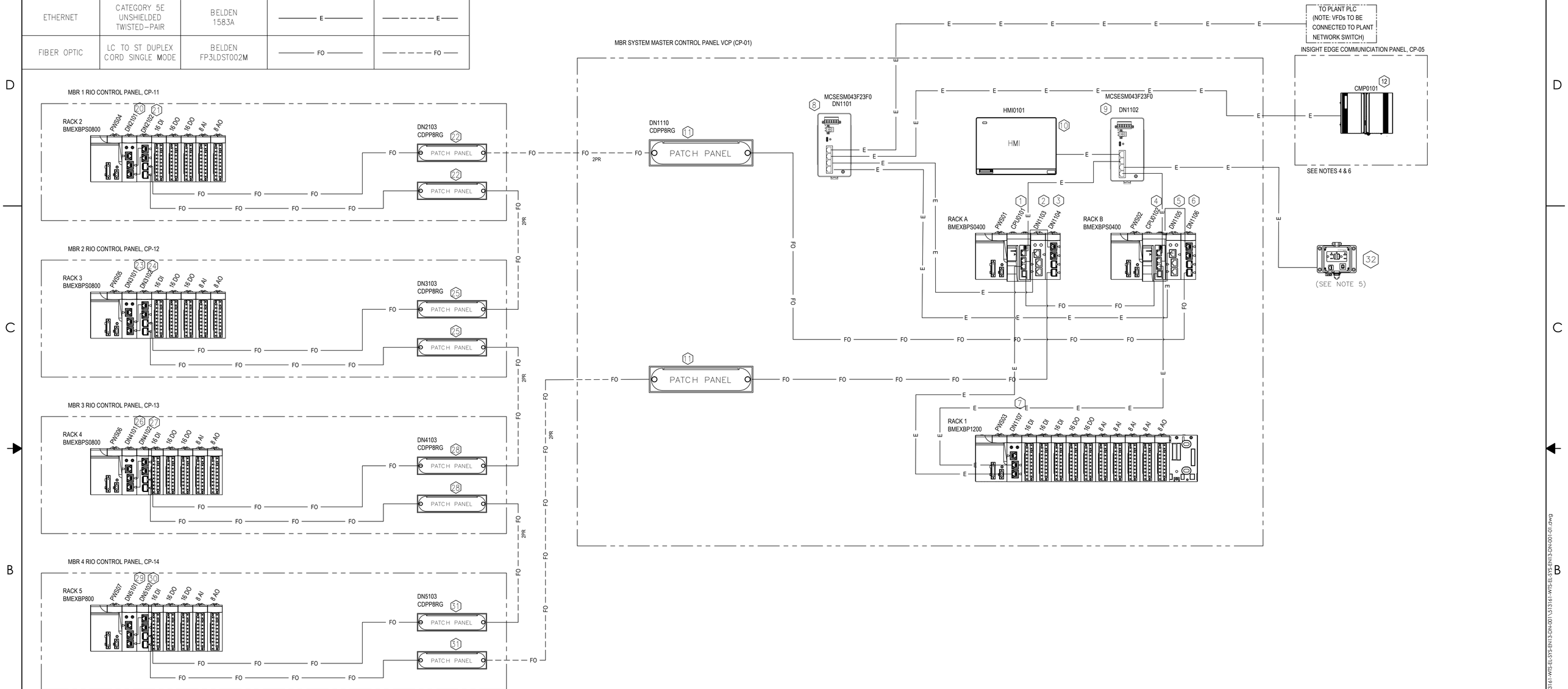
Table 10-5 : I/O Point List for MFS and MTH Control

Point Type	Count
Discrete Input Points	130
Discrete Output Points	104
Analog Input Points	28
Analog Output Points	5

10.7. Network Architecture

The network architecture drawing can be found on the following page.

COMMUNICATION	CABLE TYPE	RECOMMENDED MANUFACTURER PART #	LEGEND	
			BY VEOLIA WTS	BY CONTRACTOR
ETHERNET	CATEGORY 5E UNSHIELDED TWISTED-PAIR	BELDEN 1583A	E	E
FIBER OPTIC	LC TO ST DUPLEX CORD SINGLE MODE	BELDEN FP3LDST002M	FO	FO



NOTES

1. DASHED LINES DENOTES WIRING BY OTHERS/GENERAL CONTRACTOR.
2. NETWORK COMMUNICATION CABLES SHOULD BE INSTALLED IN SEPARATE CONDUIT FROM POWER, CONTROL AND INSTRUMENTATION CIRCUITS.
3. VEOLIA DEFAULT NETWORK PARAMETERS WILL BE USED UNLESS OTHERWISE SPECIFIED BY THE CONTRACTOR / SYSTEM INTEGRATOR.
4. VEOLIA EXPECTS THE CUSTOMER'S PLANT TO HAVE A HIGH-SPEED INTERNET CONNECTION WITH A SECURED VPN ACCESS WHICH VEOLIA PERSONNEL CAN USE FOR INSIGHT REMOTE DATA ACQUISITION AND 24/7 TECHNICAL SUPPORT. THE CUSTOMER IT TEAM OR THEIR DELEGATES WILL PROVIDE VEOLIA WITH AN IP SCHEMA FOR ETHERNET DEVICES. THIS SCHEMA WILL INCLUDE AN IP ADDRESS RANGE, SUBNET MASK, DEFAULT GATEWAY AND DNS FOR DEVICES THAT WILL NEED TO ACCESS THE INTERNET OR BE ACCESSIBLE OVER THE VPN.

   IF THE CUSTOMER CANNOT PROVIDE HIGH SPEED INTERNET & A VPN ACCESS TO VEOLIA, WE MAY FACILITATE INSIGHT AND TECHNICAL SUPPORT BY ENABLING THE CELLULAR FUNCTION INSIDE THE INSIGHT COMMUNICATION PANEL OR BY PROVIDING A SEPARATE CELLULAR VPN GATEWAY FOR THIS PURPOSE.
5. PROGRAMMING PORT MOUNTED ON ENCLOSURE DOOR WITH IP ADDRESS RESERVED FOR VEOLIA PROGRAMMER. IF THE IP ADDRESSES ARE ASSIGNED BY SYSTEM INTEGRATOR, SYSTEM INTEGRATOR TO RESERVE ONE IP ADDRESS FOR PROGRAMMING LAPTOP.
6. INSIGHT EDGEBOX:
   INSIGHT COMMUNICATION PANEL IS TO BE MOUNTED AT SITE BY THE GENERAL CONTRACTOR, PREFERABLY PRIOR TO VEOLIA COMMISSIONING FSR'S ARRIVAL. THE INSIGHT COMMUNICATION PANEL SHOULD BE MOUNTED WITHIN 100M OF THE MAIN CONTROL PANEL. IT IS UNDER THE GENERAL CONTRACTOR'S SCOPE OF WORK TO PROVIDE POWER AND RUN THE ETHERNET COMMUNICATION CABLE FROM THE MAIN CONTROL PANEL TO THE INSIGHT COMMUNICATION PANEL.
7.
8.
9.

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
A	INITIAL RELEASE	-				

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TOLERANCES UNLESS NOTED
DECIMALS ANGLES
.X - -
.XX - FRAC
.XXX - -

VEOLIA

CUSTOMER INFORMATION

EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

NETWORK ARCHITECTURE DIAGRAM

DRAWING NUMBER				REVISION
639082-WTS-EL-SYS-EN13-DN-001				A
REF.: -	DOC. OWNER: -			
PROJECT NO.	PART/MATERIAL NO.	SCALE	SIZE	SHEET
639082	-	NONE	D	01 OF 02

FILE LOCATION: C:_ADSKVault\NAM\513161 - NORSD WRRF EXPANSION\4. Electrical Drawings\513161-WTS-EL-SYS-EN13-DN-001\513161-WTS-EL-SYS-EN13-DN-001-01.dwg

COMMUNICATION	CABLE TYPE	RECOMMENDED MANUFACTURER PART #	LEGEND	
			BY VEOLIA WTS	BY CONTRACTOR
ETHERNET	CATEGORY 5E UNSHIELDED TWISTED-PAIR	BELDEN 1583A	——— E ———	— — — — E —
FIBER OPTIC	LC TO ST DUPLEX CORD SINGLE MODE	BELDEN FP3LDST002M	——— FO ———	— — — — FO —

I/O CARD INFORMATION	
MODULE	DESCRIPTION
IO-DI	BMXDDI1602, 16-CH, DIGITAL INPUT
IO-DO	BMXDDO1602, 16-CH, DIGITAL OUTPUT
IO-AI	BMXAMI0800, 8-CH, ANALOG INPUT
IO-AO	BMXAMO0802, 8-CH, ANALOG OUTPUT
IO-COMM	BMECRA31210, ETHERNET DROP ADAPTOR

ETHERNET CABLE SCHEDULE

PANEL	FROM COMPONENT	PORT	PANEL	TO COMPONENT	PORT
CP-01	DN1101	1	CP-01	HMI0101	
CP-01	DN1101	2	CP-01	CPU0101	
CP-01	DN1101	3	CP-05	CMP0101	
CP-01	CPU0101	2	CP-01	CPU0102	2
CP-01	DN1102	1	CP-01	DN1107	1
CP-01	DN1107	2	CP-01	CPU0102	
CP-11	DN2102	1	CP-11	DN2101	1
CP-11	DN2101	2	CP-11	DN2102	2
CP-12	DN3102	1	CP-12	DN3101	1
CP-12	DN3101	2	CP-12	DN3102	2
CP-13	DN4102	1	CP-13	DN4101	1
CP-13	DN4101	2	CP-13	DN4102	2
CP-14	DN5102	1	CP-14	DN5101	1
CP-14	DN5101	2	CP-14	DN5102	2
CP-01	DN1101	4		CLIENT CONTROL SCOPE	

FO CABLE SCHEDULE

PANEL	FROM COMPONENT	PORT	PANEL	TO COMPONENT	PORT
CP-01	DN1101	5	CP-01	DN1110	
CP-01	DN1110		CP-11	DN2103	1
CP-11	DN2103	2	CP-11	DN2102	
CP-11	DN2102		CP-11	DN2103	
CP-11	DN2103		CP-12	DN3103	
CP-12	DN3103		CP-12	DN3102	1
CP-12	DN3102	2	CP-12	DN3103	
CP-12	DN3103		CP-13	DN4103	
CP-13	DN4103		CP-13	DN4102	1
CP-13	DN4102	2	CP-13	DN4103	
CP-13	DN4103		CP-14	DN5103	
CP-14	DN5103		CP-14	DN5102	1
CP-14	DN5102	2	CP-14	DN5103	
CP-14	DN5103		CP-01	DN1110	
CP-01	DN1110		CP-01	DN1102	

NETWORK: ETHERNET - IO

BAUD RATE: 10/100 Mbps
SUBNET MASK: 255.255.255.0
GATEWAY: 0.0.0.0
(SEE NOTE 3)

REF.	IP ADDRESS	COMPONENT ID	DLR PRECEDENCE	DESCRIPTION
1	192.168.176.10	CPU0101	N/A	BMEH582040, M580 CPU, RACK A, CP-01
4	192.168.176.13	CPU0102	N/A	BMEH582040, M580 CPU, RACK B, CP-01
7	192.168.176.15	DN1107	N/A	BMECRA31210, X80 PERFORMANCE ETHERNET DROP ADAPTER, RACK-1, CP-01
8	N/A	DN1101	N/A	MCSESM043F23F0, MODICON MANAGED SWITCH 4TX, CP-01
9	N/A	DN1102	N/A	MCSESM043F23F0, MODICON MANAGED SWITCH 4TX, CP-01
11	N/A	DN1110	N/A	CDPP8RG, PANDUIT PATCH PANEL COPPER, 8-PORT, CP-01
20	192.168.176.16	DN2101	N/A	BMECRA31210, X80 PERFORMANCE ETHERNET DROP ADAPTER, RACK-2, CP-11
21	192.168.176.17	DN2102	N/A	BMXNRP0200, FIBER CONVERTER MODULE;MODICON X80, CP-11
22	N/A	DN2103	N/A	CDPP8RG, PANDUIT PATCH PANEL COPPER, 8-PORT, CP-11
23	192.168.176.18	DN3101	N/A	BMECRA31210, X80 PERFORMANCE ETHERNET DROP ADAPTER, RACK-3, CP-12
24	192.168.176.19	DN3102	N/A	BMXNRP0200, FIBER CONVERTER MODULE;MODICON X80, CP-12
25	N/A	DN3103	N/A	CDPP8RG, PANDUIT PATCH PANEL COPPER, 8-PORT, CP-12
26	192.168.176.20	DN4101	N/A	BMECRA31210, X80 PERFORMANCE ETHERNET DROP ADAPTER, RACK-4, CP-13
27	192.168.176.21	DN4102	N/A	BMXNRP0200, FIBER CONVERTER MODULE;MODICON X80, CP-13
28	N/A	DN4103	N/A	CDPP8RG, PANDUIT PATCH PANEL COPPER, 8-PORT, CP-13
29	192.168.176.22	DN5101	N/A	BMECRA31210, X80 PERFORMANCE ETHERNET DROP ADAPTER, RACK-5, CP-14
30	192.168.176.23	DN5102	N/A	BMXNRP0200, FIBER CONVERTER MODULE;MODICON X80, CP-14
31	N/A	DN5103	N/A	CDPP8RG, PANDUIT PATCH PANEL COPPER, 8-PORT, CP-14
32	(NOTE 5)	RECP	N/A	PROGRAMMING PORT, RJ45+ 120VAC, CP-01

NETWORK: ETHERNET - HMI AND PLANT NETWORK

BAUD RATE: 10/100 Mbps
SUBNET MASK: 255.255.255.0
GATEWAY: (SEE NOTE 4)
(SEE NOTE 3)

REF.	IP ADDRESS	COMPONENT ID	DESCRIPTION
1	192.168.176.10	CPU0101	BMEH582040, M580 CPU, RACK A, CP-01
2	192.168.176.12	DN1103	BMENOC0301, M580 I/O SCANNER MODULE, RACK A, CP-01
3	N/A	DN1104	BMXNRP0200 X80 Fiber Module, RACK-A, CP-01
4	192.168.176.13	CPU0102	BMEH582040, M580 CPU, RACK B, CP-01
5	192.168.176.14	DN1105	BMENOC0301, M580 I/O SCANNER MODULE, RACK B, CP-01
6	N/A	DN1106	BMXNRP0200 X80 Fiber Module, RACK-B, CP-01
7	192.168.176.15	DN1107	BMECRA31210, X80 PERFORMANCE ETHERNET DROP ADAPTER, RACK-1, CP-01
8	N/A	DN1101	MCSESM043F23F0, MODICON MANAGED SWITCH 4TX, CP-01
9	N/A	DN1102	MCSESM043F23F0, MODICON MANAGED SWITCH 4TX, CP-01
10	192.168.176.30	HMI0101	HMIDT752, HARMONY GTU- 15W TOUCH SMART DISPLAY FWXGA, CP-01
12	N/A	CMP0101	INSIGHT EDGE COMMUNICATION PANEL, CP-05

NOTES

1. DASHED LINES DENOTES WIRING BY OTHERS/GENERAL CONTRACTOR.
2. NETWORK COMMUNICATION CABLES SHOULD BE INSTALLED IN SEPARATE CONDUIT FROM POWER, CONTROL AND INSTRUMENTATION CIRCUITS.
3. VEOLIA DEFAULT NETWORK PARAMETERS WILL BE USED UNLESS OTHERWISE SPECIFIED BY THE CONTRACTOR / SYSTEM INTEGRATOR.

REV	DESCRIPTION	ECO	DWN	APPR	APPR	DATE
A	INITIAL RELEASE	-				

PROPRIETARY AND CONFIDENTIAL: THIS DRAWING AND ALL INFORMATION AND KNOWLEDGE CONTAINED OR REFERRED HEREIN ARE THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF VEOLIA AND AS SUCH ARE INSTRUMENTS OF SERVICE FOR USE SOLELY WITH RESPECT TO THIS PROJECT. THESE INSTRUMENTS OF SERVICE SHALL NOT BE REPRODUCED, TRANSMITTED, DISCLOSED OR USED OTHERWISE IN WHOLE OR IN PART, WITHOUT PRIOR WRITTEN AGREEMENT BY VEOLIA AND MUST BE IMMEDIATELY RETURNED OR DESTROYED UPON REQUEST.

TOLERANCES UNLESS NOTED
DECIMALS ANGLES
.X - -
.XX - FRAC
.XXX - -

VEOLIA

CUSTOMER INFORMATION
EAGLE MOUNTAIN CITY (EMC)
MEMBRANE FILTRATION SYSTEM
EAGLE MOUNTAIN CITY, UTAH

NETWORK ARCHITECTURE DIAGRAM

DRAWING NUMBER: 639082 -WTS-EL-SYS-EN13-DN-001
REVISION: A
REF.: -
DOC. OWNER: -
PROJECT NO.: 639082
PART/MATERIAL NO.: -
SCALE: NONE
SIZE: D
SHEET: 02 OF 02

FILE LOCATION: C:_ADSKVault\NAM\513161 - NORSD WRRF EXPANSION\4. Electrical Drawings\513161-WTS-EL-SYS-EN13-DN-001\513161-WTS-EL-SYS-EN13-DN-001-02.dwg

11. Annual Operation and Maintenance Cost

11.1. Bid form B

Please refer to Bid form, Attachment B provided separately with Cost forms

Please note the following:

- Power Consumption Estimates: The data presented in Attachment B is for information purposes only and is based on the design information provided in the RFP and presuming that the equipment is operated according to the design basis and in accordance with the seller's operations and maintenance manuals.
    - The MFS power consumption estimate has been provided at the Average Daily Flow (6.0 MGD) with three (3) MFS trains in service.
    - The MTH power consumption estimate has been provided at the Maximum Month Flow WAS (276,000 gpd) with two (2) MTH trains in service.
- Chemical Consumption Estimates: Cleaning chemical consumption estimates are based on the frequencies and concentrations summarized in Attachment B. Frequencies are typical for ZeeWeed MBR operation; actual frequency of maintenance and recovery cleans may change with final design or may change once system is in operation.

11.2. Recommended Operations Procedures and Schedules

The Operations and Maintenance procedures utilize Veolia's extensive experience with full-scale proven designs. These thoroughly tested procedures are standard across all of Veolia's full-scale Membrane Bioreactor (MBR) facilities, thereby minimizing risk for Eagle Mountain City. The only component recommended for replacement is the membrane modules.

11.2.1. Membrane Module Replacement Price – Prorated Replacement

Membrane Module Replacement Price is provided in Bid form-Attachement B (Membrane system operations), Table 10.

The base Membrane Module Replacement Price (MMRP) used to calculate the prorated amount to be paid by the Buyer to replace defective membrane modules under warranty shall be the list price (MMRP) at the time of replacement order. Membrane module prorated replacement price does not include bagging, boxing, crating, taxes and will be shipped on the basis of INCOTERMS 2020 FCA Veolia Manufacturing facility.

For membrane modules supplied under valid warranty claims, the prorated share that the Buyer will pay is calculated as follows:

$$\text{Prorated Share of Price} = \frac{\text{Number of Whole Months Elapsed Between the Membrane Modules Claim Date and the Warranty Start Date}}{\text{Total Warranty Duration in Months}} \times \text{MMRP}$$

11.2.2. Maintenance Procedures and Schedules for ZeeWeed Membranes

1. Cleaning Procedures

Please refer to section 10.2 for cleaning procedures.

2. General Cassette Inspection

The ZeeWeed membranes and cassettes are designed for longevity and require minimal maintenance. Regular inspections should be carried out on membrane cassettes, using the same cassettes during each inspection. These cassettes are known as “indicator cassettes,” and act as a sample for the entire train, eliminating the need to inspect every installed cassette individually. Veolia suggests one indicator cassette per train. This could be one of the first or last cassettes in each tank. Cassette removal and reinstallation is typically a 15 to 45 minute procedure. After the first year of operation, frequency of inspections can be adjusted based on the past findings and recorded trends in system operation, these trends and findings can be captured using our InSight Monitoring system.

For scheduling purposes, it is often recommended to time the inspection during one of the annual recovery cleans. Module and cassette inspection steps include:

3. Checking Aeration Pattern

Before the cassette is removed from the membrane tank for inspection, a visual examination of the aeration pattern is performed. This is typically done with the water level within the membrane tank set to 7.5 – 10cm above the top of the cassette. While the cassette is being aerated, a rectangular bubble pattern should be visible on the surface of the water directly above it. Any inconsistencies, including insufficient or imbalanced air distribution, are noted. Irregularities are an indication that the aeration system of the membrane cassette may need further inspection and maintenance.

4. After Removing the Cassette

It is recommended that the following information is recorded after the indicator cassette(s) have been removed from the membrane tank:

- **SHELLS:** Closely examine the cassette and membranes for signs of aquatic life, particularly in the form of shells, which can be as small as 1 mm in length.
- **CASSETTE FRAME & HARDWARE:** Check the cassette frame welds for signs of leaking or corrosion. Check all connections for loose or missing fasteners.
- **SOLIDS ACCUMULATION PATTERNS:** Take full-length photographs of all four sides of the cassette. Note any solid accumulation on the Inspection Template. Contact Veolia if excessive solids accumulation or debris (example: twigs, leaves) are found.

Additional details on membrane cassette removal can be found in the Sample IOM manual provided in Appendix D

Maintenance Procedures and Schedules for Major Equipment

The following table is a comprehensive list outlining the recommended inspection and maintenance tasks for mechanical equipment that are to be performed regularly in order to maintain optimal performance of your plant, and to ensure your system will attain the desired longevity.

With membrane related equipment being provided as per the specification, operator maintenance associated with this equipment should be similar between membrane vendors. The list provided below provides an approximate estimate of the labor requirements only.

Table 11-1: Time Matrix Associated with Major Equipment

D	W	M	Q	S	A	Task
Manhours						**Analytical Testing**
0.5						Maintain operating logs and take action in response to trends in log data.
						General Operations
0.5						Review the results of analytical tests and make process adjustments.
						All Motors
			3			Where possible, remove the fan cover and clean off dust from the fan and airway. Use low-pressure compressed air and/or dry cloth.
		3				Monitor temperature, discharge pressure, and vibration. Check for unusual noise, vibration, and bearing temperature.
	0.25					Check the level and condition of oil through sight glass on the bearing frame.
			0.5			Check / add bearing lubricating grease.
						All Pumps
	0.5					Monitor seal integrity. Visually inspect the pump and piping for leaks.
			2			Check the seal chamber/stuffing box for leakage.
			2			Oil should be changed at least every 3 months or more often if there are any adverse atmospheric conditions or conditions which might contaminate or break down the oil. If it is cloudy or contaminated, as seen by inspection through the sight glass, it should be replaced.
					1	Check pump capacity, pressure, and power.
						All Blowers
	1					Clean or replace the inlet air filter.
			2			Check condition and tension of V belt and replace if necessary
					3	Oil should be changed at least annually or more often if there are any adverse atmospheric conditions or conditions which might contaminate or break down the oil. If it is cloudy or contaminated, as seen by inspection through the sight glass, it should be replaced.
					1	Check blower capacity, pressure, and power.
						Automatic Valves (including solenoid valves)
			3			Drain, clean, and service airline filters.

					4	Inspect mechanical activators, for signs of wear and replace as necessary.
						Hand Valves
			2			Exercise valves, open and close.
						Air Compressor
	0.25					Check tank drain, legs, and moisture traps.
	0.25					Overall visual inspection.
		0.25				Check for unusual noise or vibration.
	0.25					Manually operate the pressure relief valve.
		1				Clean the cooling surfaces of the intercooler and the compressor.
	0.25					Check for air leaks.
	0.5					Clean or replace the air filter.
			2			Check condition and tension of V belt and replace if necessary.
					2	Inspect the pressure switch diaphragm and contacts (every 5,000 operating hours or yearly whichever comes first).
					1	Check compressor capacity, pressure, and power.
					1	Replace element filter on Air Dryer
365	169	51	66	0	13	Sum of estimated man hours
664						**Total estimated man hours per year**

11.3. Summary Tabulation of Electrical Loads

Electrical loads and power consumption data are detailed in Bid Form Attachment B – Membrane System Operations.

- Table 21: Annual Air Scour Blower Power Consumption
- Table 22: Annual Permeate Pump Power Consumption
- Table 23: RAS Pump Power Consumption
- Table 24: Filtrate Pump Power Consumption
- Table 25: TWAS Pump Power Consumption

Detailed blower and pump performance curves are provided for reference in Appendix B.

12. Capital Cost and Net Present Value

12.1. Capital Cost Bid Form

The Capital Cost forms, as detailed in Addendum 2, have been provided separately.

12.2. Bid Form - Attachment C

Please refer to Bid form, Attachment C provided separately with Cost forms

12.3. Concrete Cost Evaluation

General arrangement drawings for the membrane tank, including all dimensions required for concrete evaluation, are provided by Veolia. Membrane tank GA drawings can be found in Section 7.4. Further tank dimensions and Veolia's design specifications are located in Section 8.

13. Warranty

13.1. Membrane Filtration System (MFS) Warranty

The Seller offers a comprehensive three-part warranty for the Eagle Mountain Wastewater Treatment Facility (EMWWTF), ***Membrane Filtration System (MFS)*** as follows:

- **MFS Mechanical Warranty:** The Seller will repair or replace any device or part thereof that was supplied by the Seller that proves to be defective. This warranty excludes the membrane modules.
- **MFS Module Warranty:** This warranty provides protection and assurances to the Buyer/Owner with respect to the membrane modules. In addition to the warranty limitations as defined in this document, please refer to the "ZeeWeed Membrane Module Prorated Extended Warranty" in Section 13.1.6.
- **MFS Performance Warranty:** This warranty provides protection and assurances to the Buyer/Owner with respect to the ability of the Seller's system to meet the established performance criteria.

Unless otherwise noted, all warranties start upon substantial completion or six (6) months from equipment shipment, whichever occurs first. Substantial completion is defined as when the Buyer/Owner makes beneficial use of the equipment supplied by the Seller, or as successful completion of the MFS Performance Test as described in Section 13.1.5 of this proposal, whichever occurs first.

13.1.1. MFS Warranty Provisions

All warranties are subject to the following provisions:

General

- The MFS is operated and maintained at all times in accordance with the Seller's Installation, Operations, & Maintenance Manual;
- The Seller has, until performance of its obligation herein is met, reasonable access to the equipment and the operational data relating thereto;
- The Buyer/Owner furnishes adequate and competent operating, supervisory and maintenance staff, and necessary laboratory facilities with test equipment and personnel;
- The Buyer/Owner utilizes the services of the Seller until its performance obligations are met;
- The Buyer/Owner supplies all necessary raw materials and services of a quantity and of a quality specified by the Seller;
- An adequate and continuous power supply is available that will enable operation of all required equipment; and
- Any construction debris is flushed and removed from membrane tanks prior to membrane installation.

Screening

- Screening is required upstream of the MFS. The opening size for the screens in any dimension must be 2 mm or less. There should be no possibility of bypass of any particle larger than 2 mm in any dimension. The Seller must be consulted regarding the type, capacity, and size opening of the screens that are to be installed.

- Pre-screening must use mesh, punched hole or disc filter type screens. Wedge wire screens are not acceptable, nor is any unscreened bypass (even temporary).
- All tanks, clarifiers, settlers, channels, etc. following the screens are to be protected from the outside elements such that no leaves, twigs or any foreign materials can enter the MFS train.

Process Parameters and Water Quality

- The use of any chemicals added to the wastewater treatment process (e.g.: polymers, flocculants, coagulants, antifoams) that may come in contact with the ZeeWeed membranes must be approved by the Seller prior to use. This includes, but is not limited to, chemicals used in processes outside of the Seller's MFS that may be transferred to the Seller's MFS, such as in solids handling facilities.
- The MFS is guaranteed to perform its contractual obligations under the feed quality parameters outlined in Table 13-1 and operating parameters outlined in Table 13-2. Any value above or below the ranges stated may impact the system performance.
- All water quality parameters shall be measured using EPA approved methods with a sufficient resolution, specific to influent, operating, and target effluent concentrations, to accurately and consistently report measured results.
- Chemicals that are not compatible with the ZeeWeed PVDF membrane are not permitted in contact with the membrane fibers (Seller's chemical compatibility summary available upon request).
- Fats, oil, and grease (FOG) concentration shall not exceed 150 mg/L of emulsified FOG in the membrane tank influent with no free oil and less than 10 mg/L of mineral or non-biodegradable oil.
- Any compound not listed in Table 13-1 and for which analytical data has not been supplied in the Request for Proposals is assumed to be in such a concentration that it does not require removal by the treatment process, does not affect membrane performance, and will not need to be targeted by chemical cleanings to restore performance (e.g. surfactant).
- The MFS operation is warranted under the original membrane system design (Phase 1 only) as described in Section 8.5.1.2 of the proposal. Any changes such as, but not limited to, the design or operation of the MFS, the configuration of the upstream or downstream unit operations, equipment sizing, chemical types and dosing rates must be reviewed and assessed by the Seller to determine their feasibility and potential impact on the system performance and warranty.

Table 13-1: Membrane Tank Mixed Liquor Influent Quality

Parameter	Units	Design Value	Operating Range		
Temperature	°C	10 [1]	10	-	24
pH	SU	7.0	6.5	-	7.5
Soluble $cBOD_5$	mg/L	5	BDL	-	5
NH_3-N	mg/L	0.5	BDL	-	1.0
Colloidal TOC (cTOC) [2]	mg/L	7	BDL	-	10
Soluble alkalinity as $CaCO_3$	mg/L	100	50	-	150
Time to filter (TTF) [3]	seconds	100	5	-	200
Material greater than 2 mm in size [4]	mg/L	0	0	-	1

Note 1: As specified in Section 46 53 49, 2.05C., of the Request for Proposals. All other parameters listed in each row are assumed values.

Note 2: Colloidal TOC (cTOC) is the difference between the TOC measured in the filtrate passing through a 1.5 µm filter paper and the TOC measured in the ZeeWeed membrane permeate.

Note 3: Per the standard Time to Filter procedure, measured in seconds per 50 mL sample, using a 0.45 micron filter paper. Procedure available upon request.

Note 4: Per the standard Sieve Test procedure (available upon request).

Table 13-2: MFS Tank Operating Parameters

Parameter	Units	Design Value	Operating Range
MLSS concentration in MFS tanks [1]	mg/L	10,000	8,000 [2] - 12,000

Note 1: MFS tank MLSS concentration of up to 12,000 mg/L is permissible during MDF events, PHF events, and N-1 events lasting up to 24 hours only. MFS tank MLSS concentration to be 10,000 mg/L or less during all other flow conditions, when measured at the RAS outlet location.

Note 2: Lower MLSS concentrations may be appropriate. Consultation with Seller is required as mixed liquor is used for membrane chemical cleaning neutralization sequences..

13.1.2. MFS Mechanical Warranty

The mechanical warranty period on all equipment supplied, unless as noted in the following paragraph, is twenty-four (24) months from the date of substantial completion or thirty (30) months from equipment shipment, whichever occurs first.

The mechanical warranty period on MFS Blowers (20-B-201A/B/C/D) supplied, is sixty (60) months from the date of substantial completion or sixty-six (66) months from equipment shipment, whichever occurs first.

The mechanical warranty is only applicable to equipment supplied by the Seller. The Seller's sole obligation and the Buyer's exclusive remedy arising out of or relating to the equipment or services or any breach under this warranty is to repair or replace, at its factory or appropriate location determined by Seller, any device or part thereof, which shall prove to have been thus defective. Warranty repair, replacement or re-performance by Seller shall not extend or renew the applicable warranty period.

The Seller assumes no liability for any damage to equipment caused by inadequate storage or handling per manufacturer's recommendations in supplied technical literature, or by defective or sub-standard workmanship or materials provided by the Buyer/Owner or any other third party responsible for handling, storing or installing the equipment. The Seller also assumes no liability for the outcomes of improper commissioning, operation or maintenance of the Equipment by Buyer or third parties, repairs or alterations made by Buyer without the Seller's written consent, influent water which does not comply with agreed parameters, erosion or corrosion, or fair wear and tear.

The Buyer/Owner undertakes to give immediate notice to the Seller if goods or performance appear defective and to provide the Seller with reasonable opportunity to make inspections and tests. If the Seller is not at fault, the Buyer/Owner shall pay the Seller the costs and expenses of the inspections and tests.

Goods shall not be returned to the Seller without the Seller's permission. The Seller will provide Buyer/Owner with a "return goods authorization" (RGA) number to use for returned goods. All returns are F.C.A. – Oakville, Ontario, Canada. All costs associated with the removal and shipment of the defective part from the Buyer/Owner's facility to the Seller's factory and all costs related to return shipment to the Buyer/Owner's facility and installation of a repaired or replacement part shall be the Buyer/Owner's responsibility.

Implied warranties, including but not limited to warranties of fitness for particular purpose, use or application, and all other obligations or liabilities on the part of the Seller, unless such warranties, obligations or liabilities are expressly agreed to in writing by the Seller, are null and void.

13.1.3. MFS Module Warranty

A two-hundred-forty (240) month prorated warranty is offered on the MFS modules with the first one-hundred-forty-four (144) months offered as a full replacement warranty and the remaining ninety-six (96) months as a prorated warranty. Refer to "**ZeeWeed Membrane Module Prorated Warranty"** in Section 13.1.6 for a detailed description of the membrane warranty offered.

13.1.4. MFS Performance Warranty

A Performance Warranty for the MFS is offered to provide protection and assurances to the Buyer/Owner with respect to the ability of the Seller's MFS to meet the established performance criteria. Based on the influent wastewater and/or mixed liquor characteristics and MFS operating parameters specified in this document, the equipment offered herein will be capable of meeting the performance defined below. If any changes are made to the MFS without the Seller's written consent that would affect the Seller's ability to meet this Performance Warranty, then all obligations to the Buyer/Owner under this Performance Warranty shall be deemed discharged. The MFS performance will be demonstrated during a Performance Test (refer to the "Performance Test" section of this document for details on the Performance Test procedure).

The MFS Performance Warranty shall begin on the same date as the Performance Test and is applicable for a period of twenty-four (24) months. The MFS Performance Warranty includes the parameters listed within Section 13.1.4.1 and 13.1.4.2 of this document.

13.1.4.1. Capacity Guarantee

The Seller warrants, subject to the provisions set forth above, that after stable operation of the Seller's system has been attained and operators have acquired reasonable skills, the MFS modules supplied for this project will be capable of producing the results set forth in Table 13-3.

Table 13-3: Guaranteed MFS Performance at Design Temperature - Capacity

Parameter	Units	Guaranteed Values
MinMF [1]	mgd	≤ 4.2
ADF, with all trains in service [1]	mgd	≤ 6.0
MMF, with all trains in service [1]	mgd	≤ 7.2
PDF, with all trains in service [1]	mgd	≤ 10.2
PHF, with all trains in service [1]	gpm	≤ 11,319
Flow with one membrane train out of service (N-1) for longer than 1 month	mgd	≤ 6.0
Flow with one membrane train out of service (N-1) for less than 1 month	mgd	7.2
Flow with one membrane train out of service (N-1) for less than 24 hours	mgd	10.2

Note 1: The flow conditions are defined as follows:

Minimum Month Flow (MinMF) – The minimum daily flow occurring during the 30-day period with the lowest flow based on plant annual flow data.

Average Day Flow (ADF) – The average flow occurring over a 24-hour period based on plant annual flow data.

Maximum Month Flow (MMF) – The average daily flow occurring over a 30-day period with the highest flow based on plant annual flow data.

Peak Day Flow (PDF) – The maximum flow that occurs over a 24-hour period based on plant annual flow data.

Peak Hour Flow (PHF) – The maximum flow rate sustained over a 1-hour period based on plant annual flow data.

13.1.4.2. Permeate Quality Guarantee

The seller warrants, subject to the provisions set forth above, that after stable operation of the MFS has been attained and operators have acquired reasonable skills, the MFS modules supplied for this project will be capable of producing the results set forth in Table 13-4.

Table 13-4: Guaranteed MFS Performance at Design Temperature - Permeate Quality

Parameter [1]	Units	Guaranteed Values
TSS [2]	mg/L	≤ 5
Turbidity [3]	NTU	≤ 0.2 (95% of the time) ≤ 0.5 (100% of the time)

Note 1: All guarantees are contingent upon proper maintenance, calibration, operation and service of instruments and other related equipment and membranes as per Seller's and original equipment manufacturers instructions.

Note 2: The TSS guarantee is conditional on the use of a high-resolution and very-low detection-limit TSS method. The method should demonstrate a consistent and repeatable detection on water with a TSS known to be less than the TSS value guaranteed in the table above. Samples must be taken immediately downstream of the MFS membranes and tested within 24 hours to reduce the potential of biogrowth and/or TDS precipitation. If turbidity is low (less than the guaranteed turbidity values above), and TSS is greater than the guaranteed TSS value, it can be assumed that biogrowth, TDS precipitation, and/or testing errors have occurred, and turbidity will be used in lieu of TSS to confirm MFS performance.

Note 3: Guaranteed values are as measured by online instrumentation on the permeate for each train. Periodic high readings are often observed during a state transition at the start of a production cycle, and do not represent suspended solids or membrane integrity failure. Such readings shall be excluded from the guaranteed values.

13.1.5. MFS Performance Test

A fourteen (14)-day Performance Test will be completed to demonstrate the ability of the Seller's system to meet the MFS performance warranty requirements.

Within thirty (30) days of completion of commissioning of the system, or three (3) months from the date of shipment of the MFS membranes to the Buyer, whichever occurs first, the Buyer/Owner shall start-up the Equipment. Thereafter, the Buyer/Owner shall use its reasonable best efforts to maintain continuous and stable operation of the system until the Seller's obligation under this performance guarantee has been discharged. The Buyer/Owner shall notify the Seller that the system is ready for the Performance Test or notify why the system is not ready and the party responsible for the lack of readiness shall promptly take the appropriate remedial action.

During the Performance Test, when operating on influent quality as outlined in Table 13-1 above, and within operating parameters as outlined in Table 13-2 above, the system will demonstrate performance in accordance with:

- Permeate production capacity as per Table 13-3 above;
- Permeate water quality as per Table 13-4 above;

The proposed performance criteria shall be met on a daily basis over a 24-hour period (midnight to midnight).

The Performance Test is subject to the following conditions:

- The Buyer/Owner shall afford the Seller full access to the system and to all operating data pertaining to system performance until discharge of the latter's obligations hereunder.
- Test methodology will be defined in a Performance Test Plan issued by the Seller and agreed upon by all involved parties.
- The Buyer/Owner shall operate the system during the test, with remote support from the Seller, in accordance with the Performance Test Plan, applicable standard techniques, the Seller's Installation, Operations, and Maintenance Manual, and the operating parameters specified in this section.
- Pre-treatment unit operations and/or chemicals dosing (if applicable) will be optimized to maintain the design wastewater quality and for the optimal performance of the equipment being performance tested.
- Testing shall include sampling to ensure MFS membrane tank influent quality are within the parameters listed in Table 13-1. A minimum of three (3) grab samples shall be collected per parameter, evenly spaced over the course of the Performance Test and preferably at different times over a day. Samples shall be collected and analyzed in accordance with industry standards at an accredited third-party laboratory at the Buyer/Owner's expense.
- Performance with respect to effluent water quality will be demonstrated based on on-line instrumentation and sample testing based on a seven (7)-day average value of a minimum of four (4) 24-hour composite samples collected at regular intervals. Samples shall be collected and analyzed in accordance with industry standards at an accredited third-party laboratory at the Buyer/Owner's expense. Data received from on-line instrumentation and grab or autosampler sample testing will be included as indications of the performance of the plant and to assist in the proper operation and control of the MFS. These results may include values outside of the stated warranty values (during process upsets or if instruments are poorly/not calibrated, etc.). Should results include values beyond the stated guarantees due to process upsets outside of Seller's control, additional testing at the Buyer/Owner's expense shall be performed to establish that the equipment is not meeting performance requirements.
- Seller shall issue a report summarizing equipment performance during the Performance Test.

In the event of an interruption during the Performance Test due to any of the following events, the test shall be extended by the period of the interruption plus the time required to re-attain operating conditions in effect at the time of the interruption and data recorded during that period shall not be included:

- Power interruption in excess of sixty (60) minutes per day.
- Mechanical failure of the system.
- Any influent or operating parameter outside the minimum and maximum parameters defined in this section.

If during the execution of the Performance Test the wastewater flow and/or load into the plant are outside the specified minimum and maximum parameters in this document, the Seller will modify the test protocol within reason to mimic the design condition. The Seller is not responsible for any limitations on the Performance Test protocol or results due to wastewater flow and/or load that is outside of the specified minimum and maximum parameters.

When the Seller is of the opinion (based on the results obtained at the completion of the Performance Test), that the system has fulfilled the performance guarantees herein contained, it shall give written notice to the Buyer/Owner to that effect. Within two (2) weeks immediately following receipt of such notice, the Buyer/Owner shall notify the Seller in writing that it accepts the system, or that it does not accept the system, in which latter case the Buyer/Owner shall state the specific reason for non-acceptance. In the absence of such reply from the Buyer/Owner within the two (2) week period, the MFS shall be deemed to have been accepted and the Seller's obligation under this performance warranty shall be discharged.

If, after the MFS has been operated in accordance with the conditions set forth above, it becomes reasonably apparent, based on the results obtained at the completion of the Performance Test, that the MFS performance is short of the guaranteed performance, then additional Performance Tests of the MFS shall be conducted by the Buyer/Owner at a time mutually agreed between the Seller and the Buyer/Owner. In such an event, the Seller shall be responsible to undertake all necessary reasonable corrective measures in an effort, consistent with commercial and technical reasonableness, to bring the MFS up to the guaranteed performance levels.

If for any reason outside the Seller's control, the Performance Test cannot be completed within sixty (60) days after installation of the MFS membrane modules, or eighteen (18) months from shipment, or if any changes are made to the MFS without the Seller's written consent that would affect the Seller's ability to meet this performance warranty, then all obligations to the Buyer/Owner under this performance warranty will be deemed fulfilled.

13.1.6. MFS ZeeWeed Membrane Module Extended Prorated Warranty

This schedule sets out the warranty with respect to ZeeWeed membrane modules for the MFS only ("membrane modules"). No other warranties, expressed or implied are made in connection with the sale of these products, including, without limitation, warranties as to fitness for any purpose or use or merchantability of these products. The warranty provided herein will be the exclusive and sole remedy of Buyer. This warranty is not transferable.

13.1.6.1. Definitions

The following terms shall have the meaning set forth below when used in the warranty document:

a. "Buyer" means **Eagle Mountain City.**

b. "Seller" means a business component of, or legal entity within the Veolia business which is selling the ZeeWeed membranes.

c. "Full replacement" means that in the case of a valid warranty claim for a membrane module failure, Buyer receives a replacement membrane module and does not pay for the value of use of the membrane module prior to failure.

d. "Prorated replacement" means Buyer pays for actual use of a membrane module from which Buyer has derived value over time. Prorated replacement allows the Seller to pay reasonable compensation under warranty for any product use not enjoyed by Buyer due to premature failure.

13.1.6.2. Warranty Product

This warranty applies to only the membrane modules supplied under the contract of sale. Membrane module means the hollow fiber ultrafiltration membranes and the potted plastic headers. This warranty does not cover air piping to the membrane module, permeate piping from the membrane module, piping connection fittings, connecting hardware and cassette frames with

their associated components including but not limited to spacers, aerator tubes, aerator assemblies, screen, module dummies or module blanks.

13.1.6.3. Scope of Warranty

The Seller warrants that its membrane module(s) will be free of defects due to faulty materials or errors in manufacturing workmanship.

Regular membrane module inspection and normal fiber repair shall be the responsibility of Buyer.

All full replacement membrane modules will be shipped on the basis of INCOTERMS 2020 DAP Project Site. All ancillary costs including but not limited to receiving, forklift services, storage at site, reattachment hardware, hose/clamp/camlock replacement, crane services, installation, commissioning and waste disposal are the responsibility of Buyer.

All prorated replacement membrane modules will be shipped on the basis of INCOTERMS 2020 FCA Veolia manufacturing facility. All ancillary costs including but not limited to bagging, boxing, crating, freight, freight insurance, applicable taxes, import duties, certifications, brokerage, receiving, forklift services, storage at site, reattachment hardware, hose/clamp/camlock replacement, crane services, installation, commissioning and waste disposal are the responsibility of Buyer.

13.1.6.4. Warranty Start Date

Membrane warranty will start on the earlier of:

a. The date that installation of the original membrane module(s) has been substantially completed, or

b. Three (3) months from the date of delivery of the original membrane module(s) to Buyer.

13.1.6.5. Warranty Duration

Total Warranty Duration: a total of **240 months** composed of a full replacement period and an extended prorated replacement period.

Full Replacement Warranty Duration: **96 months** of full replacement warranty coverage.

Extended Prorated Replacement Warranty Duration: **144 months** following the full replacement warranty period.

Membrane modules replaced under warranty shall assume the remainder of the warranty for the original membrane modules being replaced, with such warranty to be not less than a 24 month full replacement warranty from the date of replacement with a new membrane module.

Replacement membrane modules are covered by warranty only to the extent of the warranty of the original membrane module which has been replaced.

13.1.6.6. Notification of Claim

All claims filed under this warranty shall be made in writing by Buyer within 30 days of identifying a defect.

Buyer shall provide the following information:

a. A description of the defect giving rise to the claim;

b. Photographs showing the manufacturing defect;

c. The serial number(s) of the membrane module(s) which is (are) the subject of the warranty claim; and

d. Operating data and repair history for the life of membrane modules which are the subject of a warranty claim.

13.1.6.7. Verification of Claim

After receipt of written notification of a defect, the Seller will promptly undertake such investigations as, in the Seller's opinion, are necessary to verify whether a defect exists. The Seller reserves the right to require additional data as necessary to validate claims. Buyer may, in the course of these investigations, be requested to return membrane module(s) to the Seller for examination (see section 13.1.6.11). The Seller may also conduct reasonable tests and inspections at Buyer's plant or premises. If the results of the investigation do not validate the defect claimed, Buyer will reimburse the Seller for all reasonable expenses associated with said investigation, including expenses for all tests, inspections, and associated travel.

13.1.6.8. Satisfaction of Claims

The Seller will have the right to satisfy claims under this warranty in a flexible manner. Such flexibility may include the repair of existing membrane modules or changes in operating protocols or membrane module replacement or by upgrading failed membrane modules with newer membrane module(s) that may embody design and efficiency improvements. Buyer consents to the supply of replacement membrane modules which may be of a different design than original membrane modules.

13.1.6.9. Operating Information

To maintain the membrane module warranty, membrane system operation records from initial start-up date until claim must be maintained by Buyer and made available to the Seller upon request. Records must be provided in sufficient detail as applicable to verify the subject of a warranty claim and can include but is not limited to, operation data including information on feed water quality, temperatures, flows, trans-membrane pressures, aeration rates, permeate quality, cleaning intervals, cleaning chemical concentrations, elapsed time since start-up, relevant analytical data and reporting of any screen bypass events.

Buyer shall maintain and share access to a single reference copy in electronic form of a membrane module map containing the history of activity by membrane module and the serial number for each module. Buyer shall log its procedures performed related to a membrane module including relocation of membrane modules, repairs, replacements and any other noteworthy events. repair%

Buyer authorizes the Seller to conduct any reasonable review of operation and maintenance records or to inspect facilities where membrane modules are installed, upon reasonable notice to Buyer. Such reviews and/or inspections are intended to also assist the Seller and Buyer in detection of membrane system faults and to optimize the care and operation of the membrane modules.

13.1.6.10. Limitation of Warranties

Occurrence of any of the following as reasonably determined by the Seller will void this warranty:

a. A material failure to operate the membrane system in accordance with Seller's operations and maintenance manual supplied to Buyer as part of the contract, including material failure to adhere to the Seller's specified membrane module cleaning procedures and the use of anything other than Seller-approved membrane module cleaning agents.

b. Failure to adhere to the preventive maintenance program as presented in the Seller's operations and maintenance manual, in published product manuals and in specifications.

c. Failure to adhere to all transportation and storage requirements. ZeeWeed membrane modules may be stored up to 12 months from date of receipt and must be transported and stored in original intact packaging out of direct sunlight in ambient temperatures between 5-35 Degrees Celsius. Storage beyond 12 months from date of receipt requires a written request to Veolia to maintain membrane module warranties.

d. Introduction of destructive foreign materials and chemical agents into the membrane module.

e. Failure to maintain and provide system operating data and repair history for the life of membrane modules which are the subject of a warranty claim.

f. Physical abuse or misuse, incorrect removal or installation of membrane modules by non-Seller personnel including fiber damage caused by operator error in handling of membrane modules or cassettes.

g. Unauthorized alteration of any components or parts originally supplied by the Seller.

h. Intentional damage.

13.1.6.11. Return Procedure

In the event that the return of a membrane module is required pursuant to this warranty, Buyer will first obtain a Return Goods Authorization (RGA) number from the Seller. Membrane module(s) shipped to the Seller for warranty examination must be shipped freight prepaid in environmentally controlled freight and storage with ambient air temperature between 5-35 Degree Celsius. If Buyer desires temporary replacement membrane module(s) to replace those alleged to be defective and returned to the Seller for warranty examination, Buyer shall be responsible for the cost associated with any such replacements until examination of the returned membrane modules pursuant to this warranty is complete. Any membrane module examined by Seller as part of a warranty claim where the membrane module is subsequently found to be performing as warranted or where a membrane module failure is not covered under the warranty will be returned to Buyer, freight collected or disposed of by Seller and the cost associated with any membrane analysis and diagnostic work will be levied against the Buyer based on Veolia standard labor rates.

13.1.6.12. Disclaimer and Limitation on Liability

To the maximum extent permitted by law, in no event shall Seller be liable for any loss of profit or revenues, loss of production, loss of use of equipment or services or any associated equipment, interruption of business, cost of capital, cost of replacement water or power, downtime costs, increased operating costs, claims of Buyer's customers for such damages, or for any special, consequential, incidental, indirect, punitive or exemplary damages arising out of or relating to the performance or actual or alleged breach of the agreement, regardless of whether a claim is based in contract (including warranty or indemnity), extra-contractual liability, tort (including negligence or strict liability), statute, equity or any other legal theory.

13.2. Membrane Thickener System (MTH) Warranty

The Seller offers a comprehensive three-part warranty for the Eagle Mountain Wastewater Treatment Facility (EMWWTF), ***Membrane Thickening System (MTH)*** as follows:

- **MTH Mechanical Warranty:** The Seller will repair or replace any device or part thereof that was supplied by the Seller that proves to be defective.This warranty excludes the membrane modules.
- **MTH Module Warranty:** This warranty provides protection and assurances to the Buyer/Owner with respect to the MTH modules. In addition to the warranty limitations as defined in this document, please refer to the "ZeeWeed Membrane Module Prorated Warranty" in Section 13.2.6
- **MTH Performance Warranty:** This warranty provides protection and assurances to the Buyer/Owner with respect to the ability of the Seller's MTH to meet the established performance criteria.

Unless otherwise noted, all warranties start upon substantial completion or six (6) months from equipment shipment, whichever occurs first. Substantial completion is defined as when the Buyer/Owner makes beneficial use of the equipment supplied by the Seller, or as successful completion of the MTH Performance Test as described in Section 13.2.5 of this proposal, whichever occurs first.

13.2.1. Warranty Provisions

All warranties are subject to the following provisions:

General

- The MTH is operated and maintained at all times in accordance with the Seller's Installation, Operations, & Maintenance Manual;
- The Seller has, until performance of its obligation herein is met, reasonable access to the equipment and the operational data relating thereto;
- The Buyer/Owner furnishes adequate and competent operating, supervisory and maintenance staff, and necessary laboratory facilities with test equipment and personnel;
- The Buyer/Owner utilizes the services of the Seller until its performance obligations are met;
- The Buyer/Owner supplies all necessary raw materials and services of a quantity and of a quality specified by the Seller;
- An adequate and continuous power supply is available that will enable operation of all required equipment; and
- Any construction debris is flushed and removed from membrane tanks prior to membrane installation.

Screening

- Screening is required upstream of the MFS, and subsequently the MTH. The opening size for the screens in any dimension must be 2 mm or less. There should be no possibility of bypass of any particle larger than 2 mm in any dimension. The Seller must be consulted regarding the type, capacity, and size opening of the screens that are to be installed.
- Pre-screening must use mesh, punched hole or disc filter type screens. Wedge wire screens are not acceptable, nor is any unscreened bypass (even temporary).

- All tanks, clarifiers, settlers, channels, etc. following the screens are to be protected from the outside elements such that no leaves, twigs or any foreign materials can enter the MTH train.

Process Parameters and Water Quality

- The use of any chemicals added to the wastewater treatment process (e.g.: polymers, flocculants, coagulants, antifoams) that may come in contact with the ZeeWeed membranes must be approved by the Seller prior to use. This includes, but is not limited to, chemicals used in processes outside of the Seller's MTH that may be transferred to the Seller's MTH, such as in solids handling facilities.
- The MTH is guaranteed to perform its contractual obligations under the feed quality parameters outlined in Table 13-5 and operating parameters outlined in Table 13-6. Any value above or below the ranges stated may impact the system performance. In addition to the above, the MTH is contingent on proper operation of the MFS, as detailed in Section 13.1 of this proposal.
- All water quality parameters shall be measured using EPA approved methods with a sufficient resolution, specific to influent, operating, and target effluent concentrations, to accurately and consistently report measured results.
- Chemicals that are not compatible with the ZeeWeed PVDF membrane are not permitted in contact with the membrane fibers (Seller's chemical compatibility summary available upon request).
- Fats, oil, and grease (FOG) concentration shall not exceed 150 mg/L of emulsified FOG in the MFS tank influent with no free oil and less than 10 mg/L of mineral or non-biodegradable oil.
- Any compound not listed in Table 13-5 and for which analytical data has not been supplied in the Request for Proposals is assumed to be in such a concentration that it does not require removal by the treatment process, does not affect MTH membrane performance, and will not need to be targeted by chemical cleanings to restore performance (e.g. surfactant).
- The MTH operation is warranted under the original MTH design as described in Section 8.5.2.2 of the proposal. Any changes such as, but not limited to, the design or operation of the MTH, the configuration of the upstream or downstream unit operations, equipment sizing, chemical types and dosing rates must be reviewed and assessed by the Seller to determine their feasibility and potential impact on the MTH performance and warranty.

Table 13-5: MTH Tank Mixed Liquor Influent Quality

Parameter	Units	Design Value	Operating Range		
Temperature	°C	10 [1]	10	-	24
pH	SU	7.0	6.5	-	7.5
Soluble $cBOD_5$	mg/L	5	BDL	-	5
NH_3-N	mg/L	0.5	BDL	-	1.0
Colloidal TOC (cTOC) [2]	mg/L	7	BDL	-	10
Soluble alkalinity as $CaCO_3$	mg/L	100	50	-	150
Time to filter (TTF) [3]	seconds	100	5	-	200
Material greater than 2 mm in size [4]	mg/L	0	0	-	1

Note 1: As specified in Section 46 53 49, 2.05C., of the Request for Proposals. All other parameters listed in each row are assumed values.

Note 2: Colloidal TOC (cTOC) is the difference between the TOC measured in the filtrate passing through a 1.5 µm filter paper and the TOC measured in the ZeeWeed membrane permeate.
Note 3: Per the standard Time to Filter procedure, measured in seconds per 50 mL sample, using a 0.45 micron filter paper. Procedure available upon request.
Note 4: Per the standard Sieve Test procedure (available upon request).

Table 13-6: MTH Tank Operating Parameters

Parameter	Units	Design Value	Operating Range
MLSS concentration in MTH tanks	mg/L	20,000	7,000 - 20,000

13.2.2. Mechanical Warranty

The mechanical warranty period on all equipment supplied, unless as noted in the following paragraph, is twenty-four (24) months from the date of substantial completion or thirty (30) months from equipment shipment, whichever occurs first.

The mechanical warranty period on MTH Blowers (80-B-201A/B/C) supplied, is sixty (60) months from the date of substantial completion or sixty-six (66) months from equipment shipment, whichever occurs first.

The mechanical warranty is only applicable to equipment supplied by the Seller. The Seller's sole obligation and the Buyer's exclusive remedy arising out of or relating to the equipment or services or any breach under this warranty is to repair or replace, at its factory or appropriate location determined by Seller, any device or part thereof, which shall prove to have been thus defective. Warranty repair, replacement or re-performance by Seller shall not extend or renew the applicable warranty period.

The Seller assumes no liability for any damage to equipment caused by inadequate storage or handling per manufacturer's recommendations in supplied technical literature, or by defective or sub-standard workmanship or materials provided by the Buyer/Owner or any other third party responsible for handling, storing or installing the equipment. The Seller also assumes no liability for the outcomes of improper commissioning, operation or maintenance of the Equipment by Buyer or third parties, repairs or alterations made by Buyer without the Seller's written consent, influent water which does not comply with agreed parameters, erosion or corrosion, or fair wear and tear.

The Buyer/Owner undertakes to give immediate notice to the Seller if goods or performance appear defective and to provide the Seller with reasonable opportunity to make inspections and tests. If the Seller is not at fault, the Buyer/Owner shall pay the Seller the costs and expenses of the inspections and tests.

Goods shall not be returned to the Seller without the Seller's permission. The Seller will provide Buyer/Owner with a "return goods authorization" (RGA) number to use for returned goods. All returns are F.C.A. – Oakville, Ontario, Canada. All costs associated with the removal and shipment of the defective part from the Buyer/Owner's facility to the Seller's factory and all costs related to return shipment to the Buyer/Owner's facility and installation of a repaired or replacement part shall be the Buyer/Owner's responsibility.

Implied warranties, including but not limited to warranties of fitness for particular purpose, use or application, and all other obligations or liabilities on the part of the Seller, unless such warranties, obligations or liabilities are expressly agreed to in writing by the Seller, are null and void.

13.2.3. MTH Module Warranty

A One-Hundred-Twenty (120) month prorated warranty is offered on the MTH modules with the first twenty-four (24) months offered as a full replacement warranty and the remaining Ninety-six (96) months as a prorated warranty. Refer to "ZeeWeed Membrane Module Prorated Warranty" in Section 13.2.6 for a detailed description of the membrane

13.2.4. MTH Performance Warranty

A Performance Warranty is offered to provide protection and assurances to the Buyer/Owner with respect to the ability of the Seller's MTH to meet the established performance criteria. Based on the influent wastewater and/or mixed liquor characteristics and MTH operating parameters specified in this document, the equipment offered herein will be capable of meeting the performance defined below. If any changes are made to the MTH without the Seller's written consent that would affect the Seller's ability to meet this Performance Warranty, then all obligations to the Buyer/Owner under this Performance Warranty shall be deemed discharged. The MTH performance will be demonstrated during a Performance Test (refer to the "Performance Test" section of this document for details on the Performance Test procedure).

The MTH Performance Warranty shall begin on the same date as the MTH Performance Test and is applicable for the duration of the MTH Performance Test, as described in Section 13.2.5 of this document. The MTH Performance Warranty includes the parameters listed within Section 13.2.4.1 of this document.

13.2.4.1. Waste Activated Sludge (WAS) and Thickened Waste Activated Sludge (TWAS) Performance Guarantee

The Seller warrants, subject to the provisions set forth above, that after stable operation of the Seller's MTH has been attained and operators have acquired reasonable skills, the MTH modules supplied for this project will be capable of producing the results set forth in Table 13-7.

Table 13-7: Guaranteed MTH Performance at Design Temperature - Capacity

Parameter	Units	Guaranteed Values
WAS at ADF, with all trains in service [1,2]	gpd	≤ 217,000
WAS at MMF, with all trains in service [1,2]	gpd	≤ 276,000
TWAS Maximum Concentration	% (mg/L)	2 (20,000)

Note 1: The flow conditions are defined as follows:

Average Day Flow (ADF) – The average flow occurring over a 24-hour period based on plant annual flow data.

Maximum Month Flow (MMF) – The average daily flow occurring over a 30-day period with the highest flow based on plant annual flow data.

Note 2: Guarantees are contingent on the MTH receiving sufficient influent WAS to thicken the volumes defined above. Should this not be the case, Seller will only prove the equipment capability and timing of running a single batch based on the influent WAS to the MTH.

13.2.5. MTH Performance Test

A fourteen (14)-day Performance Test will be completed to demonstrate the ability of the Seller's MTH to meet the performance warranty requirements.

Within thirty (30) days of completion of commissioning of the system, or three (3) months from the date of shipment of the membranes to the Buyer, whichever occurs first, the Buyer/Owner

shall start-up the Equipment. Thereafter, the Buyer/Owner shall use its reasonable best efforts to maintain continuous and stable operation of the MTH until the Seller's obligation under this performance guarantee has been discharged. The Buyer/Owner shall notify the Seller that the MTH is ready for the Performance Test or notify why the system is not ready and the party responsible for the lack of readiness shall promptly take the appropriate remedial action. The MFS must have stabilized and met the limits set forth above and in Section 13.1 prior to the start of the MTH Performance Test, as deemed by the Seller.

During the Performance Test, when operating on influent quality as outlined in Table 13-5 above, and within operating parameters as outlined in Table 13-6 above, the MTH will demonstrate performance in accordance with:

- Filtrate production capacity as per Table 13-7 above;

The proposed performance criteria shall be met on a daily basis over a 24-hour period (midnight to midnight).

The Performance Test is subject to the following conditions:

- The Buyer/Owner shall afford the Seller full access to the system and to all operating data pertaining to system performance until discharge of the latter's obligations hereunder.
- Test methodology will be defined in a Performance Test Plan issued by the Seller and agreed upon by all involved parties.
- The Buyer/Owner shall operate the MTH during the test, with remote support from the Seller, in accordance with the Performance Test Plan, applicable standard techniques, the Seller's Installation, Operations, and Maintenance Manual, and the operating parameters specified in this section.
- Pre-treatment unit operations and/or chemicals dosing (if applicable) will be optimized to maintain the design wastewater quality and for the optimal performance of the equipment being performance tested.
- Testing shall include sampling to ensure MTH tank influent quality are within the parameters listed in Table 13-5, respectively. A minimum of three (3) grab samples shall be collected per parameter, evenly spaced over the course of the Performance Test and preferably at different times over a day. Samples shall be collected and analyzed in accordance with industry standards at an accredited third-party laboratory at the Buyer/Owner's expense.
- Performance with respect to effluent water quality will be demonstrated based on on-line instrumentation and sample testing based on a seven (7)-day average value of a minimum of four (4) 24-hour composite samples collected at regular intervals. Samples shall be collected and analyzed in accordance with industry standards at an accredited third-party laboratory at the Buyer/Owner's expense. Data received from on-line instrumentation and grab or autosampler sample testing will be included as indications of the performance of the plant and to assist in the proper operation and control of the system. These results may include values outside of the stated warranty values (during process upsets or if instruments are poorly/not calibrated, etc.). Should results include values beyond the stated guarantees due to process upsets outside of Seller's control, additional testing at the Buyer/Owner's expense shall be performed to establish that the equipment is not meeting performance requirements.
- Seller shall issue a report summarizing equipment performance during the Performance Test.

In the event of an interruption during the Performance Test due to any of the following events, the test shall be extended by the period of the interruption plus the time required to re-attain operating conditions in effect at the time of the interruption and data recorded during that period shall not be included:

- Power interruption in excess of sixty (60) minutes per day.
- Mechanical failure of the system.
- Any influent or operating parameter outside the minimum and maximum parameters defined in this section.

If during the execution of the Performance Test the wastewater flow and/or load into the plant are outside the specified minimum and maximum parameters in this document, the Seller will modify the test protocol within reason to mimic the design condition. The Seller is not responsible for any limitations on the Performance Test protocol or results due to wastewater flow and/or load that is outside of the specified minimum and maximum parameters.

When the Seller is of the opinion (based on the results obtained at the completion of the Performance Test), that the MTH has fulfilled the performance guarantees herein contained, it shall give written notice to the Buyer/Owner to that effect. Within two (2) weeks immediately following receipt of such notice, the Buyer/Owner shall notify the Seller in writing that it accepts the MTH, or that it does not accept the MTH, in which latter case the Buyer/Owner shall state the specific reason for non-acceptance. In the absence of such reply from the Buyer/Owner within the two (2) week period, the MTH shall be deemed to have been accepted and the Seller's obligation under this performance warranty shall be discharged.

If, after the MTH has been operated in accordance with the conditions set forth above, it becomes reasonably apparent, based on the results obtained at the completion of the Performance Test, that the MTH performance is short of the guaranteed performance, then additional Performance Tests of the system shall be conducted by the Buyer/Owner at a time mutually agreed between the Seller and the Buyer/Owner. In such event, the Seller shall be responsible to undertake all necessary reasonable corrective measures in an effort, consistent with commercial and technical reasonableness, to bring the MTH up to the guaranteed performance levels.

If for any reason outside the Seller's control, the Performance Test cannot be completed within sixty (60) days after installation of the MTH modules, or eighteen (18) months from shipment, or if any changes are made to the MTH without the Seller's written consent that would affect the Seller's ability to meet this performance warranty, then all obligations to the Buyer/Owner under this performance warranty will be deemed fulfilled

13.2.6. MTH ZeeWeed Membrane Module Extended Prorated Warranty

This schedule sets out the warranty with respect to ZeeWeed membrane modules for the MTH only ("membrane modules"). No other warranties, expressed or implied are made in connection with the sale of these products, including, without limitation, warranties as to fitness for any purpose or use or merchantability of these products. The warranty provided herein will be the exclusive and sole remedy of Buyer. This warranty is not transferable.

13.2.6.1. Definitions

The following terms shall have the meaning set forth below when used in the warranty document:

a. "Buyer" means **Eagle Mountain City**.

b. “Seller” means a business component of, or legal entity within the Veolia business which is selling the ZeeWeed membranes.

c. “Full replacement” means that in the case of a valid warranty claim for a membrane module failure, Buyer receives a replacement membrane module and does not pay for the value of use of the membrane module prior to failure.

d. “Prorated replacement” means Buyer pays for actual use of a membrane module from which Buyer has derived value over time. Prorated replacement allows the Seller to pay reasonable compensation under warranty for any product use not enjoyed by Buyer due to premature failure.

13.2.6.2. Warranty Product

This warranty applies to only the membrane modules supplied under the contract of sale. Membrane module means the hollow fiber ultrafiltration membranes and the potted plastic headers. This warranty does not cover air piping to the membrane module, permeate piping from the membrane module, piping connection fittings, connecting hardware and cassette frames with their associated components including but not limited to spacers, aerator tubes, aerator assemblies, screen, module dummies or module blanks.

13.2.6.3. Scope of Warranty

The Seller warrants that its membrane module(s) will be free of defects due to faulty materials or errors in manufacturing workmanship.

Regular membrane module inspection and normal fiber repair shall be the responsibility of Buyer.

All full replacement membrane modules will be shipped on the basis of INCOTERMS 2020 DAP Project Site. All ancillary costs including but not limited to receiving, forklift services, storage at site, reattachment hardware, hose/clamp/camlock replacement, crane services, installation, commissioning and waste disposal are the responsibility of Buyer.

All prorated replacement membrane modules will be shipped on the basis of INCOTERMS 2020 FCA Veolia manufacturing facility. All ancillary costs including but not limited to bagging, boxing, crating, freight, freight insurance, applicable taxes, import duties, certifications, brokerage, receiving, forklift services, storage at site, reattachment hardware, hose/clamp/camlock replacement, crane services, installation, commissioning and waste disposal are the responsibility of Buyer.

13.2.6.4. Warranty Start Date

Membrane warranty will start on the earlier of:

a. The date that installation of the original membrane module(s) has been substantially completed, or

b. Three (3) months from the date of delivery of the original membrane module(s) to Buyer.

13.2.6.5. Warranty Duration (MTH)

Total Warranty Duration: a total of **120** months composed of a full replacement period and an extended prorated replacement period.

Full Replacement Warranty Duration: 24 months of full replacement warranty coverage.

Extended Prorated Replacement Warranty Duration: 96 months following the full replacement warranty period.

Membrane modules replaced under warranty shall assume the remainder of the warranty for the original membrane modules being replaced, with such warranty to be not less than a **24** month full replacement warranty from the date of replacement with a new membrane module.

Replacement membrane modules are covered by warranty only to the extent of the warranty of the original membrane module which has been replaced.

13.2.6.6. Notification of Claim

All claims filed under this warranty shall be made in writing by Buyer within 30 days of identifying a defect.

Buyer shall provide the following information:

a. A description of the defect giving rise to the claim;

b. Photographs showing the manufacturing defect;

c. The serial number(s) of the membrane module(s) which is (are) the subject of the warranty claim; and

d. Operating data and repair history for the life of membrane modules which are the subject of a warranty claim.

13.2.6.7. Verification of Claim

After receipt of written notification of a defect, the Seller will promptly undertake such investigations as, in the Seller's opinion, are necessary to verify whether a defect exists. The Seller reserves the right to require additional data as necessary to validate claims. Buyer may, in the course of these investigations, be requested to return membrane module(s) to the Seller for examination (see section 13.2.6.11). The Seller may also conduct reasonable tests and inspections at Buyer’s plant or premises. If the results of the investigation do not validate the defect claimed, Buyer will reimburse the Seller for all reasonable expenses associated with said investigation, including expenses for all tests, inspections, and associated travel.

13.2.6.8. Satisfaction of Claims

The Seller will have the right to satisfy claims under this warranty in a flexible manner. Such flexibility may include the repair of existing membrane modules or changes in operating protocols or membrane module replacement or by upgrading failed membrane modules with newer membrane module(s) that may embody design and efficiency improvements. Buyer consents to the supply of replacement membrane modules which may be of a different design than original membrane modules.

13.2.6.9. Operating Information

To maintain the membrane module warranty, membrane system operation records from initial start-up date until claim must be maintained by Buyer and made available to the Seller upon request. Records must be provided in sufficient detail as applicable to verify the subject of a warranty claim and can include but is not limited to, operation data including information on feed water quality, temperatures, flows, trans-membrane pressures, aeration rates, permeate quality, cleaning intervals, cleaning chemical concentrations, elapsed time since start-up, relevant analytical data and reporting of any screen bypass events.

Buyer shall maintain and share access to a single reference copy in electronic form of a membrane module map containing the history of activity by membrane module and the serial number for each module. Buyer shall log its procedures performed related to a membrane

module including relocation of membrane modules, repairs, replacements and any other noteworthy events. repair%

Buyer authorizes the Seller to conduct any reasonable review of operation and maintenance records or to inspect facilities where membrane modules are installed, upon reasonable notice to Buyer. Such reviews and/or inspections are intended to also assist the Seller and Buyer in detection of membrane system faults and to optimize the care and operation of the membrane modules.

13.2.6.10. Limitation of Warranties

Occurrence of any of the following as reasonably determined by the Seller will void this warranty:

i. A material failure to operate the membrane system in accordance with Seller's operations and maintenance manual supplied to Buyer as part of the contract, including material failure to adhere to the Seller's specified membrane module cleaning procedures and the use of anything other than Seller-approved membrane module cleaning agents.

j. Failure to adhere to the preventive maintenance program as presented in the Seller's operations and maintenance manual, in published product manuals and in specifications.

k. Failure to adhere to all transportation and storage requirements. ZeeWeed membrane modules may be stored up to 12 months from date of receipt and must be transported and stored in original intact packaging out of direct sunlight in ambient temperatures between 5-35 Degrees Celsius. Storage beyond 12 months from date of receipt requires a written request to Veolia to maintain membrane module warranties.

l. Introduction of destructive foreign materials and chemical agents into the membrane module.

m. Failure to maintain and provide system operating data and repair history for the life of membrane modules which are the subject of a warranty claim.

n. Physical abuse or misuse, incorrect removal or installation of membrane modules by non-Seller personnel including fiber damage caused by operator error in handling of membrane modules or cassettes.

o. Unauthorized alteration of any components or parts originally supplied by the Seller.

p. Intentional damage.

13.2.6.11. Return Procedure

In the event that the return of a membrane module is required pursuant to this warranty, Buyer will first obtain a Return Goods Authorization (RGA) number from the Seller. Membrane module(s) shipped to the Seller for warranty examination must be shipped freight prepaid in environmentally controlled freight and storage with ambient air temperature between 5-35 Degree Celsius. If Buyer desires temporary replacement membrane module(s) to replace those alleged to be defective and returned to the Seller for warranty examination, Buyer shall be responsible for the cost associated with any such replacements until examination of the returned membrane modules pursuant to this warranty is complete. Any membrane module examined by Seller as part of a warranty claim where the membrane module is subsequently found to be performing as warranted or where a membrane module failure is not covered under the warranty will be returned to Buyer, freight collected or disposed of by Seller and the cost associated with any membrane analysis and diagnostic work will be levied against the Buyer based on Veolia standard labor rates.

13.2.6.12. Disclaimer and Limitation on Liability

To the maximum extent permitted by law, in no event shall Seller be liable for any loss of profit or revenues, loss of production, loss of use of equipment or services or any associated equipment, interruption of business, cost of capital, cost of replacement water or power, downtime costs, increased operating costs, claims of Buyer's customers for such damages, or for any special, consequential, incidental, indirect, punitive or exemplary damages arising out of or relating to the performance or actual or alleged breach of the agreement, regardless of whether a claim is based in contract (including warranty or indemnity), extra-contractual liability, tort (including negligence or strict liability), statute, equity or any other legal theory.

13.3. Technical Support, Maintenance Support, Assistance And Service Support

Please refer to Section 7.2 for technical support and services for the Eagle Mountain Wastewater Treatment Facility (EMWWTF).

14. Efficiency

14.1. Blower (Rotary Lobe and Rotary Screw) and Pump Curves

a) Blower and Pump curves have been provided as Appendix B.
b) Design Operating Points @ design flow rates for the following conditions:

Table 14-1: Blower Design Flows and Efficiencies

Design Condition	Design Flow Rates (Total) (ICFM)	Number of Blowers in Operation	Design Flow Rates Per Blower (ICFM)	Design Operating Points Rotary Lobe Blowers (Wire-to-Air HP)	Design Operating Points Rotary Screw Blowers (Wire-to-Air HP)
MFS Duty Points					
Annual Average (3 Trains in Service)	2,322	2	1,160	34.9	31.4
Maximum Month (4 Trains in Service)	3,096	2	1,548	45.2	40.9
Peak Day (4 Trains in Service)	3,096	2	1,548	45.2	40.9
Maximum Month (3 Trains in Service)	2,322	2	1,160	34.9	31.4
MTH Duty Points					
Annual Average WAS (2 Trains in Service)	643	2	321	9.9	8.4
Maximum Month WAS (2 Trains in Service)	643	2	321	9.9	8.4

Note 1: Efficiencies are not published for the proposed blowers. Wire-to-power draw has been provided in lieu of blower efficiencies. Efficiency as a measurement is used primarily in centrifugal blowers and turbos.

14.2. Duration of Operation

Table 14-2: Duration of Operation

Equipment	Hours of Operation per Day
MFS Blowers	24
MFS Process Pumps	23
MFS RAS Pumps	24
MTH Blowers	24
MTH Filtrate Pumps	18.15
MTH Drain/Recirculation/TWAS Pumps	18.15

14.3. Considerations for Site Elevation

Veolia has reviewed the site elevation and hydraulics as provided in the Contract Drawings. Veolia has indicated the required NPSH as provided by the pump vendors, in Section 8.5.1.3 (for MFS equipment), and Section 8.5.4.1 (for MTH equipment). Given the high elevation, Veolia's preliminary calculations indicate sufficient NPSHa for the proposed process pumps at the maximum design flow and line losses. As detailed engineering progresses, these assumptions will need to be verified and could impact the NPSHa calculations completed in the preparation of this proposal.

15. Exceptions, Deviations, and Clarifications

In submitting this proposal, Veolia reaffirms its commitment to delivering a comprehensive, high-quality solution that meets the project requirements. In the interest of transparency and to ensure mutual understanding of the proposed scope of work, we respectfully note the following clarifications and technical recommendations:

1. **Drawings**

   Veolia has developed Process and Instrumentation Diagrams (P&IDs) based on our proven design standards and operational expertise. These drawings supersede the P&IDs provided in the specification documents and reflect Veolia's optimized approach to system design and integration. Our P&IDs incorporate best practices derived from extensive experience in similar applications and are designed to ensure optimal system performance, reliability, and maintainability.

2. **Thickened Sludge Drain Pumps**

   While the specification calls for centrifugal pumps from the same manufacturer as the Return Activated Sludge (RAS) pumps, Veolia recommends the use of Boerger rotary lobe pumps based on proven performance and operational experience in similar applications.

3. **Hydraulic Profile**

   Hydraulic profile is taking exception to supply of Hydraulic profile

4. **Factory Testing – Section 43 21 15, Horizontal End Suction Centrifugal Pumps**

   Section 43 21 15 requires comprehensive factory testing documentation. This comprehensive testing and documentation protocol would be provided as an additional scope item with associated cost and schedule implications. Veolia has assumed that commissioning will be performed by Veolia Field Service Representatives (FSRs) and has not included testing reports or factory witness testing beyond the manufacturer's standard offering in the base scope of supply.

5. **Air Compressors**

   Veolia proposes to supply Atlas Copco piston-type air compressors in lieu of rotary screw compressors. Our operational experience demonstrates that piston compressors provide superior longevity and reliability for this application. Additionally, air receiver tanks will be sourced from the same vendor as the compressors to ensure system compatibility, and this approach has been reflected in our pricing. While the specification requests alignment with the blower manufacturer, Veolia has selected vendors based on demonstrated excellence for each specific equipment type.

6. **Membrane Tank Depth**

   The proposed membrane tank depth is 13 feet, which represents Veolia's standard design specification and differs from the 14-foot depth specified in the requirements. Veolia's optimized 13-foot tank depth is based on proven design standards and operational efficiency. The specified 14-foot depth provides no operational advantage for the Veolia system and would result in increased capital expenditure (CAPEX) due to additional concrete requirements, as well as elevated operational expenditure (OPEX) associated with larger chemical volumes. Veolia's standard tank depth delivers optimal performance while providing cost savings over the project lifecycle.

7. **Maintenance Stand**

The Veolia system design does not require a maintenance stand.

8. Process Pumps – Motor Insulation Class

Section 43 20 00 2.03.D.4 specifies Class H insulation for pump motors. Veolia proposes standard Class F insulation motors, which are appropriate for this application. Upgrading to Class H insulation would significantly impact both cost and delivery schedule. Class H insulation is typically required only in artificially heated environments exceeding natural ambient conditions. Boerger routinely deploys Class F insulation motors in outdoor desert environments without performance issues, and can confirm that Class F insulation is suitable for this application

9. Start-Up and Training of Rotating Equipment

The RFP references the use of manufacturer-provided or factory-trained representatives for equipment start-up and training. Veolia requests confirmation that Veolia-certified representatives are acceptable for these activities, and that standard manufacturer documentation for testing is sufficient without additional calibration reports or factory/witness testing requirements.

10. Spare Parts

Spare parts not applicable to the proposed equipment have been excluded from Veolia's scope of supply. All included spare parts are itemized in Section 7.1.3 of this proposal.

11. Freight Terms

Veolia proposes CIP (Carriage and Insurance Paid To) terms in lieu of FOB (Free On Board). The FOB terminology represents an outdated convention that has been largely superseded by CIP in modern commercial practice. CIP terms provide clearer definition of responsibilities and risk transfer, particularly for inland and multimodal transportation, and align with current international trade standards as defined by Incoterms® 2020.

12. Chemical Dosing Pump Skids

Veolia will provide Variable Frequency Drives (VFDs) for the chemical dosing pump skids on a loose-ship basis. These VFDs are compact units (approximately 1.0 hp). Veolia recommends installation at a minimum distance of 10 feet from the chemical feed system where feasible. The General Contractor will be responsible for on-site VFD installation.

13. Chemical Feed Day Tanks

Chemical feed day tanks are excluded from Veolia's scope of supply.

14. Interconnecting (IC) Piping

With the exception of permeate and air headers within the membrane basins, all IC piping will be provided by others.

15. Motor Alignment

Per Section 26 05 10 - 2.01 E, the specification assigns responsibility for delivery, handling, setting, lubrication verification, drive alignment, rotation indication, and operational readiness to the division furnishing motors or motor-containing equipment. Veolia clarifies that our scope is limited to motor supply only. Installation, alignment, and commissioning activities remain within the General Contractor's scope of work.

16. Enclosure Labeling

Labels will be permanently affixed to enclosures using adhesive methods without fasteners. The use of fasteners is prohibited as it would void the panel ratings and certifications.

17. Electrical Submittals

Veolia will provide the electrical load list. The single-line diagram for power distribution is to be provided by others.

18. Electrical Wiring

The General Contractor is responsible for developing the cable schedule and wire list. Veolia's scope is limited to internal wiring within Veolia-supplied control panels.

19. Solenoid Valves

All solenoid valves within Veolia's scope of supply operate at 24 VDC.

20. Manufacturer Services

Section 1.03 requests a manufacturer's letter confirming that package design and workmanship quality are factory-approved and will not affect equipment warranty. Veolia clarifies that equipment manufacturers are supplying pumps as individual components rather than integrated packages; therefore, this requirement is not applicable to standalone equipment items.

21. Instrumentation Calibration

Veolia's standard instrumentation is factory-tested to meet performance specifications. However, individual calibration certificates are not included as part of our standard supply package. Should project-specific calibration documentation be required, Veolia would be pleased to discuss this as an additional scope item.

22. Electromagnetic Flowmeter

Veolia requests consideration of an exception to the NSF-61 certification requirement for electromagnetic flowmeters.Our proposed flowmeters meet industry-standard performance and quality specifications. Should NSF-61 certification remain a mandatory requirement, Veolia will work with the project team to identify compliant alternatives, which may impact cost and delivery schedule.

23. Float Switch

Veolia proposes MJK as the float switch manufacturer. This selection is based on proven reliability and performance in similar applications, ensuring optimal system operation and longevity.

24. Custom Tagging

Veolia will implement custom equipment tagging in accordance with the approved P&IDs. Custom tagging will be finalized and applied following formal approval of the P&IDs to ensure consistency and accuracy throughout the system.

25. Loop Diagrams

Section 40 63 13 - 1.02 - A.8 requests detailed loop control drawings. Veolia's standard deliverables include comprehensive panel wiring diagrams, terminal block layouts, and I/O schedules that provide complete information for installation, commissioning, and maintenance activities. These documents clearly identify all field device connections, internal panel wiring, and power distribution within Veolia-supplied equipment. The creation of separate loop control drawings that duplicate information already contained in our standard panel documentation does not provide additional technical value for installation or operational purposes, while significantly extending engineering schedules and increasing project costs. Veolia's standard documentation package has been successfully utilized across numerous installations and provides all necessary information for proper system integration and long-term maintenance. Should the

project team require this additional documentation format, Veolia would be pleased to discuss this as a supplemental scope item with associated schedule and cost implications.

26. Equipment Factory testing

Veolia has assumed that commissioning and testing will be performed by Veolia Field Service Representatives (FSRs) and has not included testing reports or factory witness testing beyond that in the base scope of supply.

27. Process Design Certification Affidavit

The specification requires the manufacturer to submit a signed affidavit with shop drawings, certifying that the process design criteria meets the requirements for a complete Membrane Filtration System (MFS). Veolia proposes to submit this certification exclusively for the Veolia-supplied membrane filtration system and its associated components within our defined scope of supply.

28. Bid Form Attachment C – Membrane System O&M Costs,Table 12: Recurring Costs

Veolia has identified a discrepancy in Row M of Table 12. The formula for "NPV of Recurring Cost" is shown as "H × B" in the bid form; however, based on the table structure and calculation methodology, Veolia has applied the formula "L × B" in our submission.

29. Attachment A (Bid Form for Procurement Contract) , Section 3.09

Article 3, Section 3.09 of Attachment A (bid form for procurement contract) requests a monthly fee for Technical Support and Process Monitoring. Veolia's standard service model provides connectivity and hardware support on an annual subscription basis rather than a monthly billing structure.

30. Web-Based Asset Management Tool – Section 46 53 49 - 2.20 A.J

The specification requests a web-based asset management tool with access to plant installation information, service reports, video operational procedures, additional data collection, reporting and trend reviews, and a digitally interactive and searchable Operations and Maintenance manual. Veolia provides InSight, our proprietary web-based platform for comprehensive plant support. InSight delivers access to key performance indicators, process reports, operational data, and system monitoring capabilities. While InSight provides robust functionality for plant operations and performance management, its specific features and interface differ from the exact description provided in the specification. Please refer to Section 7.2.2 of this proposal for detailed information regarding InSight's capabilities and how it supports operational excellence and asset management objectives.

Veolia welcomes the opportunity to discuss any of these items and remains committed to collaborating with the Eagle Mountain WWTF project team to achieve optimal project outcomes.

16. List of Manufacturers

Please refer to Bid form, Attachment D

17. Commercial Offer

17.1. System Price

The pricing is submitted separately as part of Capital Bid form.

Please note that the presented pricing does not include any provision for any procurement restrictions imposed on Seller by Buyer's funding parties. Should these restrictions be required, such as "Buy America", Seller reserves the right to adjust the pricing herein upon review of the restrictions.

17.2. Price Validity

The quoted system price will be valid for 60 days from the day of proposal submission as specified in Attachment A ,Article 2.01 of the Request for Proposal.. If a formal Purchase Order or Procurement Agreement is not received and accepted within this Validity Period, both the pricing and delivery schedule are subject to review and adjustment.

The proposed system pricing is based upon receipt of a Notice to Proceed (NTP) for Manufacturing/Equipment Procurement being provided by February 4th, 2027. In the event the NTP for Manufacturing/Equipment Procurement is not received before this date, the equipment and service prices contained herein will be subject to adjustment that reflects changes in the Producer Price Index ,PPI by Commodity: Machinery & Equipment: Pumps, Compressors and Equipment (WPU1141) as published by the U.S. Department of Labor (www.bls.gov/ppi). This adjustment will be from the date of the proposal to the date the NTP for Manufacturing/Equipment Procurement is received.

If a formal NTP for Manufacturing/Equipment Procurement is not received and accepted within one month of the NTP date referenced above, Seller will be afforded the right to review and adjust the scope of supply, pricing and delivery schedule offered herein.

17.3. Taxes

Pricing provided herein does not include Buyer's Taxes, tariffs or duties.

Seller may be required by law to determine and collect Sales Tax, Value Added Tax, Goods and Services Tax, or similar Indirect Tax from Buyer ("Buyer's Taxes") and remit to the applicable taxing jurisdiction for the provision of goods and/or services as outlined in this Proposal.

Seller's invoiced price and schedule shall be based on applicable Federal and Provincial /State laws, local ordinances, codes, standards, duties, and taxes assessed on the Seller in effect as of the date of Seller's proposal. Should such laws, codes, taxes and standards change and increase the cost of performing the work or impact the schedule, Seller shall, upon notice to Buyer of such, be entitled to an equitable adjustment of price and /or schedule. Similarly, should such laws, codes, taxes and standards change and decrease the cost of performing the work, the Buyer shall be entitled to an equitable adjustment of price.

Unless Buyer has furnished Seller with evidence of tax exemption or direct pay permit acceptable to taxing authorities prior to the execution of any Purchase Order / Agreement or Seller's acceptance of Buyer's Purchase Order (as applicable), Seller will determine any applicable taxes according to the laws, codes, and standards of the taxing jurisdiction and include them at the time of invoicing, Buyer shall pay all Buyer's Taxes as invoiced by Seller, and Seller is relieved of any obligation to (i) apply any tax exemption or direct pay permit, and/or (ii) refund the Buyer any tax paid by the Seller.

If a Tax Exemption Certificate provided by Buyer is determined to be invalid by the relevant taxing jurisdiction, then Buyer shall either (i) provide Seller with a cured exemption certificate, or (ii) pay to Seller the required Buyer'sTaxes, or (iii) pay directly to the relevant taxing jurisdiction pursuant to a demand for payment from that jurisdiction in the name of Buyer. Buyer shall pay fines, penalties, and/or interest assessed by the relevant taxing jurisdiction in direct connection to that jurisdiction's determination that an exemption certificate provided by Buyer is invalid.

If Seller fails to timely and accurately collect Buyer's Taxes from Buyer as required by any taxing jurisdiction, then Seller will provide to Buyer corrected invoices that (i) comply with the regulations of the taxing jurisdiction, and (ii) separately itemize such Buyer's Taxes, and Buyer will remit such taxes to Seller except that Buyer shall not pay to Seller or any relevant taxing jurisdiction any amount of fines, penalties, and/or interest assessed against Seller by the relevant taxing jurisdiction for Seller's failure to timely and accurately collect, remit, or report Buyer's Taxes collected from Buyer. If Seller collects from Buyer an amount of Buyer's Taxes in excess of those required by law, then Seller shall repay such excess Buyer's Taxes to Buyer except where prohibited by the laws and regulations of the relevant taxing jurisdiction.

17.4. Delivery

The following freight terms for delivery of equipment used are as defined by INCOTERMS 2020.

All pricing is **CIP** (Incoterms 2020) to designated Project Site (**Eagle Mountain City Water Filtration System), Eagle Mountain City, UT**. Delivery to the project site is conditional upon provision of access roads of a nature that will permit access by tractor-trailers. Off-loading and positioning of equipment at the job-site is not included.

Upon acceptance of Buyer's Purchase Order or, alternatively, where specified in the Purchase Order, upon receipt of Buyer's Notification to Proceed with Manufacturing/Equipment Procurement that satisfies Seller's requirements for meeting the delivery schedule, Seller shall commence fabrication of equipment. The place of delivery specified therein shall be firm and fixed, provided that Buyer may notify Seller no later than forty-five (45) days prior to the scheduled shipment date of the equipment of an alternate point of delivery. Provided the parties agree to a change order to take into account any additional cost or delay incurred by Seller in implementing this change, the alternate place of delivery shall become the agreed place of delivery for all purposes under such Purchase Order. Failure by Buyer to take delivery of the equipment shall be a material breach of such Purchase Order.

17.5. Shipment to Storage

If any part of the equipment cannot be delivered when ready due to any cause not attributable to Seller, Buyer shall designate a climate-controlled storage location and Seller shall ship such equipment to storage. Upon shipment to the storage location then (i) title and risk of loss shall thereupon pass to the Buyer if it had not already passed; (ii) any amounts payable to the Seller upon delivery or shipment shall become payable upon presentation of Seller's invoice(s); (iii) any amounts otherwise payable to Seller, such as for preparation for storage, handling, inspection, preservation, insurance and any taxes shall be payable by Buyer upon submission of Seller's invoice(s); (iv) the Services provided herein shall subsequently charged at the rate prevailing at the time of actual use and Buyer shall pay the net increase; and (v) Buyer is responsible for direct payment of all costs for storage of the equipment and subsequent transportation from the storage facility to their place of installation.

17.6. Law & Permits

All permits, authorisations, and licenses which are required to construct, install and/or operate Buyer's facility or equipment, to use the Equipment, or to manage and dispose of any wastes, discharges, and residues resulting from Buyer's use of the Equipment, shall be obtained and maintained by Buyer at Buyer's sole expense. Buyer is responsible for compliance with all laws and regulations applicable to the storage, use, handling, installation, maintenance, removal, registration, and labelling of all Equipment after delivery of the Equipment, as well as for the proper management and disposal of all wastes, discharges, and residues.

17.7. Bonds

Performance and Labor & Material Payment Bonds are not included in the system price. These bonds can be purchased on request, but will be at additional cost.

17.8. Payment Terms

The pricing quoted in this proposal is based upon the following payment terms as given in Attachment B, Article 4-Payment Procedures, 4.02, subject to approval of Buyer credit (all payments are net 30 days):

- 0% with Purchase Order;
- 10% on approval of Shop Drawings;
- 75% on shipment of equipment (partial shipments permitted);
- 10% on completion of commissioning, or net 60 days from equipment shipment whichever occurs first.
- 5% on completion of the performance test or 180 days from shipment whichever occurs first.

No financial allowance has been made for any holdbacks on submitted invoices.

The Buyer shall have the right to terminate Seller's Contract for convenience at any time upon 30 days written notice to Seller. Upon receipt of such termination notice by Seller, payment to Seller shall include:

- Payment in full for unpaid invoices presented by Seller to Buyer to date of termination notice.
- Payment for Seller's costs not yet invoiced to date of termination notice, plus 10% termination fee.
- Payment to Seller for any restocking costs and Seller's costs to terminate orders with Seller's suppliers, plus 10% termination fee regarding such costs.

Seller shall only proceed with preparation of Engineering Drawings upon receipt of a formal Purchase Order and a written Notice to Proceed with Engineering Drawings from the Buyer. If, as of the date Engineering Drawings are submitted, the Buyer terminates Seller's Contract, then the Buyer shall pay Seller the milestone price for Engineering Drawings, or Seller's actual costs plus 10% for drawing preparation to the date of notice of termination, whichever is greater.

Seller shall only proceed with procurement and production of equipment and materials upon receipt of a formal Purchase Order and a written Notice to Proceed with Manufacturing/Equipment Procurement from the Buyer.

17.9. Proposed Project Schedule

A preliminary equipment schedule is detailed below and is based on current workload backlogs and production capacity. Veolia will arrange a kick-off meeting after contract acceptance to develop a firm shipment schedule.

Table 17-1: Proposed Project Schedule Milestones

Milestones	Target Duration
Proposal Due Date	February 4th, 2026
Anticipated Contract Award	February 11th, 2026
Purchase Order Acceptance by Seller	March, 2026
Beginning of Engineering Submittals	April, 2026
Engineering Submittals/O&M Submittals[1]	24-28 weeks
Notice to Proceed for Equipment Manufacturing/Procurement	January, 2027
System Construction and Installation	Anticipated to be Q3 2028
Performance Test	14 days IPT 6 months MTP
Operations & Maintenance Manuals	2 weeks from commissioning completion

Note 1: Submittals are to follow Specification Section 01 33 00 and proposal section 7.1.4.1.. However, Veolia suggests that drawings be submitted and approved prior to other submittal information requested to streamline detailed engineering and minimize rework.A tentative submittal schedule is as follows:

- Submittal No. 1: PFD and P&IDs: **NTP for Engineering**[M1] **+ 45 days**
- Submittal No. 2: General Arrangement Drawings, BOM/Equipment List, Cutsheet package, Preliminary Network Architecture: **+ 45 days from receipt of comments for Submittal #1**
- Submittal No. 3: Electrical package including control philosophy, CLSC, electrical load list, IO list, network architecture, Electrical Panel Drawings: **+ 55 days from receipt of comments for Submittal #2**
- Veolia assumes that Owner/Engineer review is provided within 10 days of Submittal submission.

Note 2: Veolia's engineering team requires the following information from the Buyer prior to commencing work on the Submittals detailed in Note 1. Please note that the timeline defined in Table 30 assumes that Veolia's engineering team has all the required site information. If not, the timeline can only commence once the information has been received by Veolia.

- Confirmation of the hydraulic profile of the plant, especially regarding the feed to the membrane system and the pump discharge head requirements for all pumping applications connected outside of Veolia's system.
- Site considerations for plant layout and preliminary plant information including overall plant layout considerations from the Buyer and elevations.
- Environmental conditions including relative humidity range, ambient temperature (minimum and maximum).
- Confirmation of all site conditions such as elevation or any wind loading and seismic requirements.
- Confirmation of voltage and classification requirements.

Note 3: Veolia's initial submittals will include Veolia's standard symbols and equipment tagging only. Custom tagging will be incorporated following approval of drawings.

Note 4: Once all engineering is complete, Veolia will provide a draft O&M submittal prior to equipment shipment. Final O&M manual will be provided following the completion of commissioning.

Note 5: Membranes and any other long-lead items are released for purchase ahead of the complete submittal approval. Membrane delivery time varies by project, but typically are required at site as the last piece of equipment to be installed before plant start-up. Veolia will work with the Contractor during the

development of the firm project schedule to determine long lead items for pre-release and ensure the project schedule is maintained.

Note 6: The estimated delivery lead times for each piece of major equipment following approval of submittals is listed below:

- Membranes: 25 - 30 Weeks
- Balance of Equipment: 15 - 30 weeks

17.10. Royalty and License Fees

17.10.1. Application Patents

Seller has a number of patents covering the products, equipment and applications offered in this proposal.

17.10.2. Non-Exclusive Royalty Free License

Seller grants Buyer a non-exclusive, non-terminable, royalty free license to use the intellectual property embedded in the equipment delivered to and paid for by the Buyer, as well as any drawings, design or data delivered to and paid for by the Buyer, for the purposes of owning, financing, using, operating, and maintaining the relevant equipment at Buyer's site. Such license may only be assigned to a subsequent owner of the equipment or to an operations and maintenance sub-contractor. Such license does not extend to the re-creation of the equipment or the manufacture of spares or consumables by Buyer or third parties.

Any software Seller owns and provides pursuant to this proposal shall remain Seller's property. Seller provides to Buyer a limited, non-exclusive and terminable royalty free project-specific license to such software for the use, operation or maintenance at Buyer's site of any equipment purchased hereunder to which software is a necessary component. Buyer agrees not to copy, sub-license, translate, transfer or reverse engineer, or decode the software. Single user versions of software may be used on one CPU. LAN/WAN versions may be used on a single server with only the number of concurrent users as agreed to by the Parties. Unless otherwise expressly agreed by Seller, this license shall terminate and the software shall be returned to Seller as soon as the Buyer no longer operates the equipment as sold, or upon the material breach of these terms.

Furthermore, the chemistries used in the manufacture of Seller's ultrafiltration and microfiltration membranes sold under the ZeeWeed brands are proprietary and the Buyer undertakes not to analyze these membranes or to permit analysis of these membranes by a third party.

17.11. Terms and Conditions

Veolia's proposed offer and price is contingent upon our mutual agreement to acceptable terms and conditions of sale. To facilitate our discussions and streamline the negotiation process, we propose using the negotiated contract for New Braunfels with MGC and Veolia standard Terms and Conditions attached as Appendix E as the basis for our agreement. We believe this approach will provide a solid starting point that reflects terms both parties have found workable. We look forward to working collaboratively with you to finalize terms that meet both of our organizations' needs.

Appendix A

Veolia Water Technologies & Solutions
3600 Horizon Blvd, Trevose, PA 19053, United States
tel: 905 465 3030
technical support: 866 271 5425

North America Hourly Rates – $USD/hr

Field Service Representative		In-office Rate	On-site Rate
field service representative	product support representative	**N/A**	**$225**
Engineer Level			
lead engineer	electrical/controls engineer	**$205**	**$245**
process engineer	application engineer		
mechanical engineer	field engineer		
design engineer	operator training		
Management			
project manager	senior engineer	**$240**	**$280**

Scheduling & Technical Support

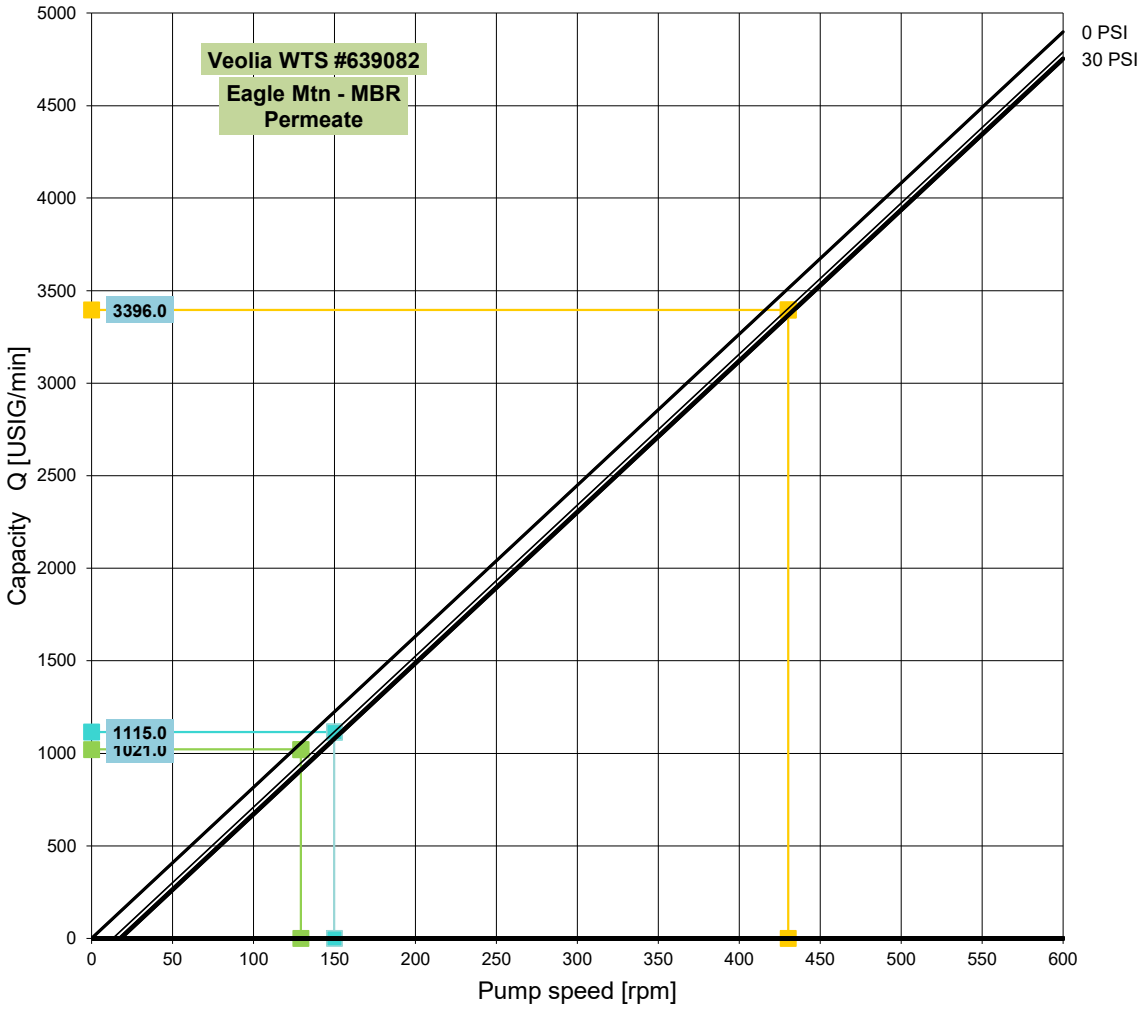
contact services at +1 (866) 271-5425 to schedule service. Support is available by phone M-F 8:30am to 5:00pm Eastern time (GMT-5).

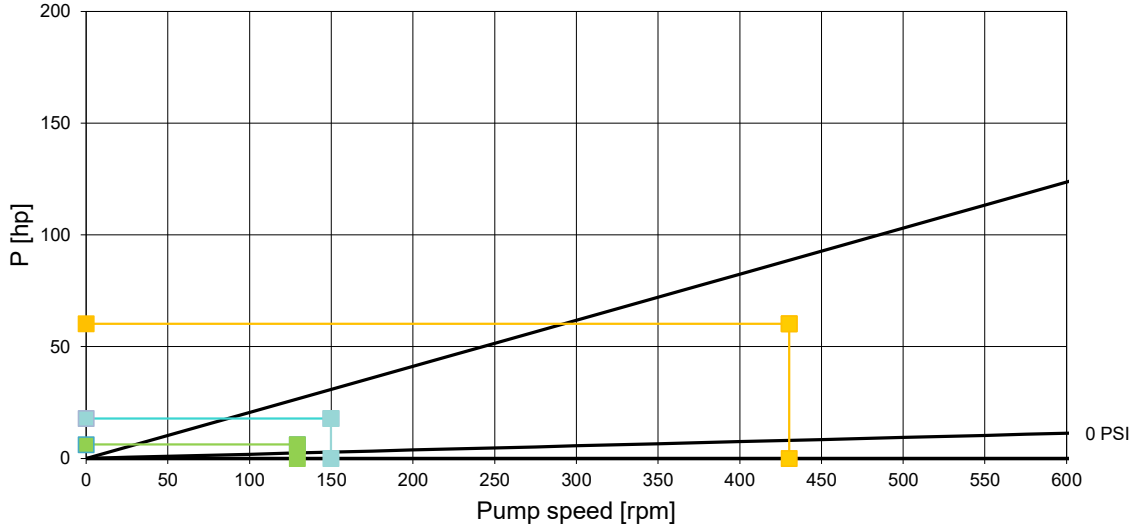
Conditions

1. On-site rates are inclusive of travel and living expenses in Canada and the lower US. Remote sites, or those requiring special or urgent travel or accommodations, may incur additional charges.
2. In times of special circumstances (i.e. pandemic/national emergencies) additional costs may be incurred.
3. A minimum booking of 40 hours (one working week) is required for on-site commissioning, startup or training services on capital projects or additional charges may be applied.
4. Travel time is charged at the applicable service rate. Travel hours begin at the Veolia representative's residence or airport and end at arrival to the hotel or work site, and vice versa.
5. Hours exceeding a 10-hour day or a 40-hour work week may be considered overtime at 1.5 times the above rates. Holiday rates, at 2 times above rates, apply based on US/Canada holidays and/or holidays observed in the country where the work is performed.
6. For extended duration assignments, staff rotations are scheduled on a monthly basis. Site-specific training required by customer will be billed as time worked.
7. Supplies, materials, consumables or services purchased for direct use during service will be charged separately.
8. Average monthly exchange rates will be used to calculate service billed in currencies other than the US dollar.
9. State/provincial taxes, use taxes, withholding taxes and all other taxes are extra where applicable. Buyer is responsible to provide any applicable tax exemption certificates with its purchase order or work order.
10. All services provided are governed by Veolia Water Technologies & Solutions general term and conditions. Additional or conflicting terms contained in purchase orders which authorize work are prohibited and shall not apply except where agreed to in writing.
11. For multiple scheduled or recurring site visits, please request a firm service proposal.
12. These rates are valid through December 31, 2025.

Appendix B

Performance Curve
EL3050 Rotor Type G

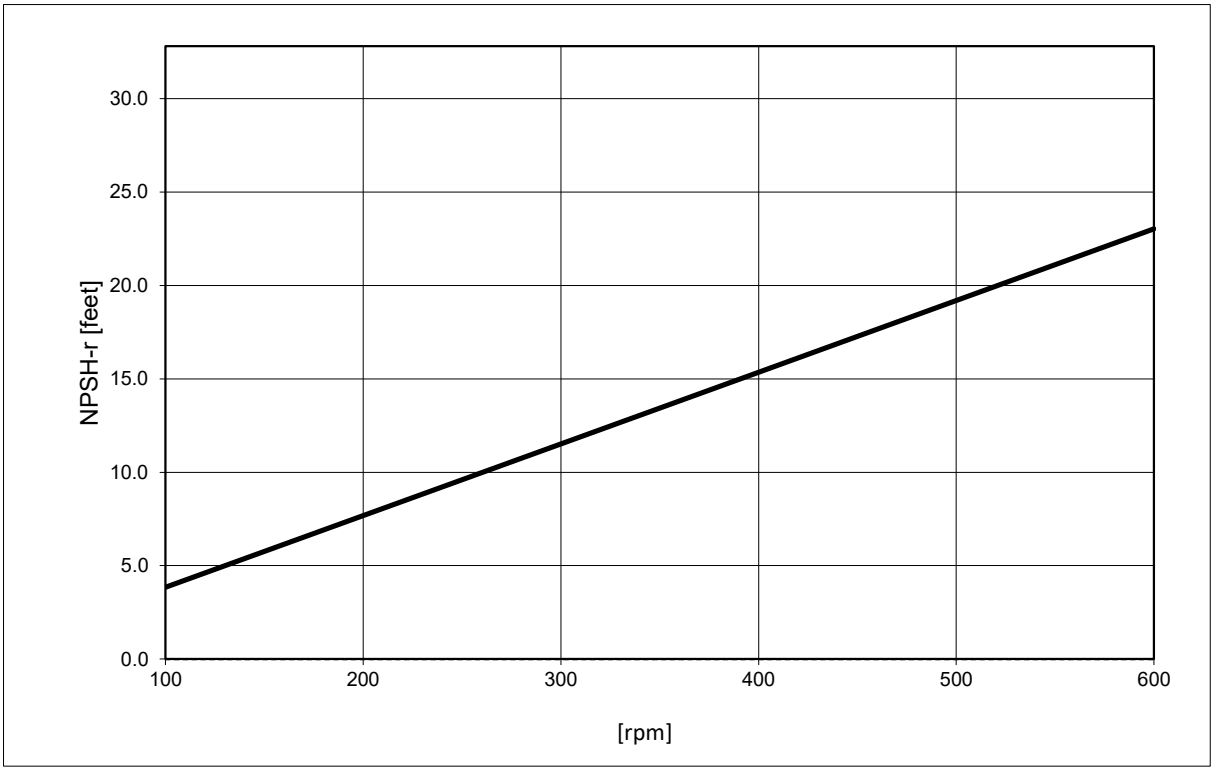




NPSH-Performance Curve

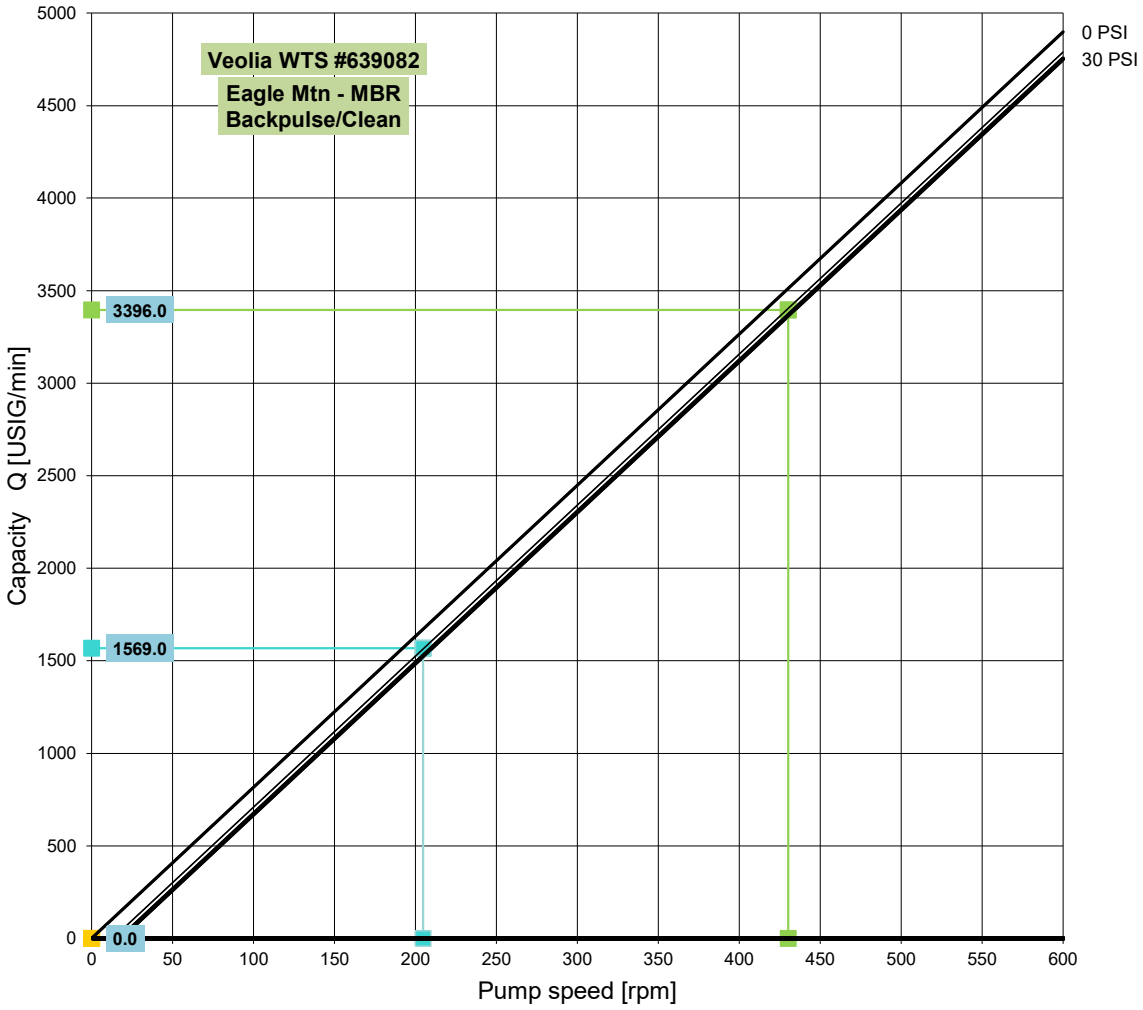
EL3050	G	Kennlinienrechner-JMO-V-2.12

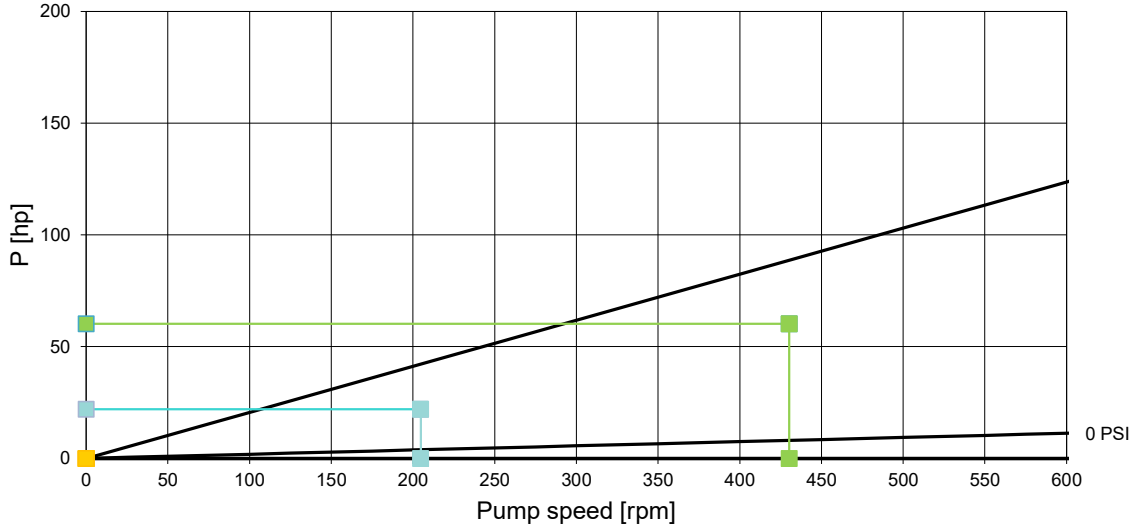
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**3.8**	**7.7**	**11.5**	**15.4**	**19.2**	**23.0**
NPSH-a [feet] OP1= 28.2	24.4	20.5	16.7	12.8	9.0	5.2
NPSH-a [feet] OP2= 28.2	24.4	20.5	16.7	12.8	9.0	5.2
NPSH-a [feet] OP3= 28.2	24.4	20.5	16.7	12.8	9.0	5.2



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible

Performance Curve
EL3050 Rotor Type G





NPSH-Performance Curve

EL3050	G	Kennlinienrechner-JMO-V-2.12

n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**3.8**	**7.7**	**11.5**	**15.4**	**19.2**	**23.0**
NPSH-a [feet] OP1= 28.2	24.4	20.5	16.7	12.8	9.0	5.2
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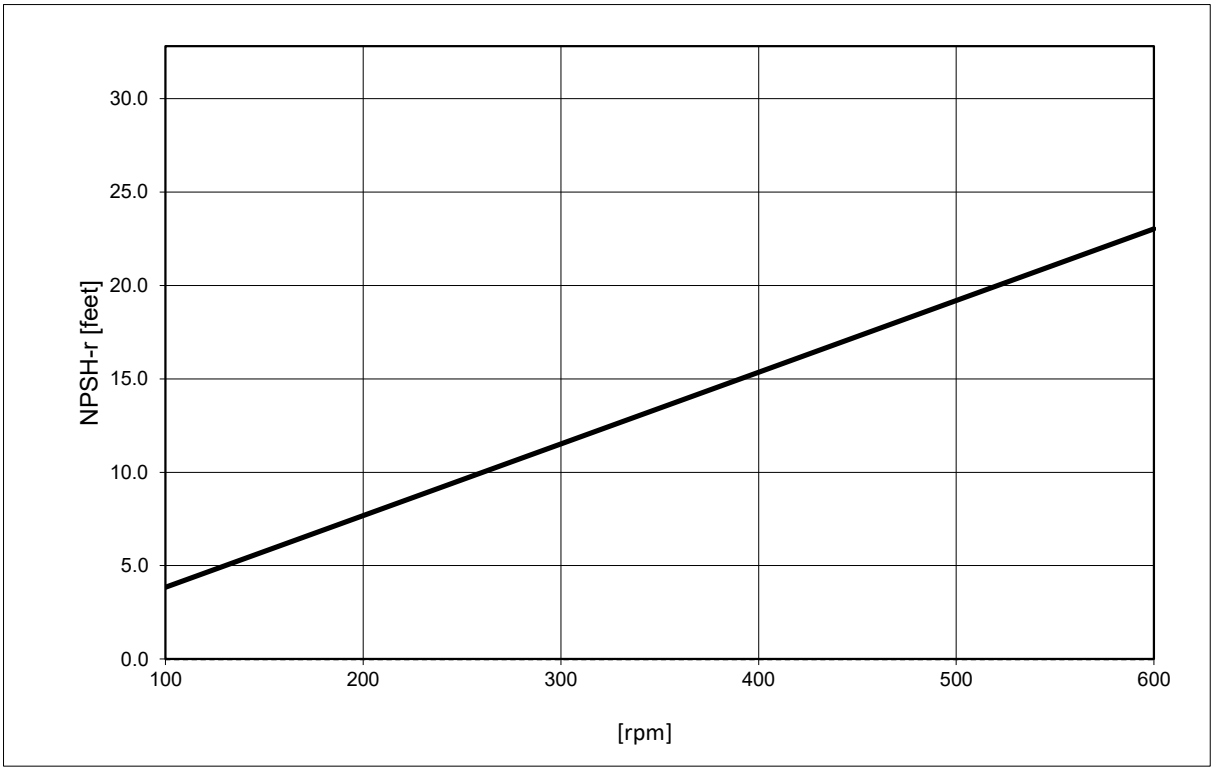
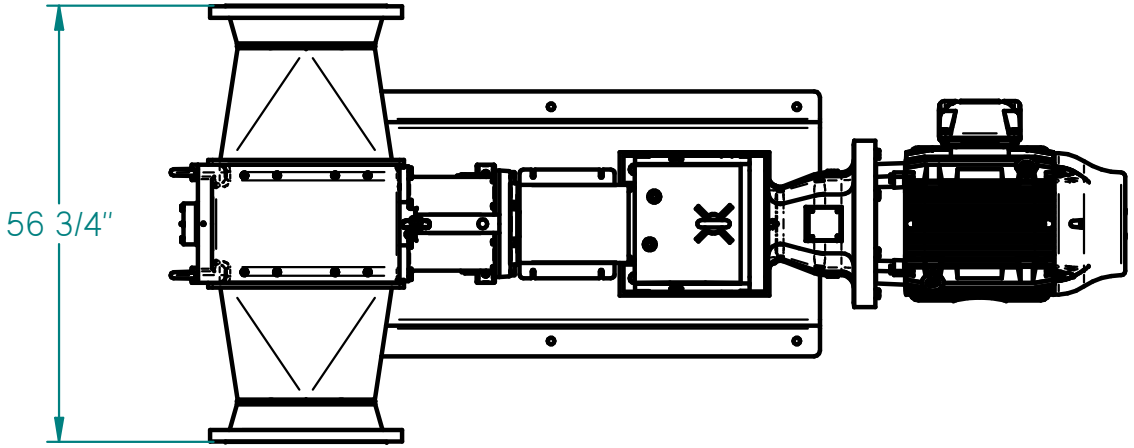
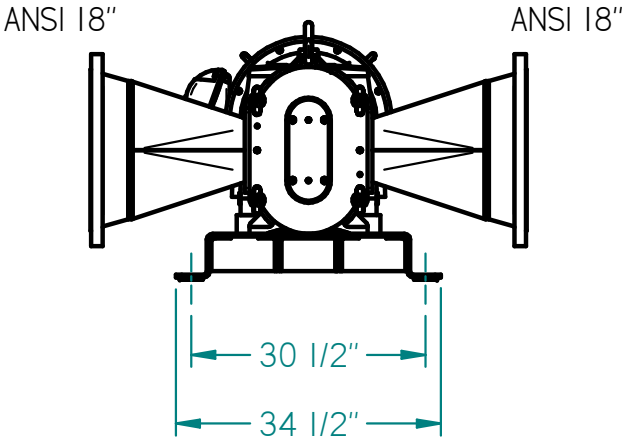
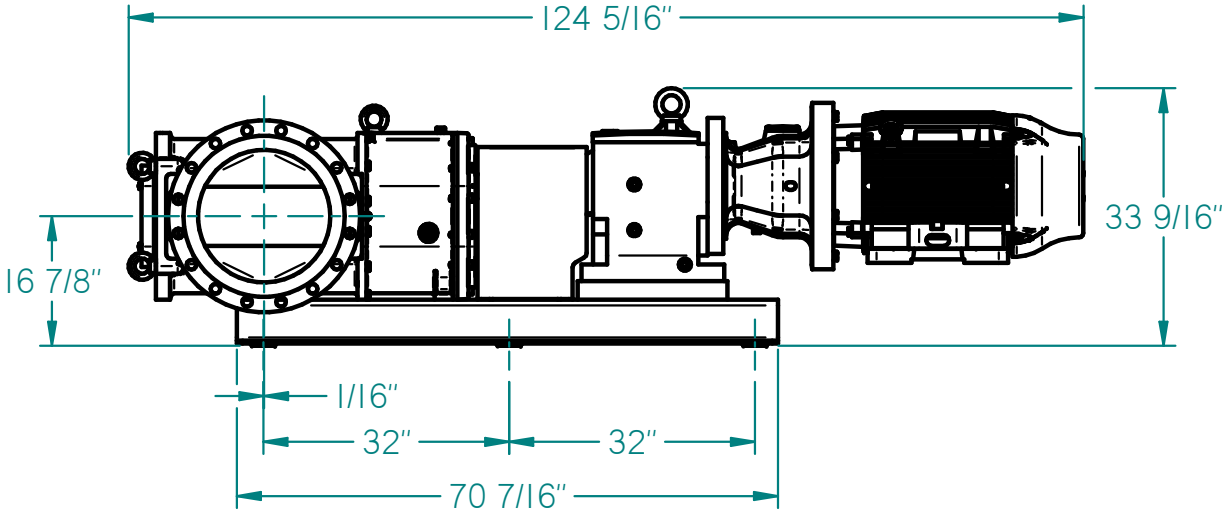


NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible







NOTE:
1. TOTAL WEIGHT = 4,828 LBS

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BOERGER, LLC
2860 Water Tower Place
Chanhassen, MN 55317
TEL: 612-435-7300
FAX: 612-435-7301

THIRD-ANGLE PROJECTION

BÖRGER®

Model: EL 3050
Gear: Nord - In-Line SK82-AN400TC
Power: 100 HP

	NAME	DATE
DRAWN	mlindquist	01/29/26
CHECKED		

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

TOLERANCES ± 1/2"

DO NOT SCALE DRAWING

SHEET 1 OF 1

SIZE	DWG. NO.	REV
A	SD-047-109	0

DATA SHEET

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11431935
		Catalog # :	10018ST3QIE405T-W22

Frame	: 404/5T	Locked rotor time	: 23s (cold) 13s (hot)
Output	: 100 HP (75 kW)	Temperature rise	: 80 K
Frequency	: 60 Hz	Duty cycle	: Cont.(S1)
Rated voltage	: 460 V	Ambient temperature	: -20°C to +40°C
Poles	: 4	Altitude	: 1000 m.a.s.l.
Rated current	: 116 A	Protection degree	: IP56
	: 6.2x(Code G)	Cooling method	: IC411 - TEFC
Rated speed	: 1775 rpm	Mounting	: F-1
Rated torque	: 296 ft.lb	Rotation[1]	: Both (CW and CCW)
Insulation class	: F	Noise level[2]	: 68.0 dB(A)
Service factor	: 1.25	Starting method	: Direct On Line
Moment of inertia (J)	: 29.9 sq.ft.lb	Approx. weight[3]	: 1233 lb
Design	: B		

Output	25%	50%	75%	100%
Efficiency (%)	94.5	95.0	95.0	95.4
Power Factor	0.54	0.77	0.84	0.85

Foundation loads

Max. traction : 1628 lb

Max. compression : 2861 lb

Losses at normative operating points (speed;torque), in percentage of rated output power

P1 (0,9;1,0)	P2 (0,5;1,0)	P3 (0,25;1,0)	P4 (0,9;0,5)	P5 (0,5;0,5)	P6 (0,5;0,25)	P7 (0,25;0,25)
4.6	3.8	3.7	2.0	1.4	0.8	0.5

		Drive end	Non drive end
Bearing type	:	6316 C3	6314 C3
Sealing	:	Inpro/Seal	Inpro/Seal
Lubrication interval	:	10000 h	12000 h
Lubricant amount	:	34 g	27 g
Lubricant type	:	Mobil Polyrex EM	

Notes

This revision replaces and cancel the previous one, which must be eliminated.
(1) Looking the motor from the shaft end.
(2) Measured at 1m and with tolerance of +3dB(A).
(3) Approximate weight subject to changes after manufacturing process.
(4) At 100% of full load.

These are average values based on tests with sinusoidal power supply, subject to the tolerances stipulated in NEMA MG-1.

Rev.	Changes Summary	Performed	Checked	Date

Performed by				
Checked by			Page	Revision
Date	02/02/2026		1 / 5	

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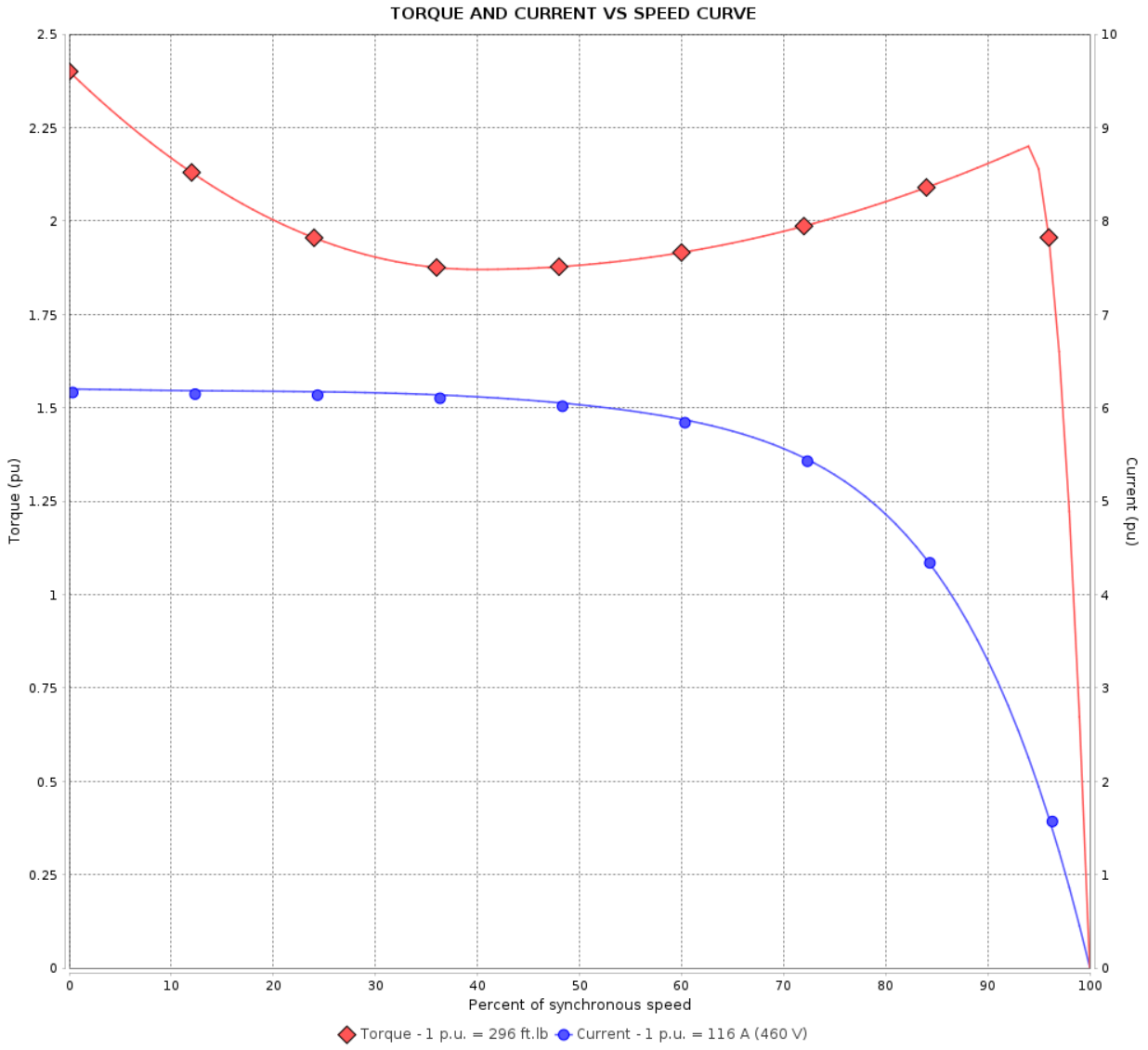
Subject to change without notice

TORQUE AND CURRENT VS SPEED CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11431935
		Catalog # :	10018ST3QIE405T-W22



Performance	: 460 V 60 Hz 4P

Rated current	: 116 A	Moment of inertia (J)	: 29.9 sq.ft.lb
LRC	: 6.2	Duty cycle	: Cont.(S1)
Rated torque	: 296 ft.lb	Insulation class	: F
Locked rotor torque	: 240 %	Service factor	: 1.25
Breakdown torque	: 220 %	Duty cycle	: Cont.(S1)
Rated speed	: 1775 rpm		

Locked rotor time : 23s (cold) 13s (hot)

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Checked by			Page	Revision
Date	02/02/2026		2 / 5	

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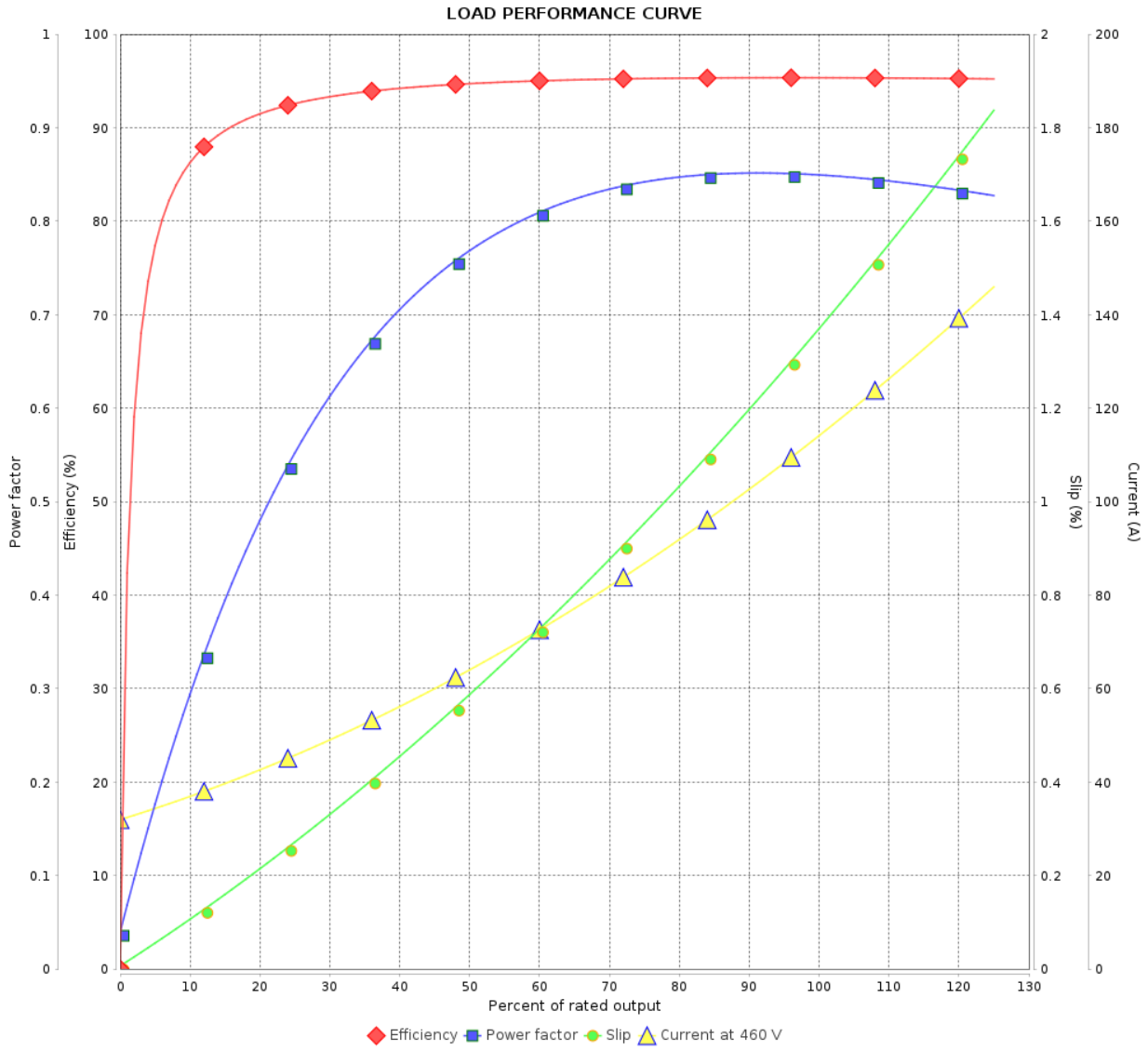
LOAD PERFORMANCE CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11431935
		Catalog # :	10018ST3QIE405T-W22



Rev.	Changes Summary	Performed	Checked	Date

Performed by				
Checked by			Page	Revision
Date	02/02/2026		3 / 5	

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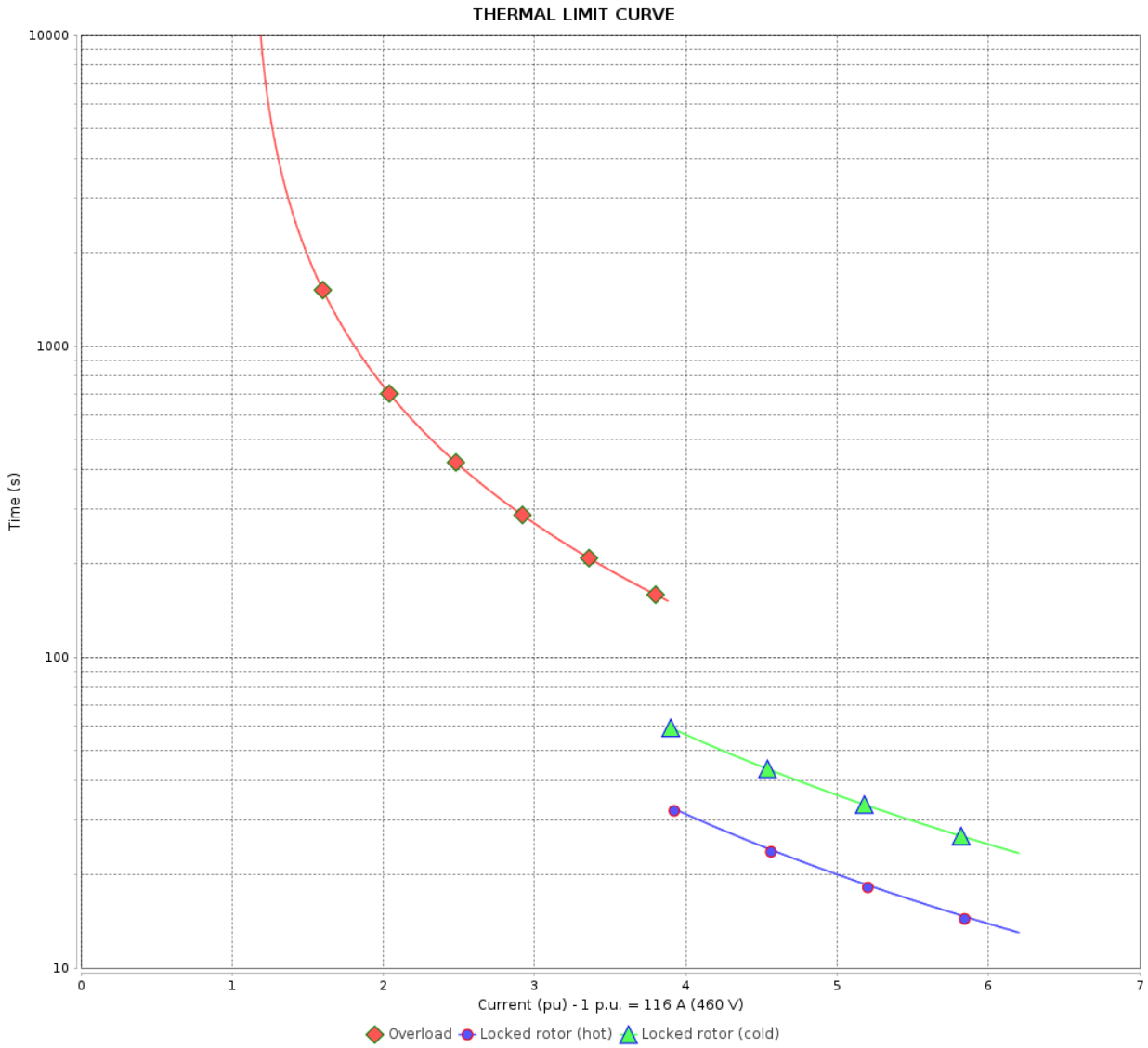
THERMAL LIMIT CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11431935
		Catalog # :	10018ST3QIE405T-W22



Heating constant

Cooling constant

Rev.	Changes Summary	Performed	Checked	Date

Performed by				
Checked by			Page	Revision
Date	02/02/2026		4 / 5	

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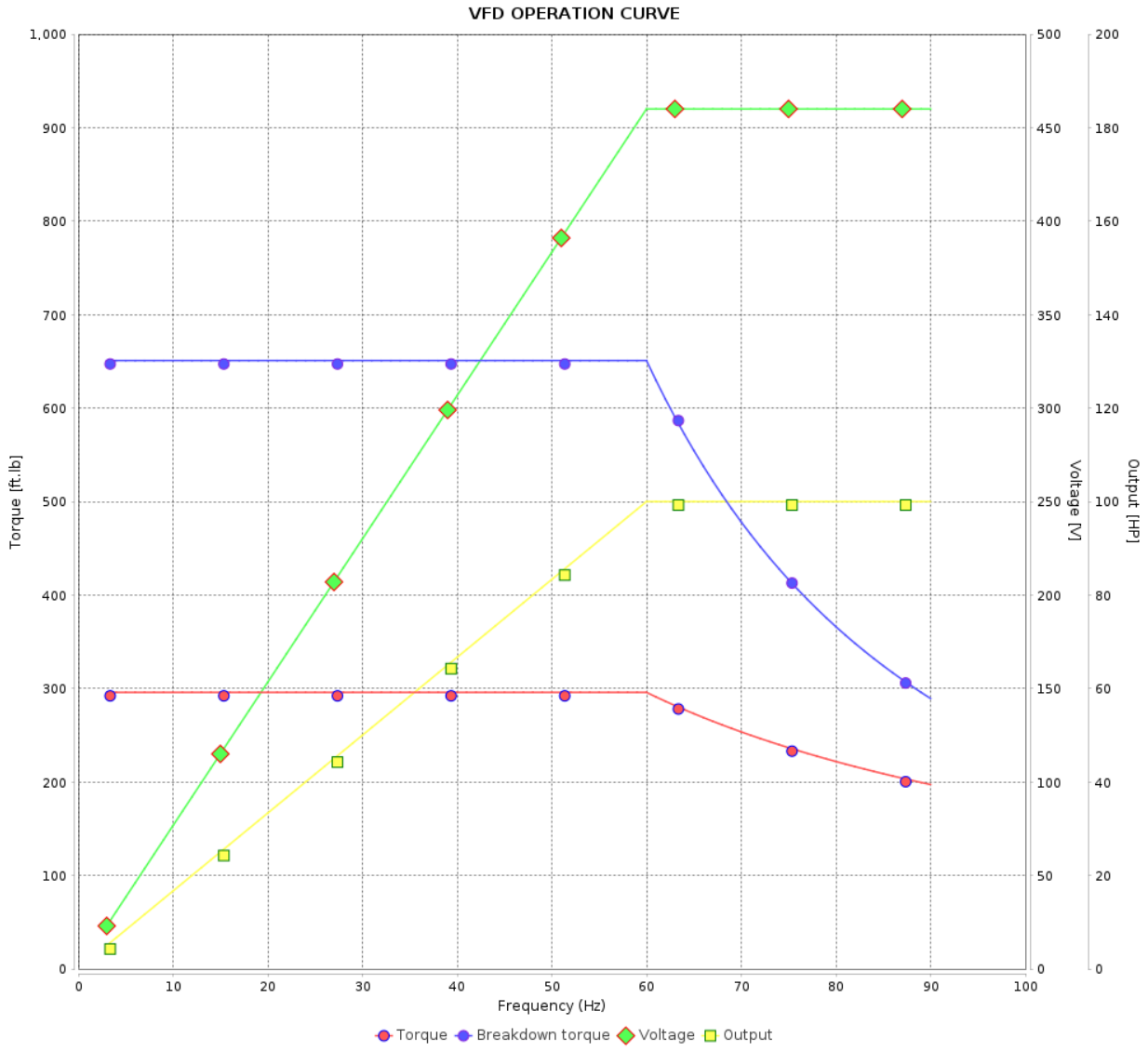
Subject to change without notice

VFD OPERATION CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11431935
		Catalog # :	10018ST3QIE405T-W22



Rev.	Changes Summary	Performed	Checked	Date

Performed by				
Checked by			Page	Revision
Date	02/02/2026		5 / 5	

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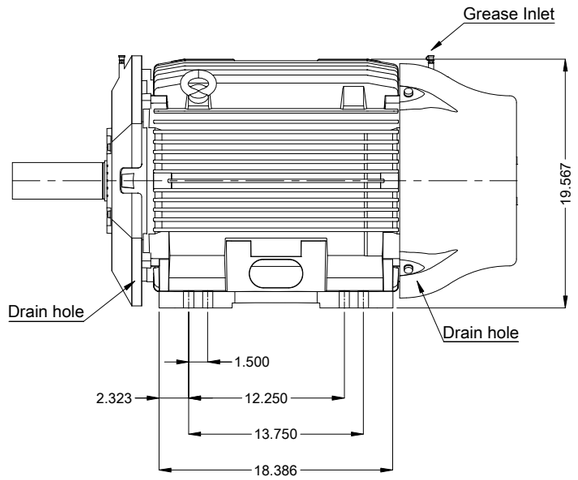
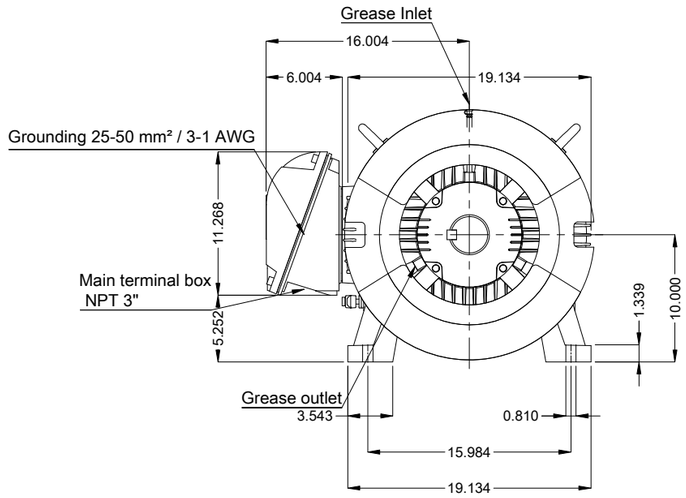
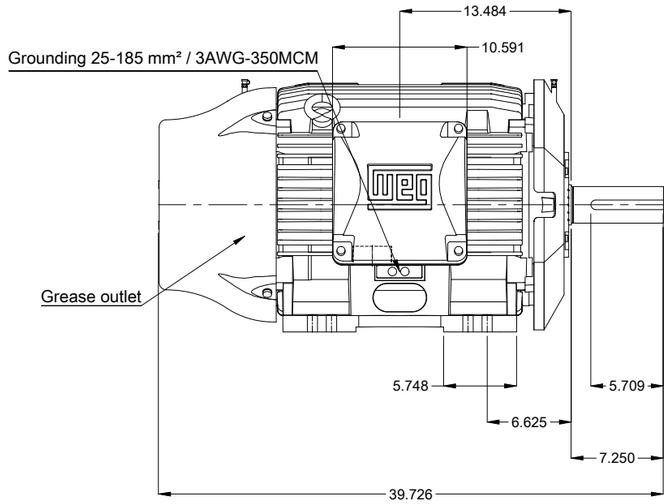
Subject to change without notice

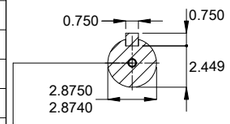






Without vertical jackscrews
Grease outlet on endshields
Drive-End Air Deflector
Color RAL 5009
Painting plan 222E
Mounting B3R(D)

DE Shaft End



DUNC 3/4"-10 WEG WPR-7339

100 HP 04 Poles 60 Hz | A

Scale 1 : 12

ECM	LOC	SUMMARY OF MODIFICATIONS	EXECUTED	CHECKED	RELEASED	DATE	VER
			HYBRISUSER				00

EXECUTED	HYBRISUSER
CHECKED	
RELEASED	
REL. DATE	

THREE PH. MOTOR IEEE 841 W22 NEMA PREM. EFF.
FRAME 404/5T IP56 TEFC

PREVIEW

WDD | 00

SHEET 1 / 1

Dimensions in inches

A3

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MADE IN BRAZIL
11431935

MODEL 10018ST3QIE405T-W22

Inverter Duty Motor
Severe Duty
IEEE 841-2021

PH3 60Hz	Fr. 404/5T 1000m.a.s.l.	IP56 TEFC	1221lb
V 460		A 116	
HP 100		kW 75	
SF 1.25		SFA 145	
RPM 1775		PF 0.85	
AMB 40°C		INS cl. F DT80K	NEMA NOM EFF 95.4%
DUTY CONT.		DES B Code G	GUARANT. EFF 94.5%

FOR SAFE AREA
Mod.TE1BF0XON
CC029A

Class I, Div 2, Gr A, B, C, D, 1.15SF - T3
Class I, Zone 2, IIC, 1.15SF - T3
Class II, Div 2, Gr F, G - T4
For use on PWM: Gr. A, B, C, D, F,
VT 1000:1, CT 20:1, 1.00SF - T3A

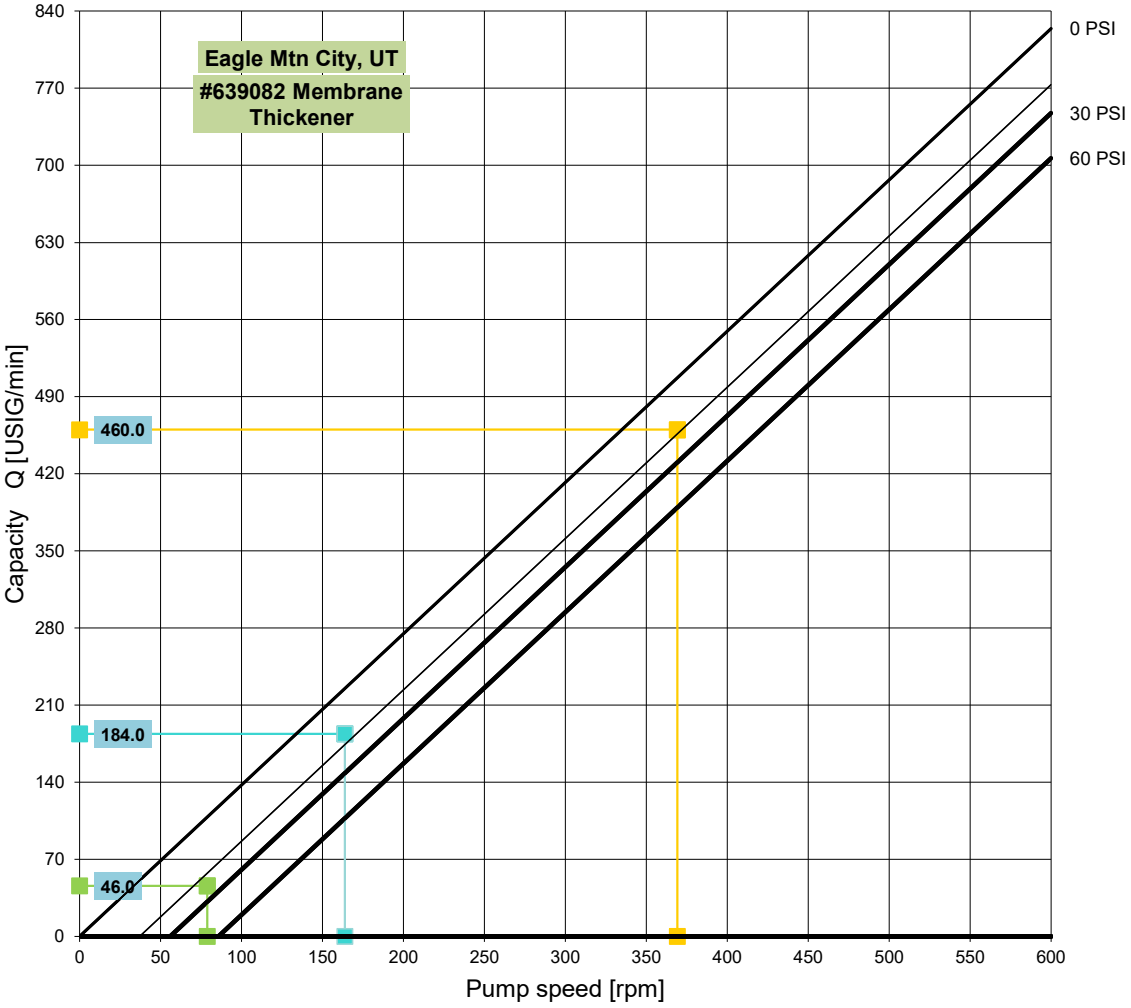
T1 T2 T3
L1 L2 L3

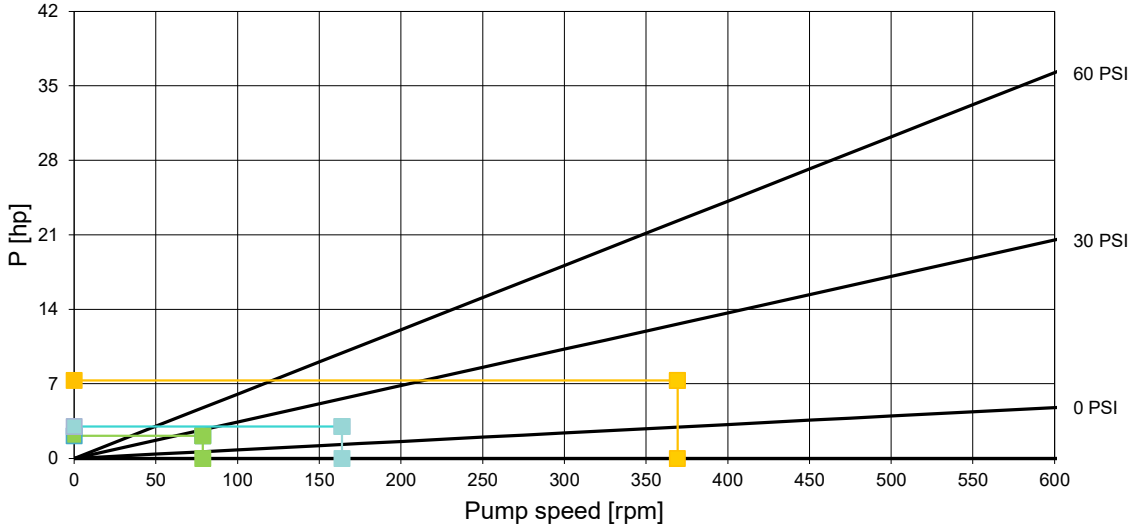
460V

→ 6316-C3 80BC03X30 (34g)
→ 6314-C3 70BC03X30 (27g)

MOBIL POLYREX EM (10000h)

Performance Curve
CL520 Rotor Type G

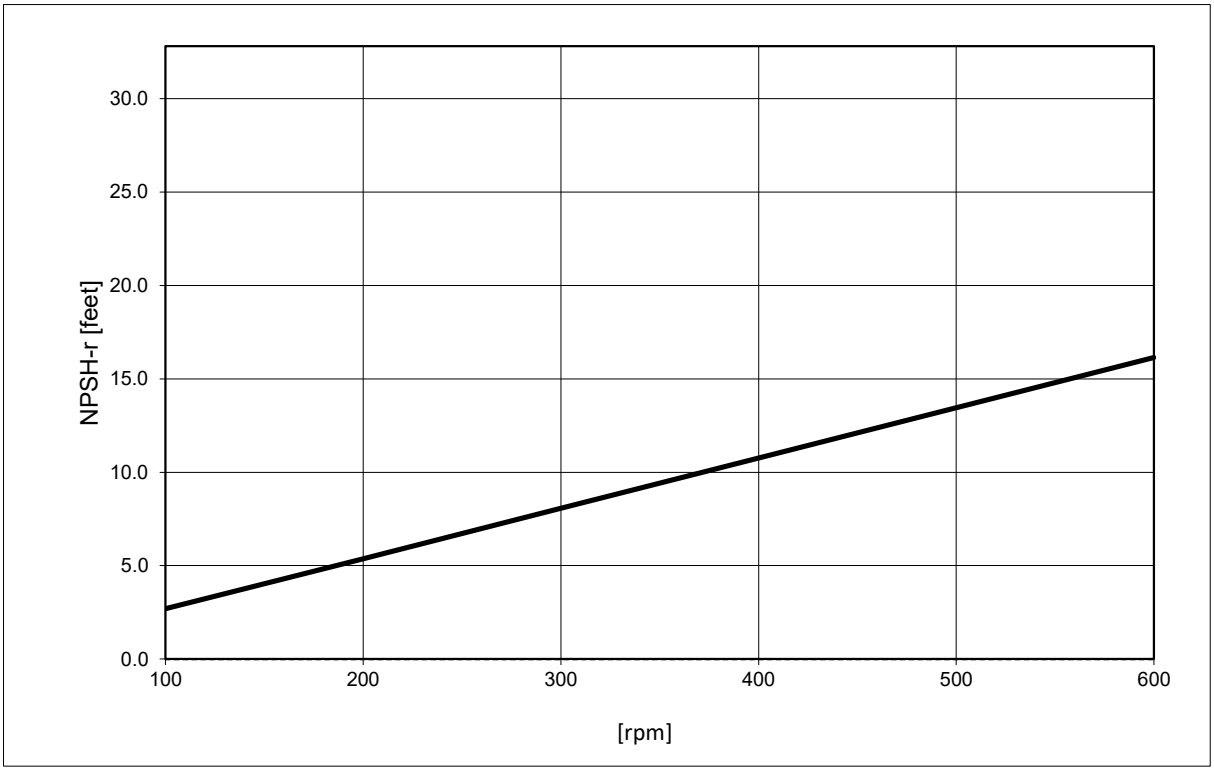




NPSH-Performance Curve

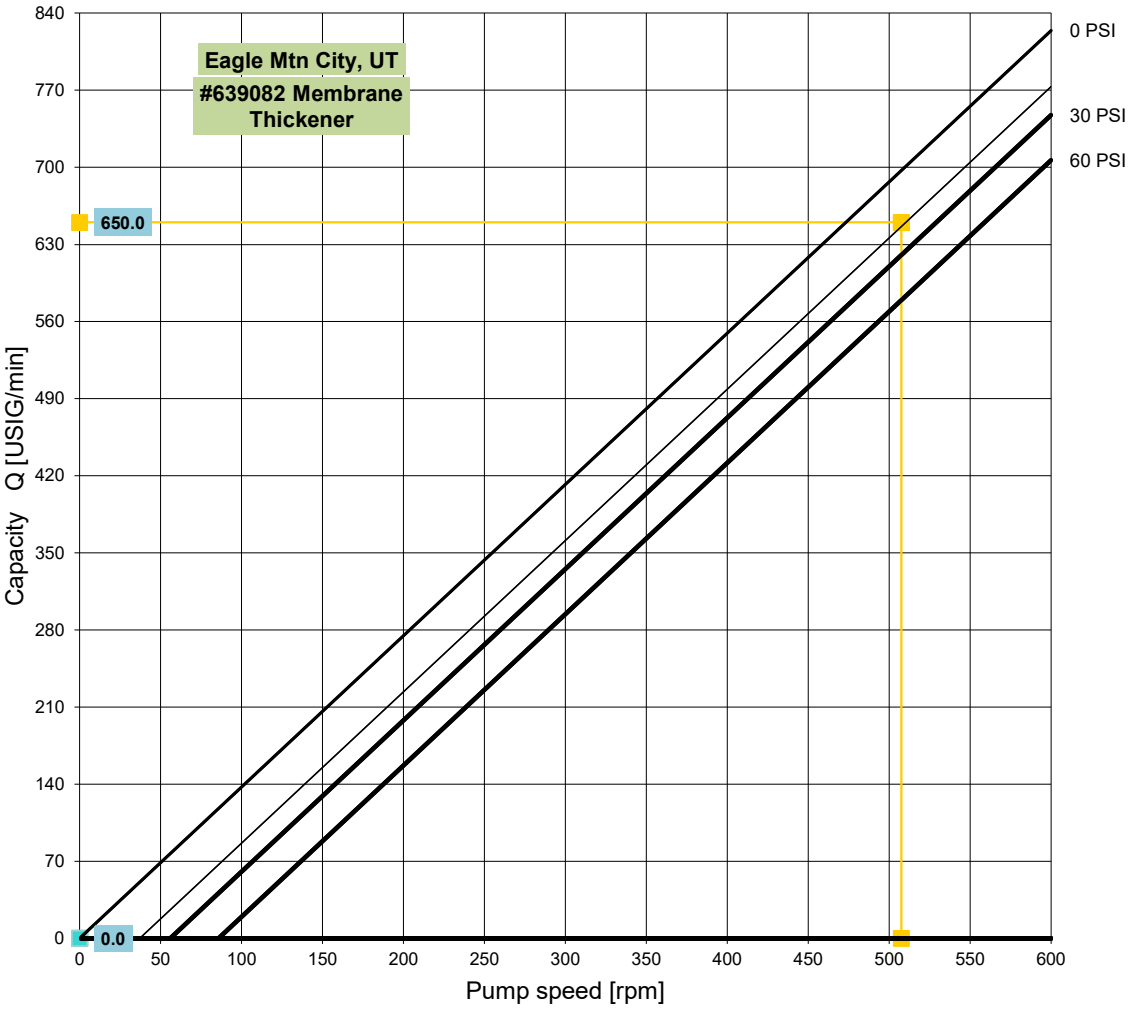
CL520	G	Kennlinienrechner-JMO-V-2.12

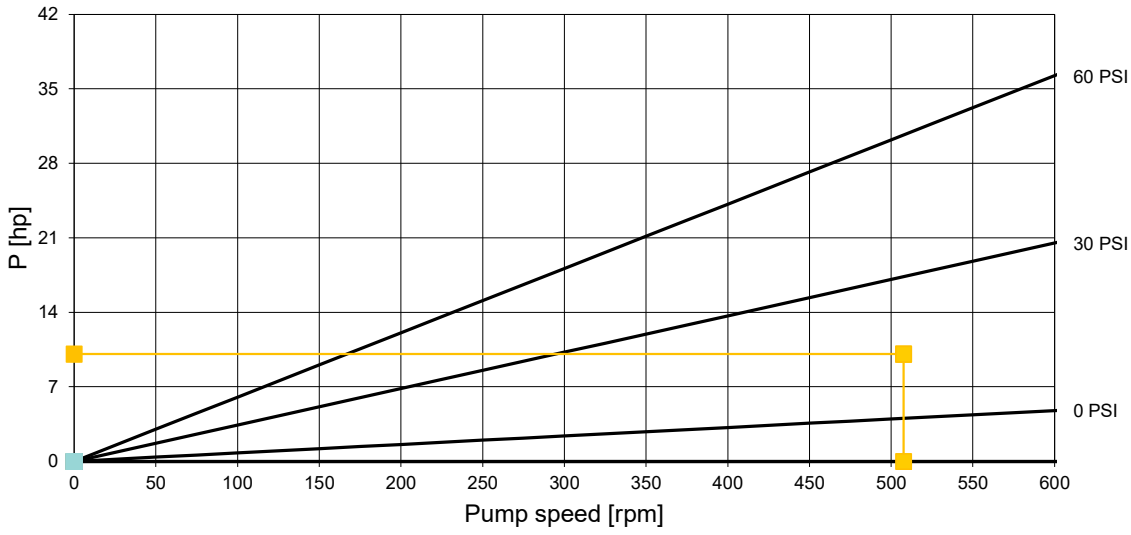
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**2.7**	**5.4**	**8.1**	**10.8**	**13.4**	**16.1**
NPSH-a [feet] OP1= 32.8	30.1	27.4	24.7	22.0	19.4	16.7
NPSH-a [feet] OP2= 32.8	30.1	27.4	24.7	22.0	19.4	16.7
NPSH-a [feet] OP3= 32.8	30.1	27.4	24.7	22.0	19.4	16.7



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible

Performance Curve
CL520 Rotor Type G

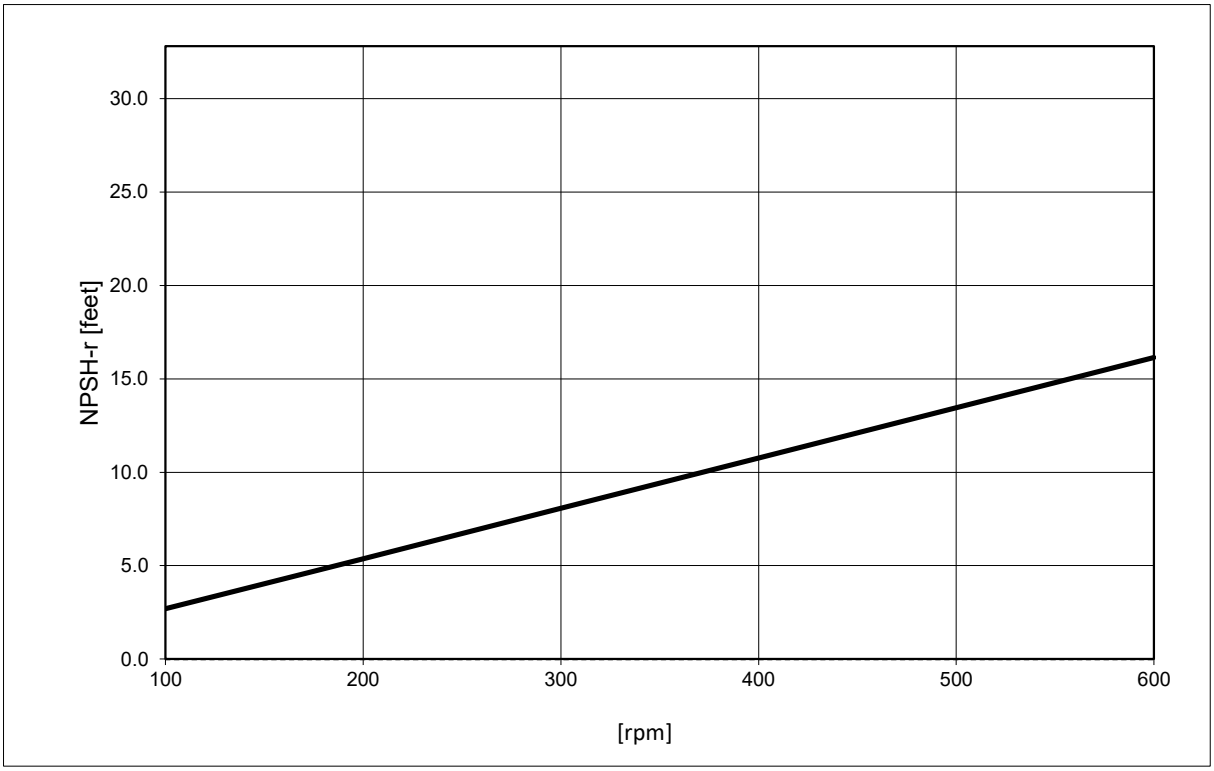




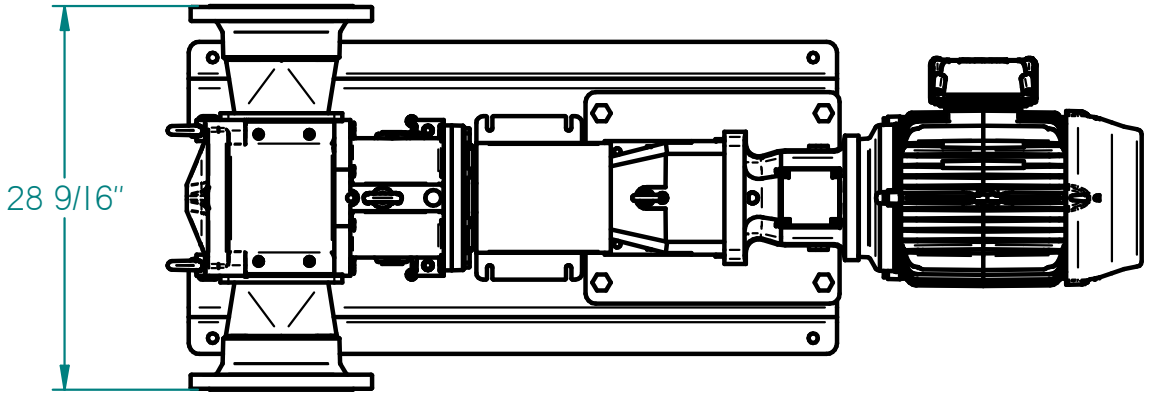
NPSH-Performance Curve

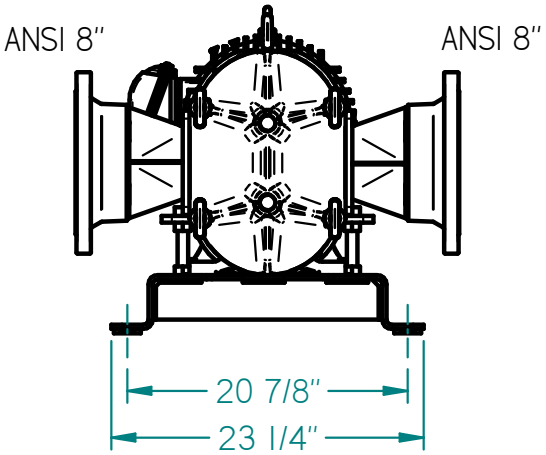
CL520	G	Kennlinienrechner-JMO-V-2.12

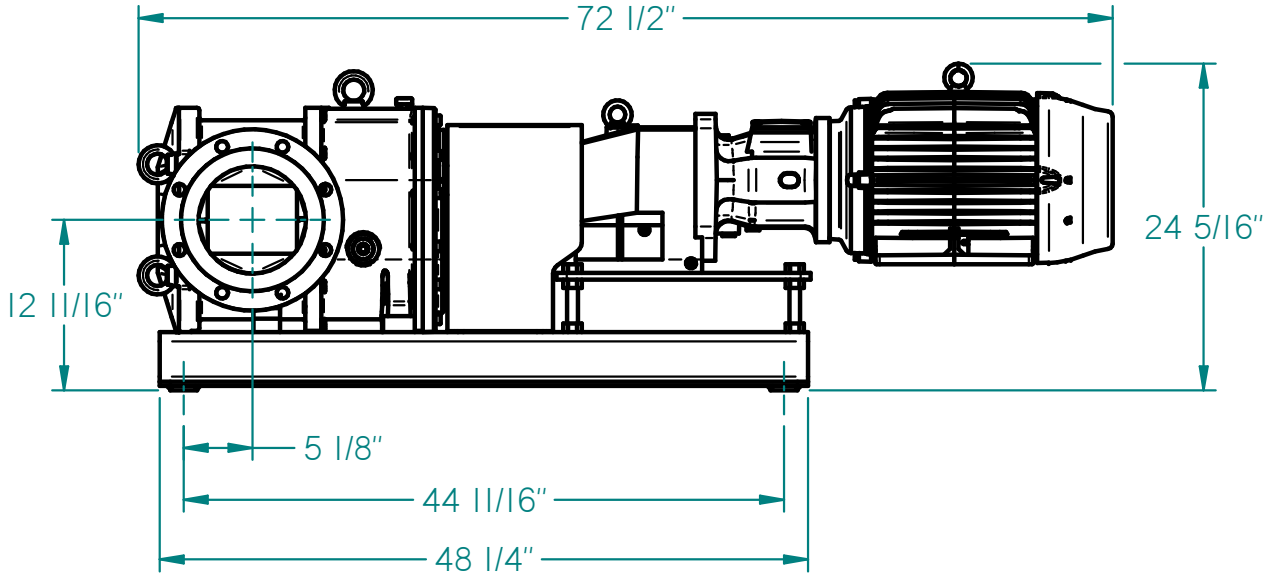
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**2.7**	**5.4**	**8.1**	**10.8**	**13.4**	**16.1**
NPSH-a [feet] OP1= 32.8						
NPSH-a [feet] OP2= 32.8						
NPSH-a [feet] OP3= 32.8	30.1	27.4	24.7	22.0	19.4	16.7



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible







NOTE:
1. TOTAL WEIGHT = 1,288 LBS

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BOERGER, LLC
2860 Water Tower Place
Chanhassen, MN 55317
TEL: 612-435-7300
FAX: 612-435-7301

THIRD-ANGLE PROJECTION

BÖRGER®

Model: CL 520
Gear: Nord - In-Line SK42-AN250TC
Power: 20 HP

	NAME	DATE
DRAWN	mlindquist	01/29/26
CHECKED		

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED
TOLERANCES ± 1/2"
DO NOT SCALE DRAWING

SHEET 1 OF 1

SIZE	DWG. NO.	REV
A	SD-047-112	0

DATA SHEET

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11460176
		Catalog # :	02018ST3QIE256TC-W22

Frame	: 254/6TC	Locked rotor time	: 41s (cold) 23s (hot)
Output	: 20 HP (15 kW)	Temperature rise	: 80 K
Frequency	: 60 Hz	Duty cycle	: Cont.(S1)
Rated voltage	: 460 V	Ambient temperature	: -20°C to +40°C
Poles	: 4	Altitude	: 1000 m.a.s.l.
Rated current	: 24.1 A	Protection degree	: IP56
	: 6.5x(Code G)	Cooling method	: IC411 - TEFC
Rated speed	: 1770 rpm	Mounting	: F-1
Rated torque	: 59.3 ft.lb	Rotation[1]	: Both (CW and CCW)
Insulation class	: F	Noise level[2]	: 64.0 dB(A)
Service factor	: 1.25	Starting method	: Direct On Line
Moment of inertia (J)	: 3.10 sq.ft.lb	Approx. weight[3]	: 345 lb
Design	: B		

Output	50%	75%	100%
Efficiency (%)	91.7	92.4	93.0
Power Factor	0.68	0.79	0.84

Foundation loads

Max. traction	: 721 lb
Max. compression	: 1067 lb

Losses at normative operating points (speed;torque), in percentage of rated output power

P1 (0,9;1,0)	P2 (0,5;1,0)	P3 (0,25;1,0)	P4 (0,9;0,5)	P5 (0,5;0,5)	P6 (0,5;0,25)	P7 (0,25;0,25)
7.4	6.4	5.9	3.5	2.4	1.6	1.1

		Drive end	Non drive end
Bearing type	:	6309 C3	6209 C3
Sealing	:	Inpro/Seal	Inpro/Seal
Lubrication interval	:	20000 h	20000 h
Lubricant amount	:	13 g	9 g
Lubricant type	:	Mobil Polyrex EM	

Notes

This revision replaces and cancel the previous one, which must be eliminated.
(1) Looking the motor from the shaft end.
(2) Measured at 1m and with tolerance of +3dB(A).
(3) Approximate weight subject to changes after manufacturing process.
(4) At 100% of full load.

These are average values based on tests with sinusoidal power supply, subject to the tolerances stipulated in NEMA MG-1.

Rev.	Changes Summary	Performed	Checked	Date

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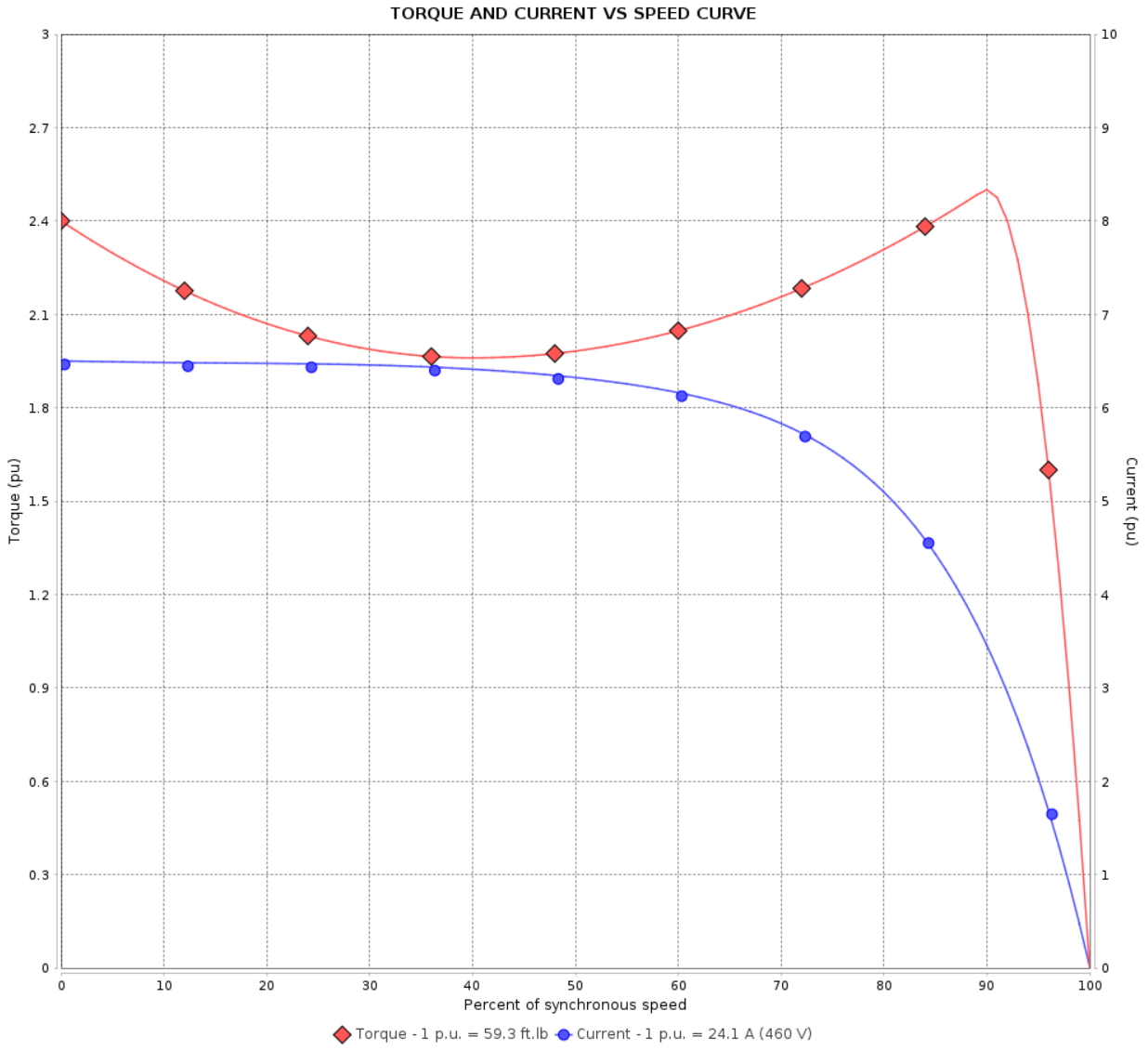
TORQUE AND CURRENT VS SPEED CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11460176
		Catalog # :	02018ST3QIE256TC-W22



Performance	: 460 V 60 Hz 4P

Rated current	: 24.1 A	Moment of inertia (J)	: 3.10 sq.ft.lb
LRC	: 6.5	Duty cycle	: Cont.(S1)
Rated torque	: 59.3 ft.lb	Insulation class	: F
Locked rotor torque	: 240 %	Service factor	: 1.25
Breakdown torque	: 250 %	Duty cycle	: Cont.(S1)
Rated speed	: 1770 rpm		

Locked rotor time : 41s (cold) 23s (hot)

Rev.	Changes Summary	Performed	Checked	Date

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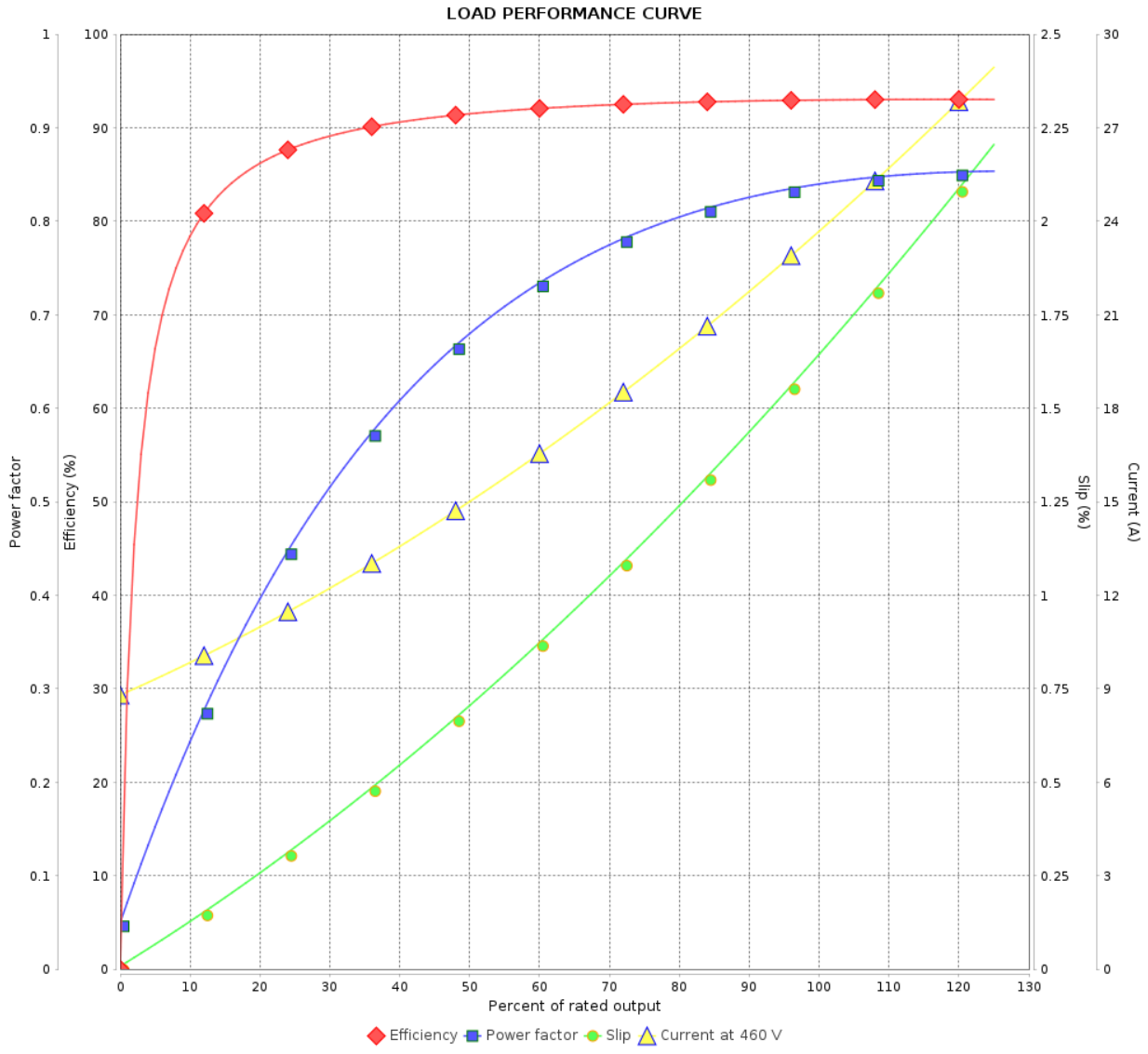
LOAD PERFORMANCE CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11460176
		Catalog # :	02018ST3QIE256TC-W22



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Checked by			Page	Revision
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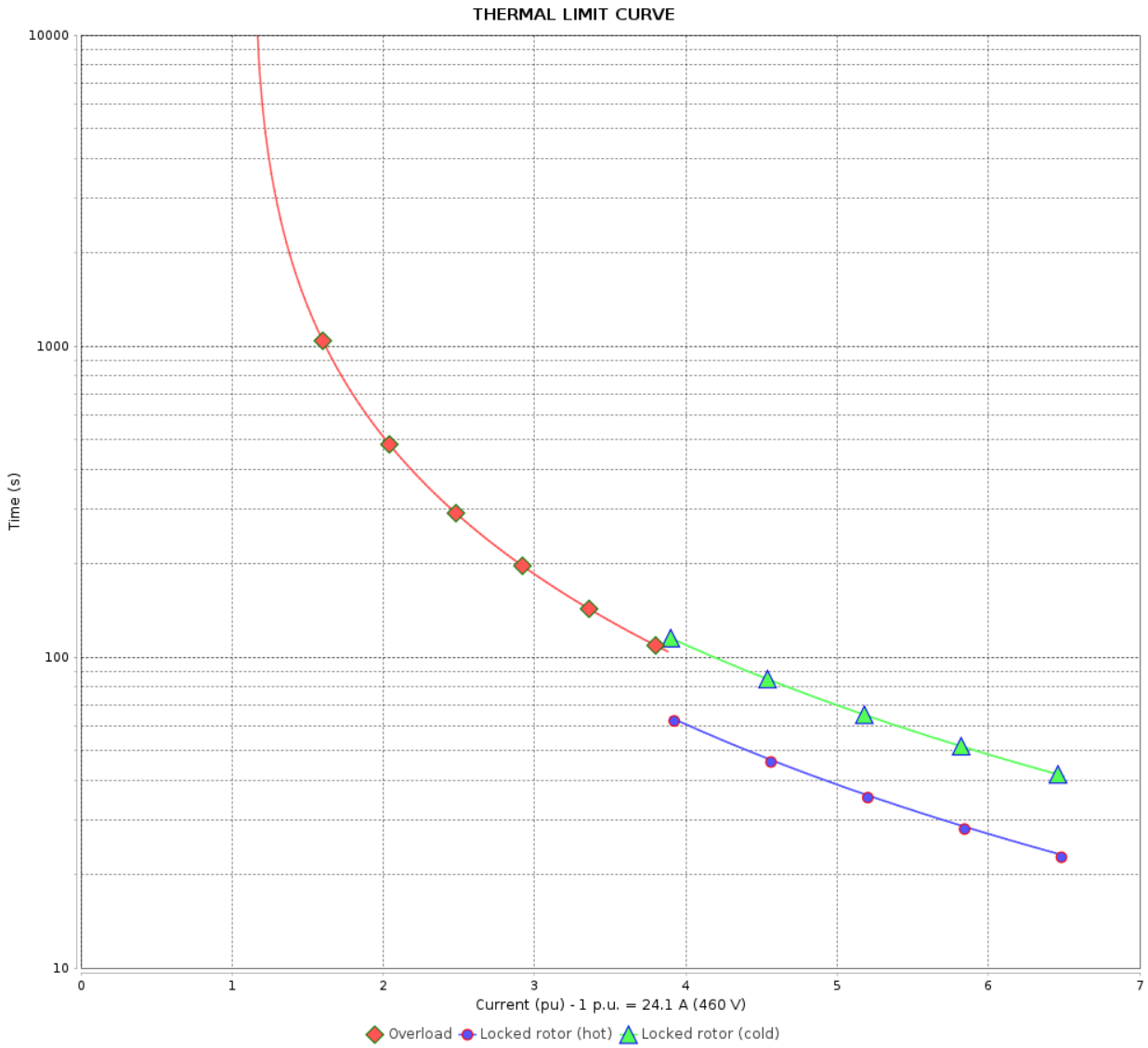
THERMAL LIMIT CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11460176
		Catalog # :	02018ST3QIE256TC-W22



Heating constant

Cooling constant

Rev.	Changes Summary	Performed	Checked	Date

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Checked by			Page	Revision
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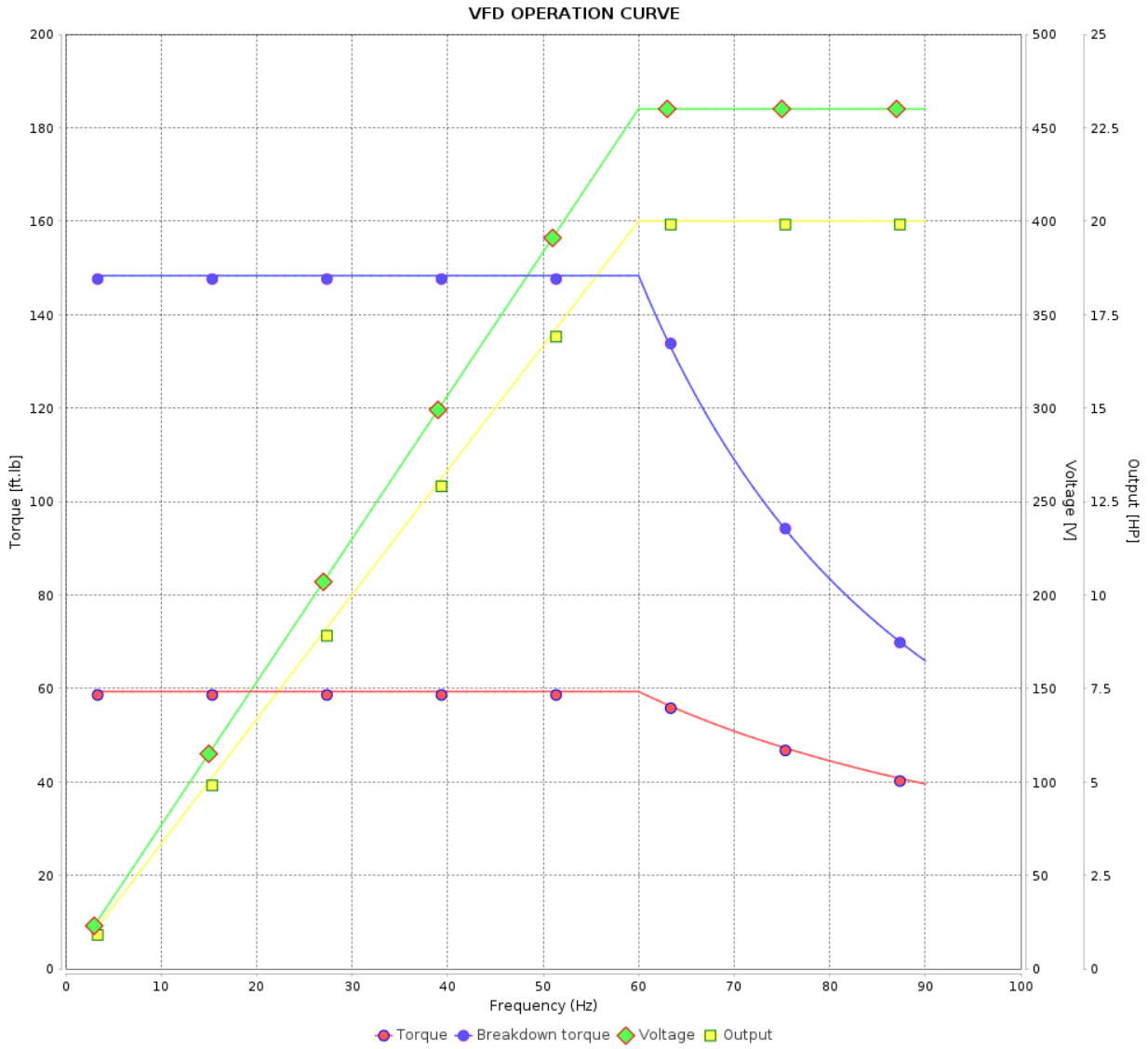
VFD OPERATION CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	11460176
		Catalog # :	02018ST3QIE256TC-W22



Rev.	Changes Summary	Performed	Checked	Date

Performed by				
Checked by			Page	Revision
Date	02/02/2026		5 / 5	

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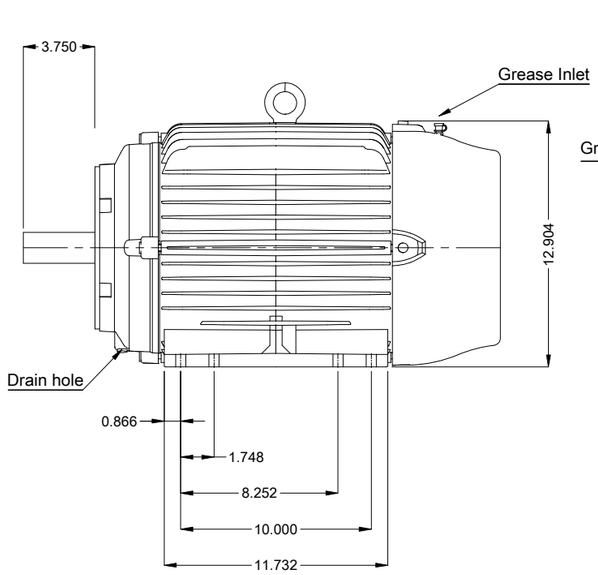
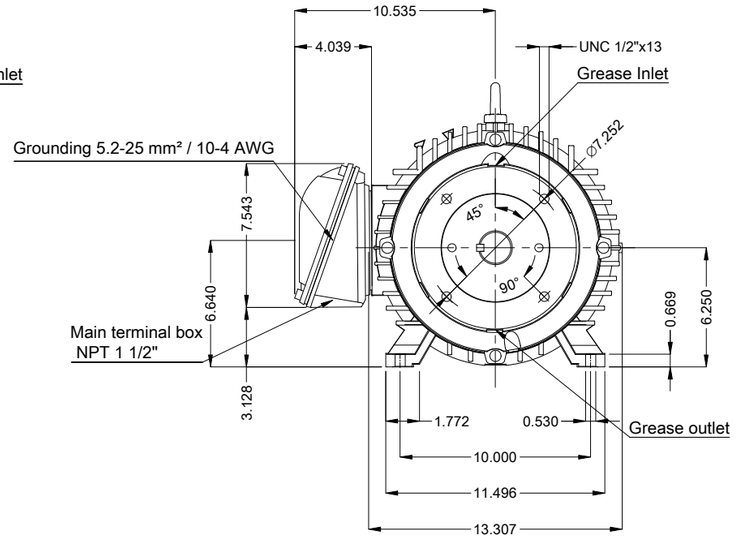
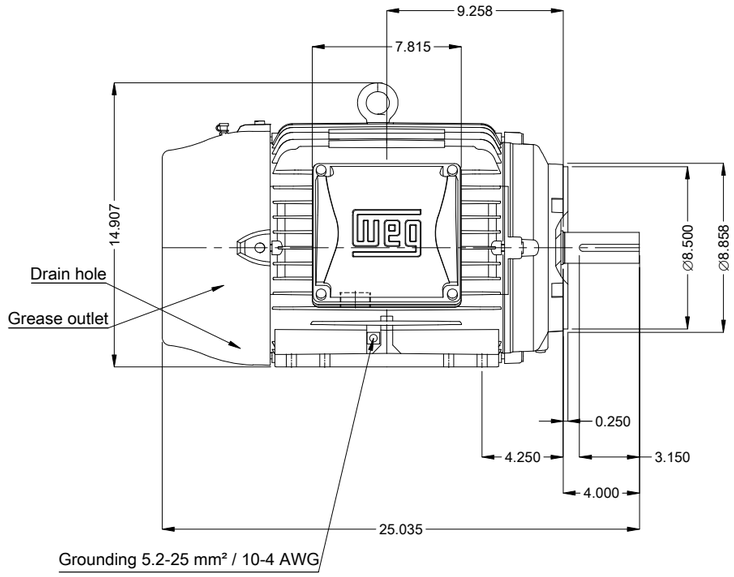
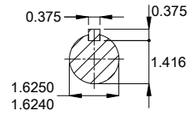






Without vertical jackscrews
Grease outlet on endshields
Color RAL 5009
Painting plan 222E
Mounting B34D

DE Shaft End



20 HP 04 Poles 60 Hz | A

Scale 1 : 8

ECM	LOC	SUMMARY OF MODIFICATIONS	EXECUTED	CHECKED	RELEASED	DATE	VER
			HYBRISUSER				00

EXECUTED	HYBRISUSER
CHECKED	
RELEASED	
REL. DATE	

THREE PH. MOTOR IEEE 841 W22 NEMA PREM. EFF.
FRAME 254/6TC IP56 TEFC

PREVIEW

WDD 00

SHEET 1 / 1

Dimensions in inches

A3

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WEG NEMA PREMIUM W22

MODEL 02018ST3QIE256TC-W22

MADE IN BRAZIL
11460176

Inverter Duty Motor
Severe Duty
IEEE 841-2021

PH3 60Hz	Fr. 254/6TC	1000m.a.s.l.	IP56 TEFC 345lb
V 460		A 24.1	
HP 20		kW 15	
SF 1.25		SFA 30.1	
RPM 1770		PF 0.84	
AMB 40°C		INS cl. F DT80K	NEMA NOM EFF 93.0%
DUTY CONT.		DES B Code G	GUARANT. EFF 91.7%

FOR SAFE AREA
Mod.TE1BFOXON
CC029A

Class I, Div 2, Gr A, B, C, D, 1.15SF - T3
Class I, Zone 2, IIC, 1.15SF - T3
Class II, Div 2, Gr F, G - T4
For use on PWM: Gr. A, B, C, D, F,
VT 1000:1, CT 20:1, 1.00SF - T3A

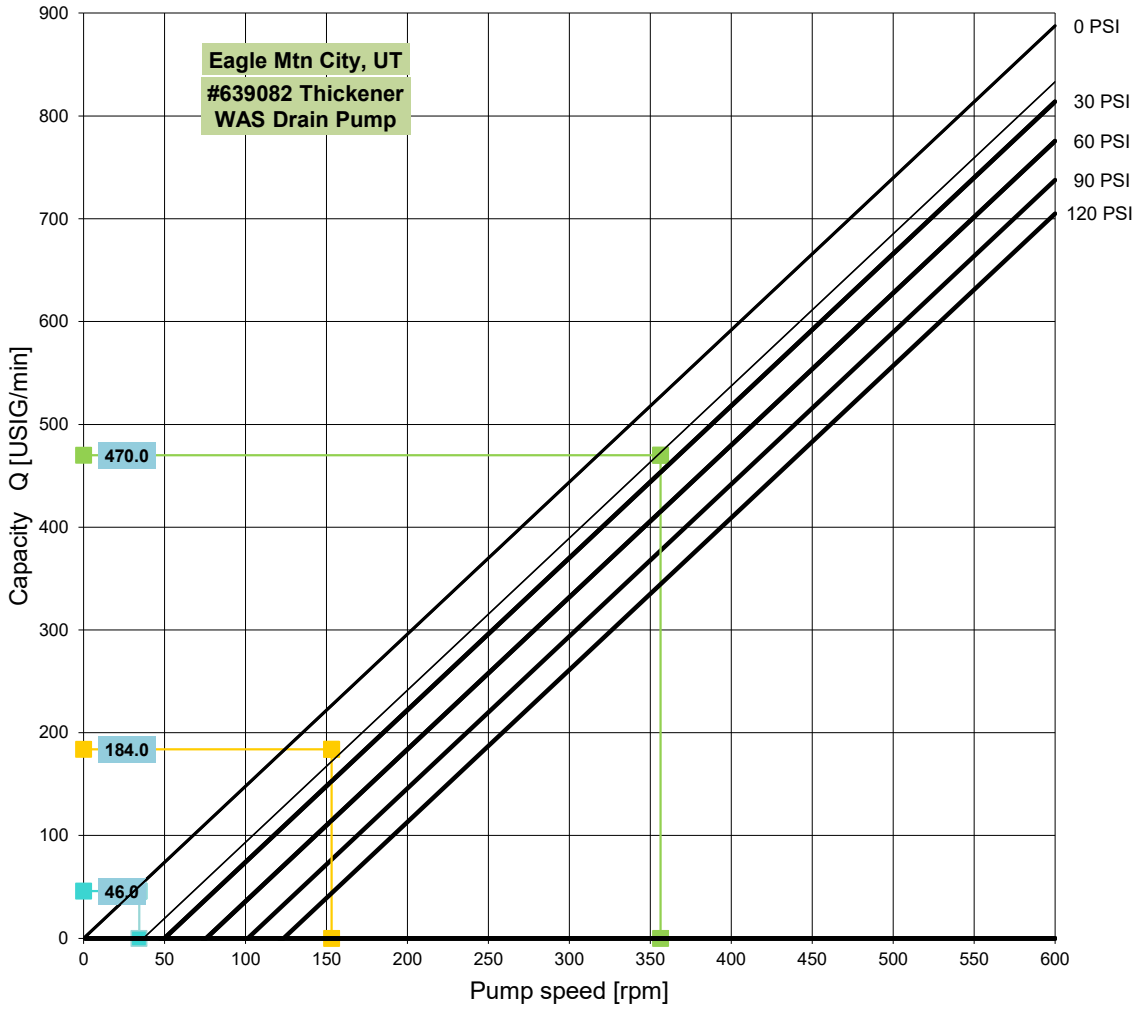
T1 T2 T3
L1 L2 L3

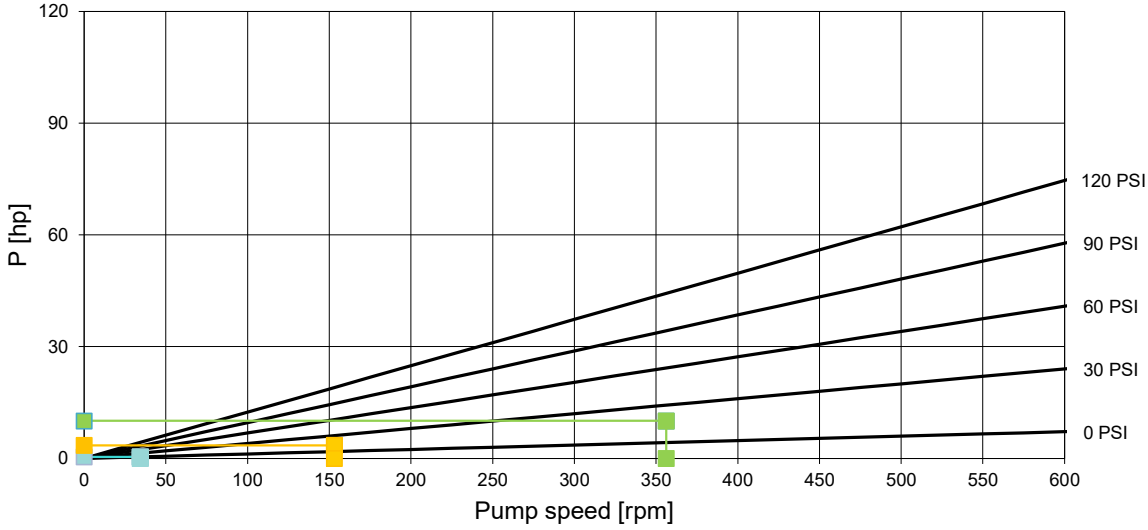
460V

6309-C3 45BC03X30 (13g)
6209-C3 45BC02X30 (9g)

MOBIL POLYREX EM (20000h)

Performance Curve
FL518 Rotor Type G

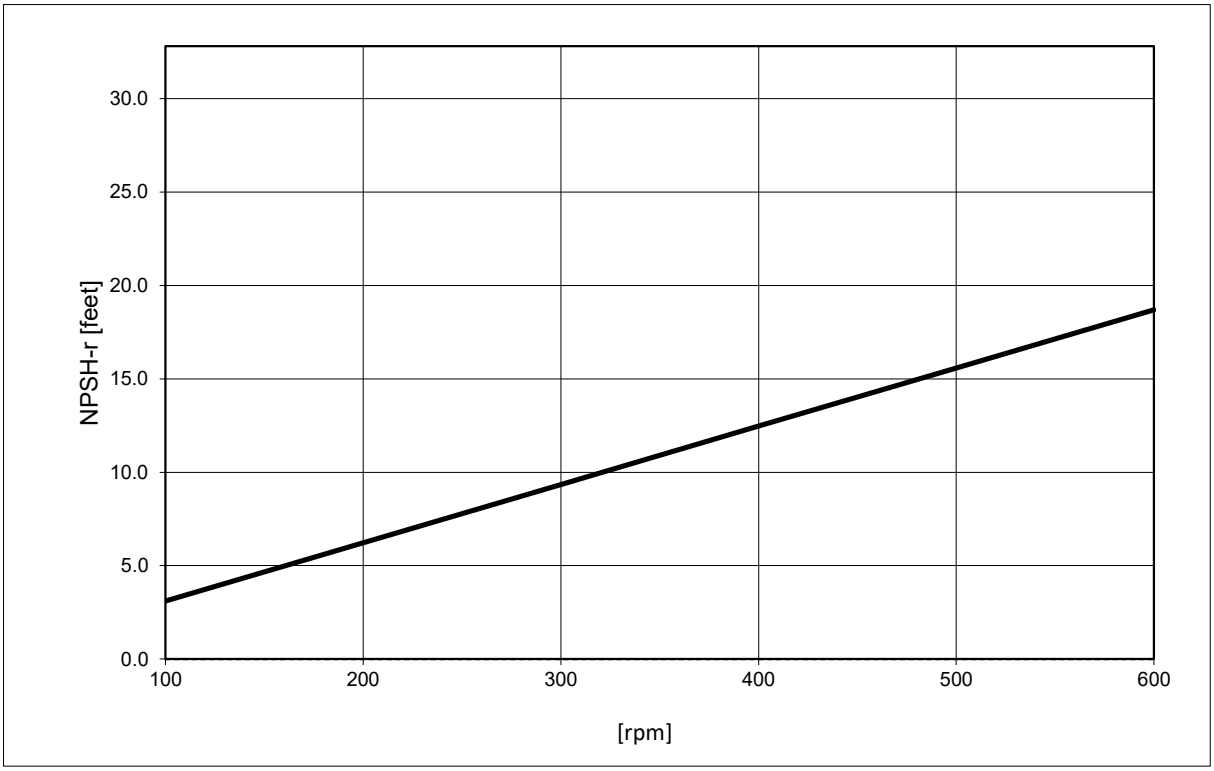




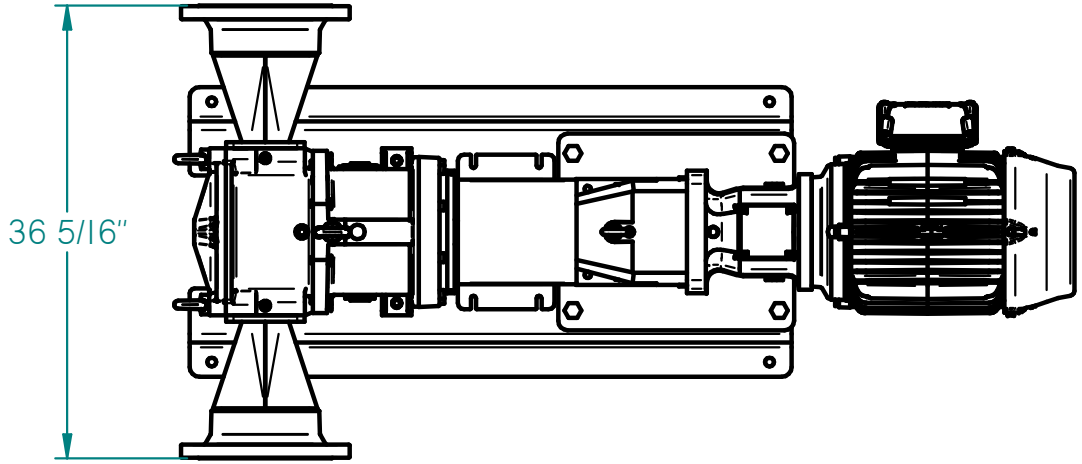
NPSH-Performance Curve

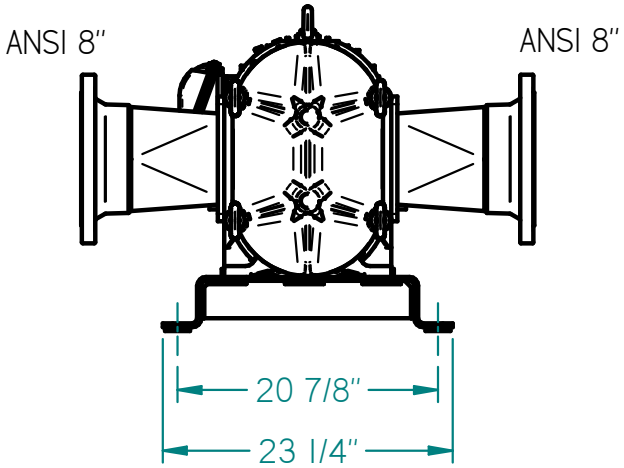
FL518	G	Kennlinienrechner-JMO-V-2.12

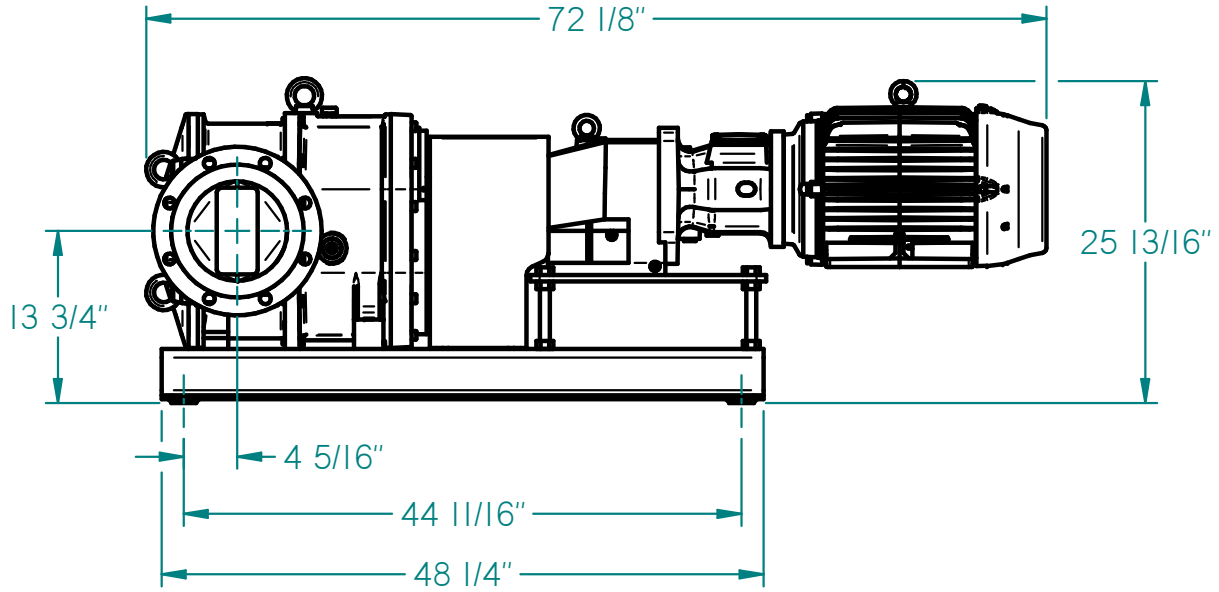
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**3.1**	**6.2**	**9.3**	**12.5**	**15.6**	**18.7**
NPSH-a [feet] OP1= 32.8	29.7	26.6	23.5	20.3	17.2	14.1
NPSH-a [feet] OP2= 32.8	29.7	26.6	23.5	20.3	17.2	14.1
NPSH-a [feet] OP3= 32.8	29.7	26.6	23.5	20.3	17.2	14.1



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible







NOTE:
1. TOTAL WEIGHT = 1,362 LBS

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BOERGER, LLC
2860 Water Tower Place
Chanhassen, MN 55317
TEL: 612-435-7300
FAX: 612-435-7301

THIRD-ANGLE PROJECTION

BÖRGER®

Model: FL 518
Gear: Nord - In-Line SK42-AN250TC
Power: 15 HP

	NAME	DATE
DRAWN	mlindquist	05/02/24
CHECKED		

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED
TOLERANCES ± 1/2"
DO NOT SCALE DRAWING

SHEET 1 OF 1

SIZE	DWG. NO.	REV
A	SD-036-927	0

DATA SHEET

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	12385114
		Catalog # :	01518ST3QIE254TC-W22

Frame	: 254/6TC	Locked rotor time	: 37s (cold) 21s (hot)
Output	: 15 HP (11 kW)	Temperature rise	: 80 K
Frequency	: 60 Hz	Duty cycle	: Cont.(S1)
Rated voltage	: 460 V	Ambient temperature	: -20°C to +40°C
Poles	: 4	Altitude	: 1000 m.a.s.l.
Rated current	: 18.0 A	Protection degree	: IP56
	: 6.4x(Code G)	Cooling method	: IC411 - TEFC
Rated speed	: 1770 rpm	Mounting	: F-1
Rated torque	: 44.5 ft.lb	Rotation[1]	: Both (CW and CCW)
Insulation class	: F	Noise level[2]	: 64.0 dB(A)
Service factor	: 1.25	Starting method	: Direct On Line
Moment of inertia (J)	: 2.62 sq.ft.lb	Approx. weight[3]	: 284 lb
Design	: B		

Output	50%	75%	100%
Efficiency (%)	91.0	91.7	92.4
Power Factor	0.68	0.78	0.83

Foundation loads

Max. traction	: 451 lb
Max. compression	: 735 lb

Losses at normative operating points (speed;torque), in percentage of rated output power

P1 (0,9;1,0)	P2 (0,5;1,0)	P3 (0,25;1,0)	P4 (0,9;0,5)	P5 (0,5;0,5)	P6 (0,5;0,25)	P7 (0,25;0,25)
8.1	7.0	6.5	3.9	2.8	1.8	1.3

		Drive end	Non drive end
Bearing type	:	6309 C3	6209 C3
Sealing	:	Inpro/Seal	Inpro/Seal
Lubrication interval	:	20000 h	20000 h
Lubricant amount	:	13 g	9 g
Lubricant type	:	Mobil Polyrex EM	

Notes

This revision replaces and cancel the previous one, which must be eliminated.
(1) Looking the motor from the shaft end.
(2) Measured at 1m and with tolerance of +3dB(A).
(3) Approximate weight subject to changes after manufacturing process.
(4) At 100% of full load.

These are average values based on tests with sinusoidal power supply, subject to the tolerances stipulated in NEMA MG-1.

Rev.	Changes Summary	Performed	Checked	Date

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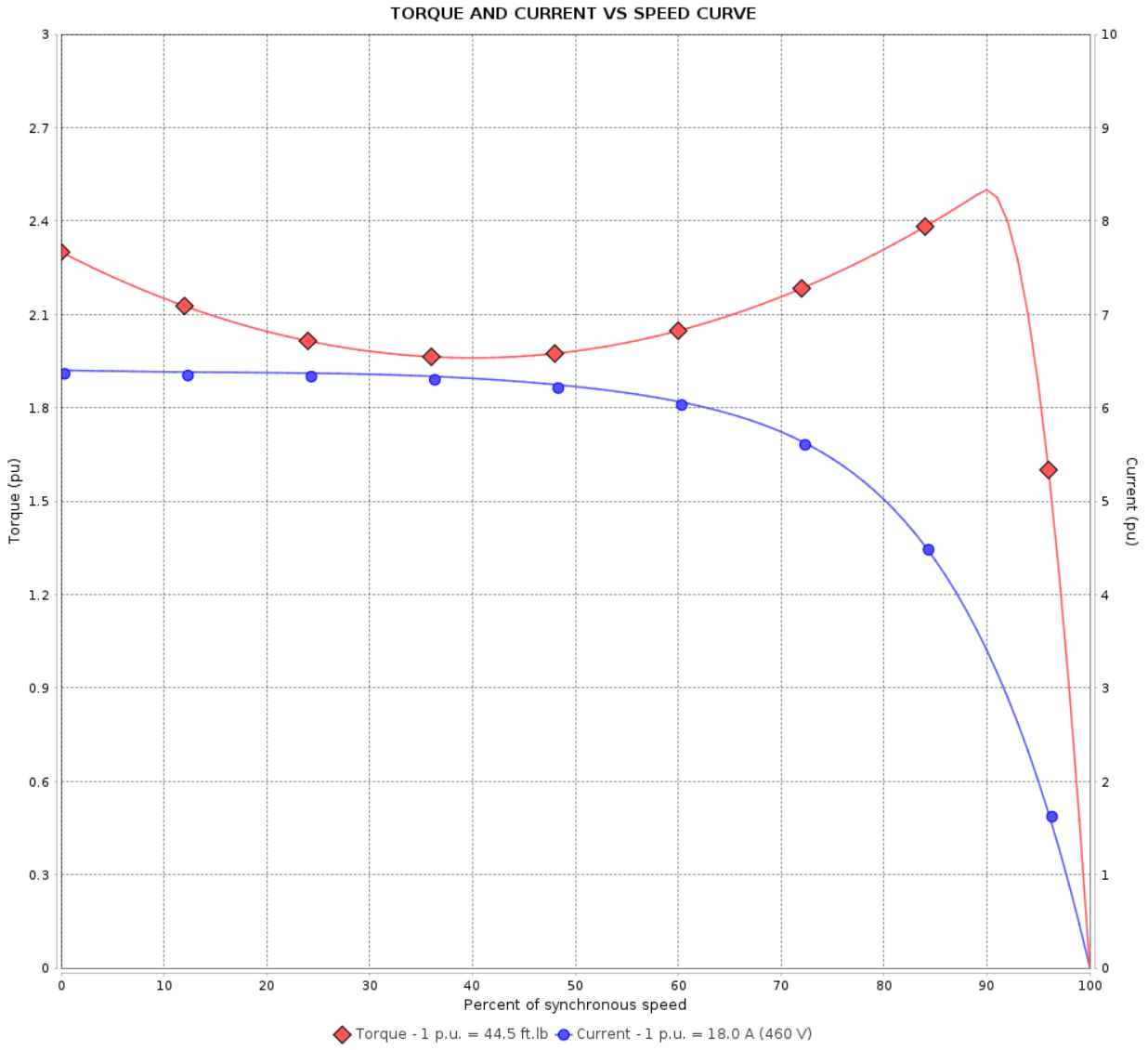
TORQUE AND CURRENT VS SPEED CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	12385114
		Catalog # :	01518ST3QIE254TC-W22



Performance	: 460 V 60 Hz 4P		
Rated current	: 18.0 A	Moment of inertia (J)	: 2.62 sq.ft.lb
LRC	: 6.4	Duty cycle	: Cont.(S1)
Rated torque	: 44.5 ft.lb	Insulation class	: F
Locked rotor torque	: 229 %	Service factor	: 1.25
Breakdown torque	: 250 %	Duty cycle	: Cont.(S1)
Rated speed	: 1770 rpm		
Locked rotor time	: 37s (cold) 21s (hot)		

Rev.	Changes Summary	Performed	Checked	Date

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Checked by			Page	Revision
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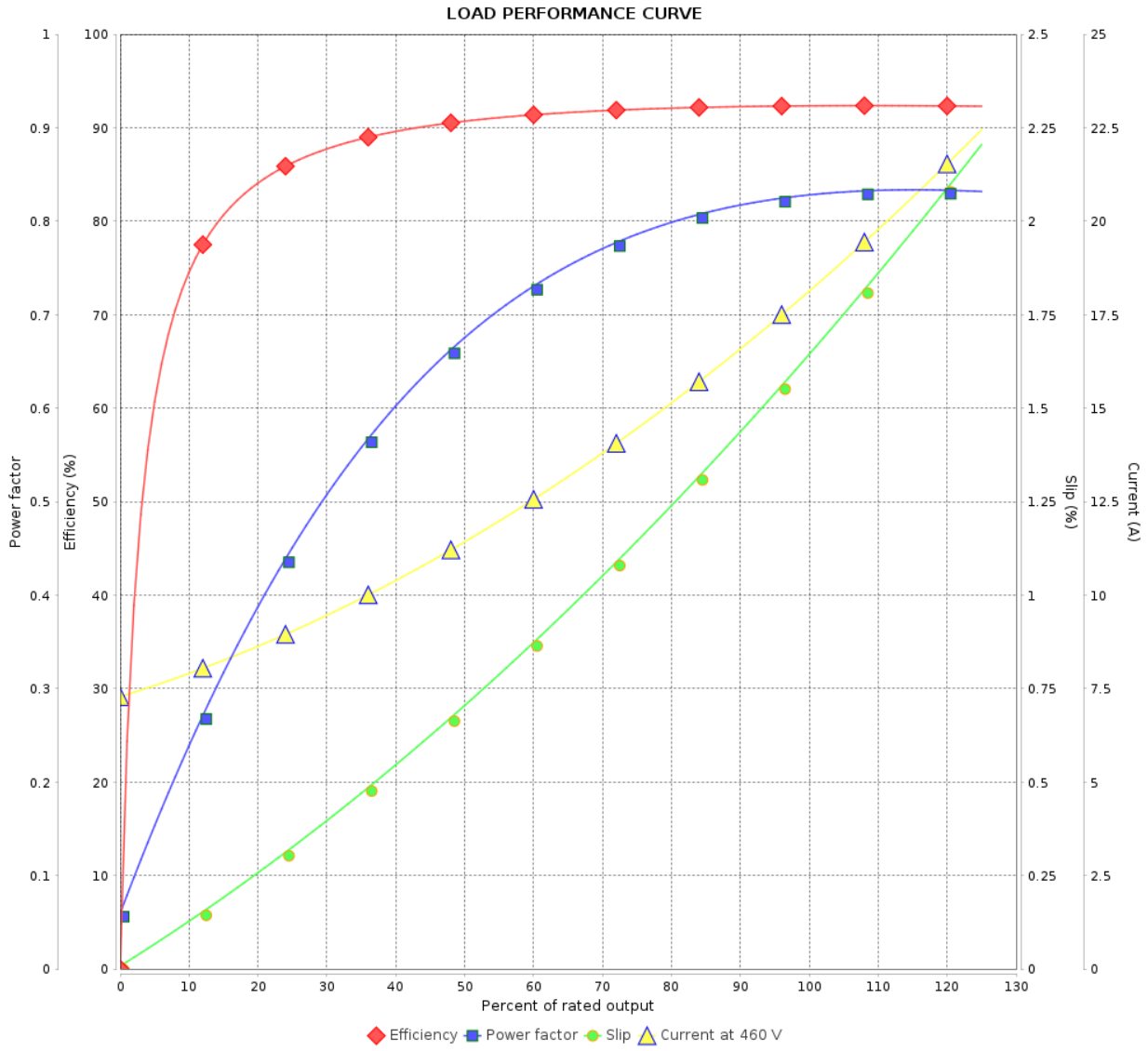
LOAD PERFORMANCE CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	12385114
		Catalog # :	01518ST3QIE254TC-W22



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Checked by			Page	Revision
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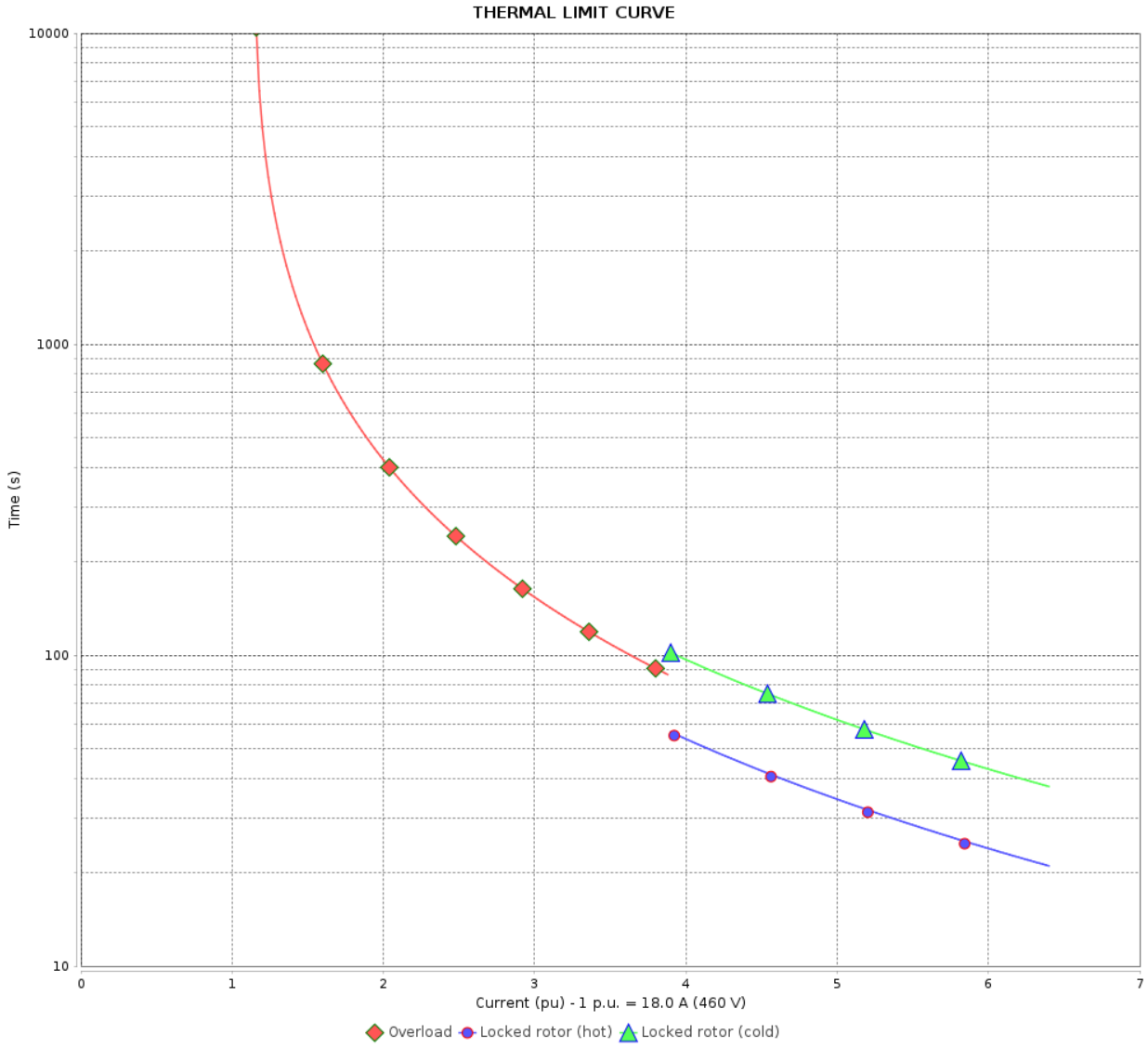
THERMAL LIMIT CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	12385114
		Catalog # :	01518ST3QIE254TC-W22



Heating constant

Cooling constant

Rev.	Changes Summary	Performed	Checked	Date

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Checked by			Page	Revision
Date	02/02/2026		4 / 5	

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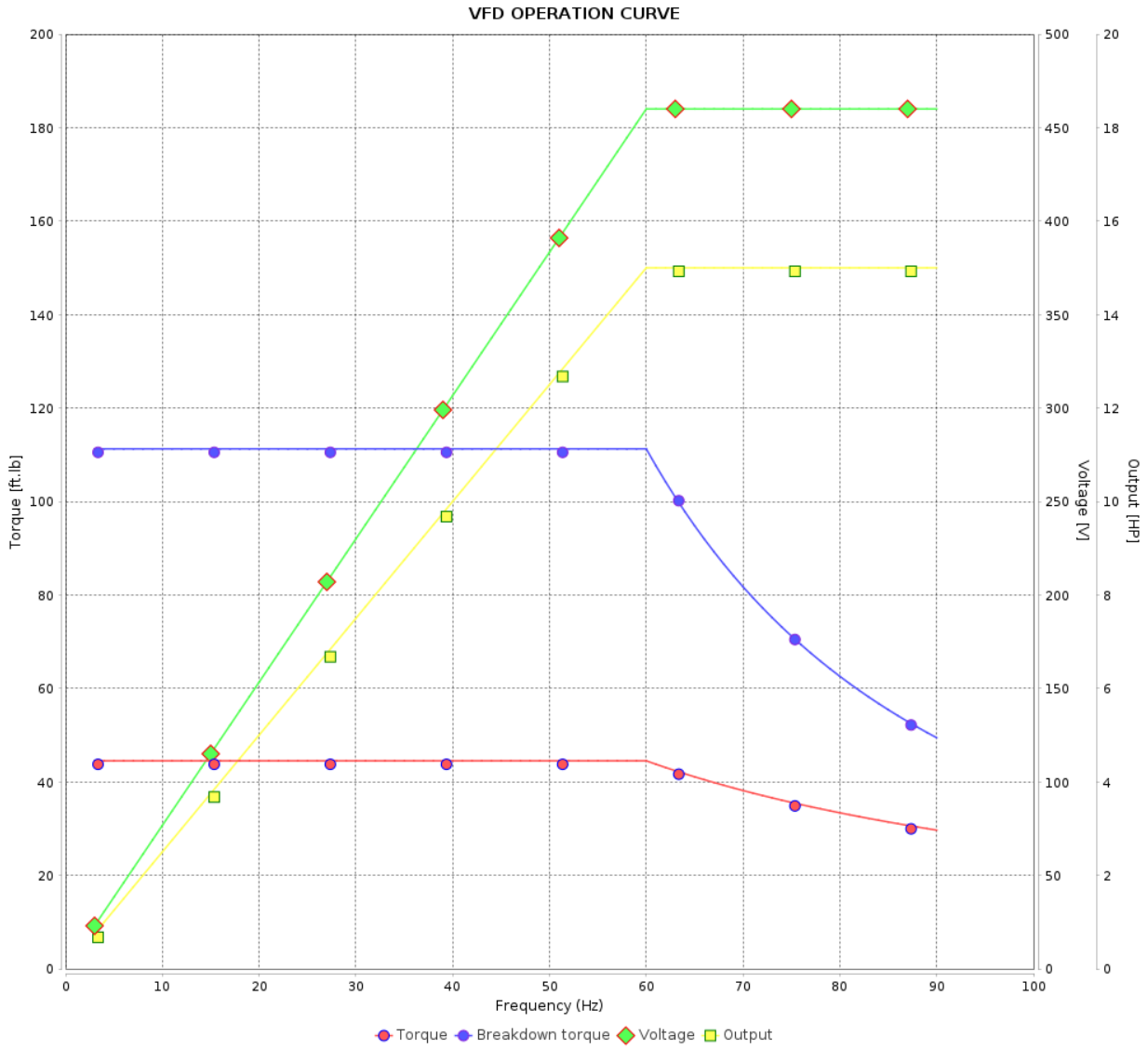
VFD OPERATION CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :

Product line	: W22 IEEE 841 NEMA Premium Efficiency Three-Phase	Product code :	12385114
		Catalog # :	01518ST3QIE254TC-W22



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Performed by				
Checked by			Page	Revision
Date	02/02/2026		5 / 5	

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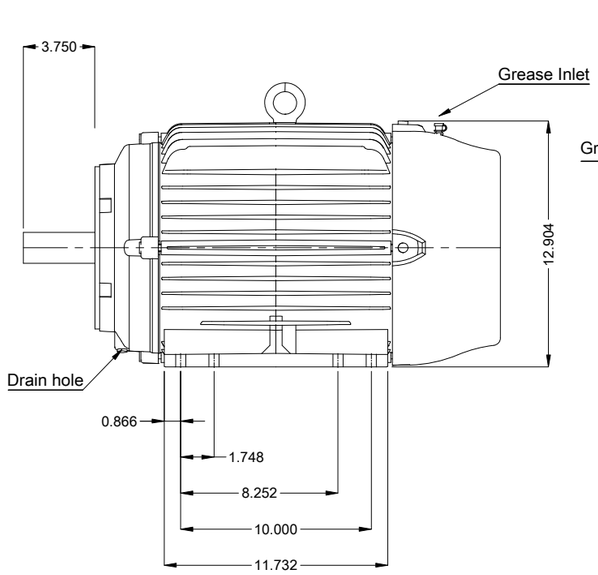
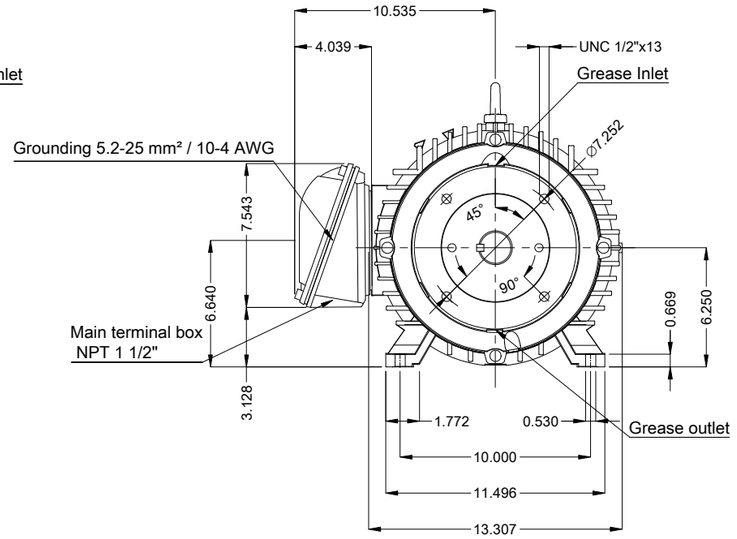
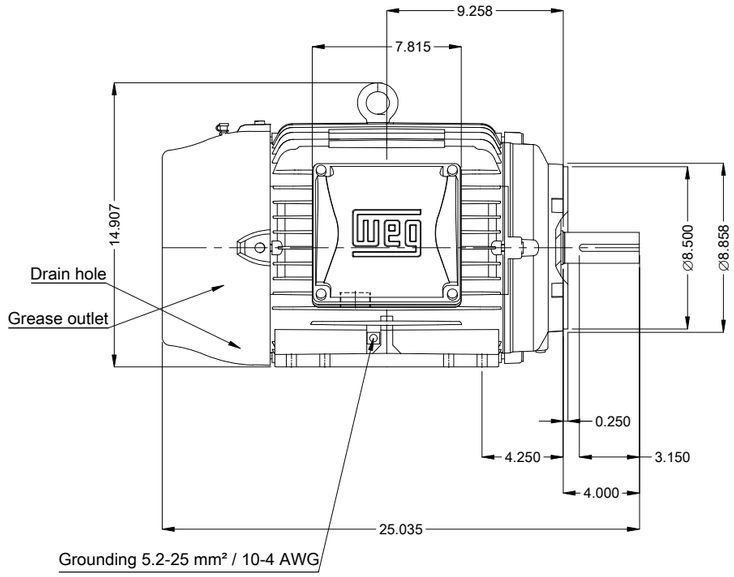
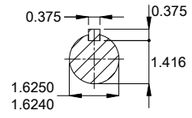






Without vertical jackscrews
Grease outlet on endshields
Color RAL 5009
Painting plan 222E
Mounting B34D

DE Shaft End



15 HP 04 Poles 60 Hz

A

Scale 1 : 8

ECM	LOC	SUMMARY OF MODIFICATIONS	EXECUTED	CHECKED	RELEASED	DATE	VER
			HYBRISUSER				00

EXECUTED	HYBRISUSER
CHECKED	
RELEASED	
REL. DATE	

THREE PH. MOTOR IEEE 841 W22 NEMA PREM. EFF.
FRAME 254/6TC IP56 TEFC

PREVIEW

WDD 00

SHEET 1 / 1

Dimensions in inches

A3

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MADE IN BRAZIL
12385114

MODEL 01518ST3QIE254TC-W22

Inverter Duty Motor
Severe Duty

IEEE 841-2021

PH3 60Hz	Fr. 254/6TC	1000m.a.s.l.	IP56 TEFC 284lb
V 460		A 18.0	
HP 15		kW 11	
SF 1.25		SFA 22.5	
RPM 1770		PF 0.83	
AMB 40°C		INS cl. F DT80K	NEMA NOM EFF 92.4%
DUTY CONT.		DES B Code G	GUARANT. EFF 91.0%

FOR SAFE AREA
Mod.TE1BF0XON
CC029A

Class I, Div 2, Gr A, B, C, D, 1.15SF - T3
Class I, Zone 2, IIC, 1.15SF - T3
Class II, Div 2, Gr F, G - T4
For use on PWM: Gr. A, B, C, D, F,
VT 1000:1, CT 20:1, 1.00SF - T3A

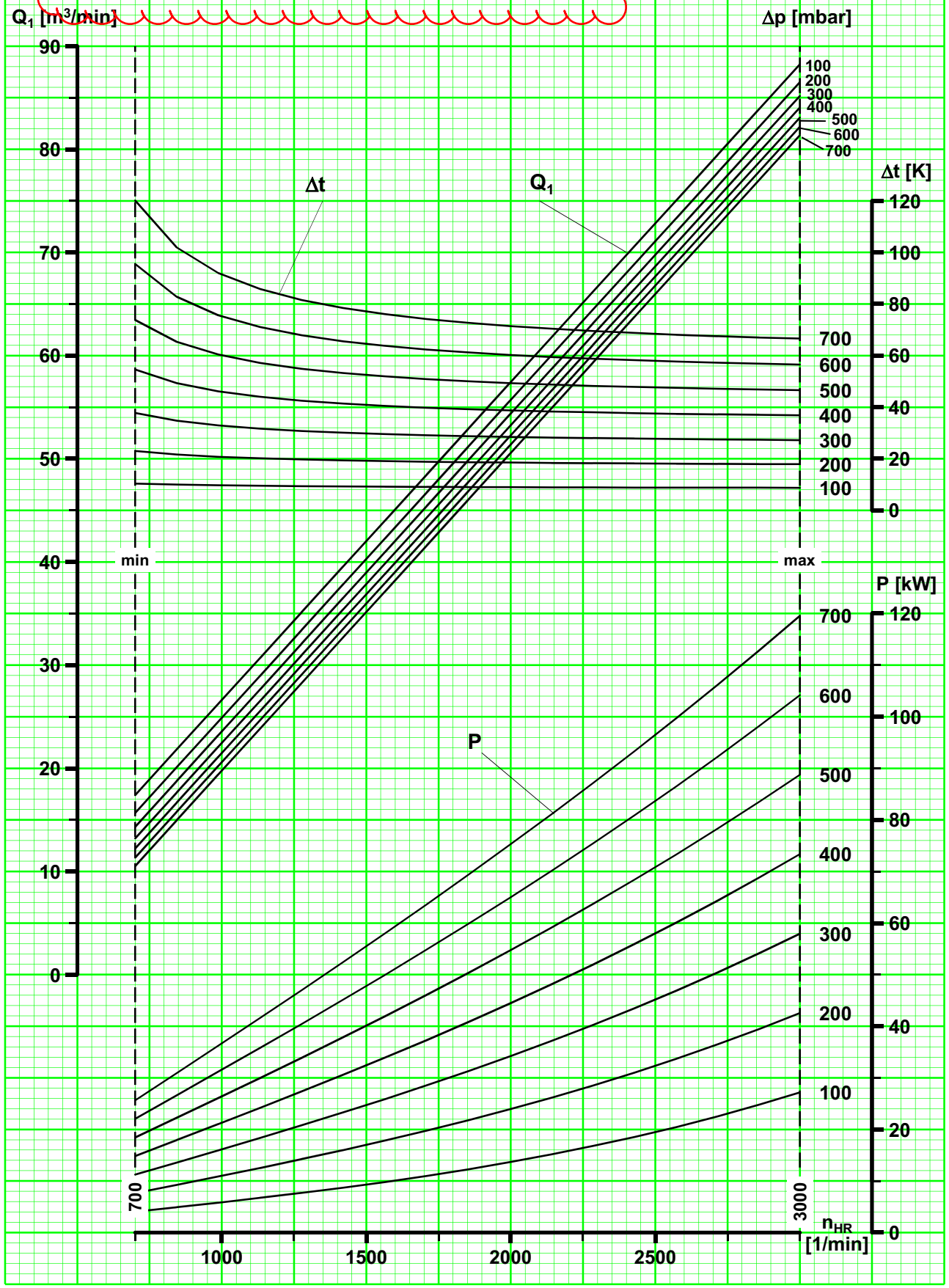
T1 T2 T3
L1 L2 L3

460V

6309-C3 45BC03X30 (13g)
6209-C3 45BC02X30 (9g)

MOBIL POLYREX EM (20000h)

MFS Blower- Rotary Lobe -GM 80L



Q_1 : Ansaugvolumenstrom (Luft) bei p_1 = 1,0 bar und t_1 = 20°C	intake volume flow (air) at p_1 = 1.0 bar and t_1 = 20°C	débit aspiré (air) pour p_1 = 1,0 bar et t_1 = 20°C
n_{HR} : Hauptrotordrehzahl	main rotor speed	vitesse du rotor principal
n_V : Antriebswellendrehzahl	drive shaft speed	vitesse de l'arbre d'entraînement
P : Leistungsbedarf an der Kupplung	power required at the coupling	puissance absorbée à l'accouplement
Δt : Temperaturerhöhung	temperature rise	élévation de température
Δp : Druckerhöhung	pressure difference	pression différentielle

Leistungsdiagramm - Überdruck - für Drehkolbengebläsestufe
performance diagram - overpressure - for stage of rotary piston blower
courbes de fonctionnement - fonctionnement en pression - pour étage de surpresseur à pistons rotatifs

GM 80 L

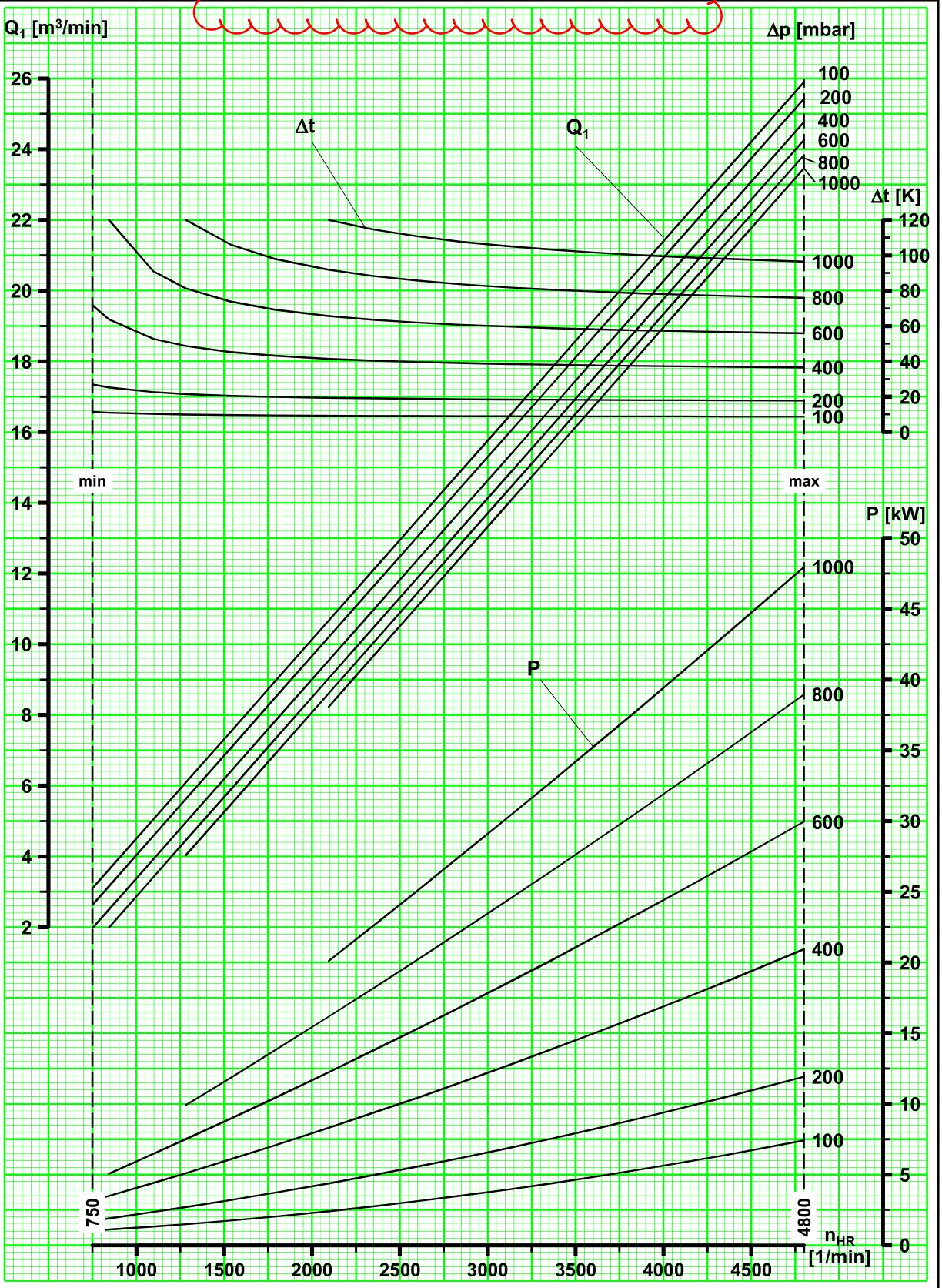
nV / nHR = 1	04/2016 TRD / Hallemann	G2-422 - XL SAP 4000323949 - 00

Aerzener Maschinenfabrik GmbH
Reherweg 28 - D-31855 Aerzen - Telefon (0 51 54) 81 0 - info@aerzener.de - www.aerzener.com

4000323949 | ZTD | 00

AERZEN

MTH Blower- Rotary Lobe -GM 25S



Q_1 : Ansaugvolumenstrom (Luft) bei p_1 = 1,0 bar und t_1 = 20°C	intake volume flow (air) at p_1 = 1.0 bar and t_1 = 20°C	débit aspiré (air) pour p_1 = 1,0 bar et t_1 = 20°C
n_{HR} : Hauptrotordrehzahl	main rotor speed	vitesse du rotor principal
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P : Leistungsbedarf an der Kupplung	power required at the coupling	puissance absorbée à l'accouplement
Δt : Temperaturerhöhung	temperature rise	élévation de température
Δp : Druckerhöhung	pressure difference	pression différentielle

Leistungsdiagramm - Überdruck - für Drehkolbengebläsestufe
performance diagram - overpressure - for stage of rotary piston blower
courbes de fonctionnement - fonctionnement en pression - pour étage de surpresseur à pistons rotatifs

GM 25 S

n_V / n_{HR} = 1	04/2016 TRD - Hallemann	G2 - 412 - XL SAP - 4000323940 - 00

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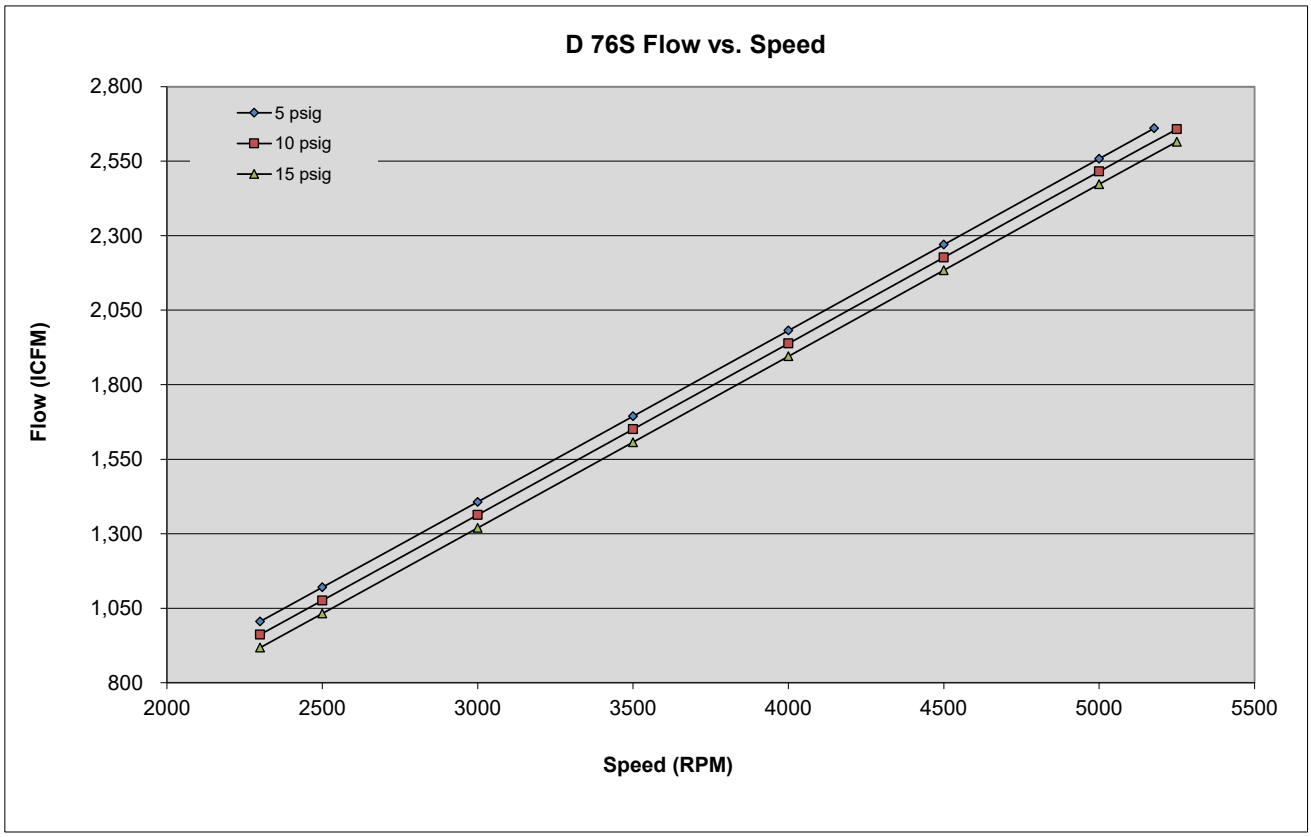
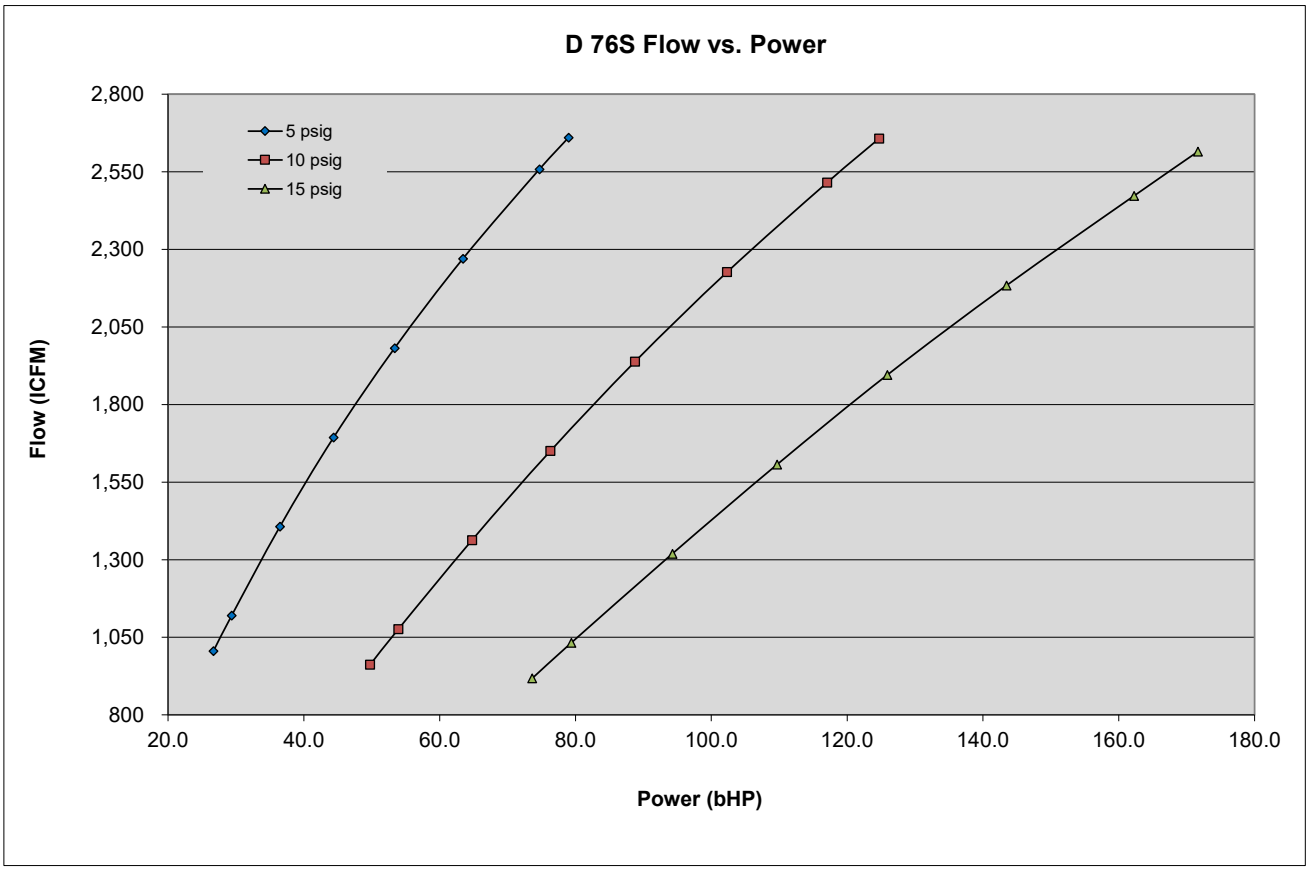
4000323940 | ZTD | 00

MFS Blower- Screw type -D 76S

Standard (ASME) Inlet Conditions:
T1 = 68F
P1 = 14.696 PSIA
RH = 36%

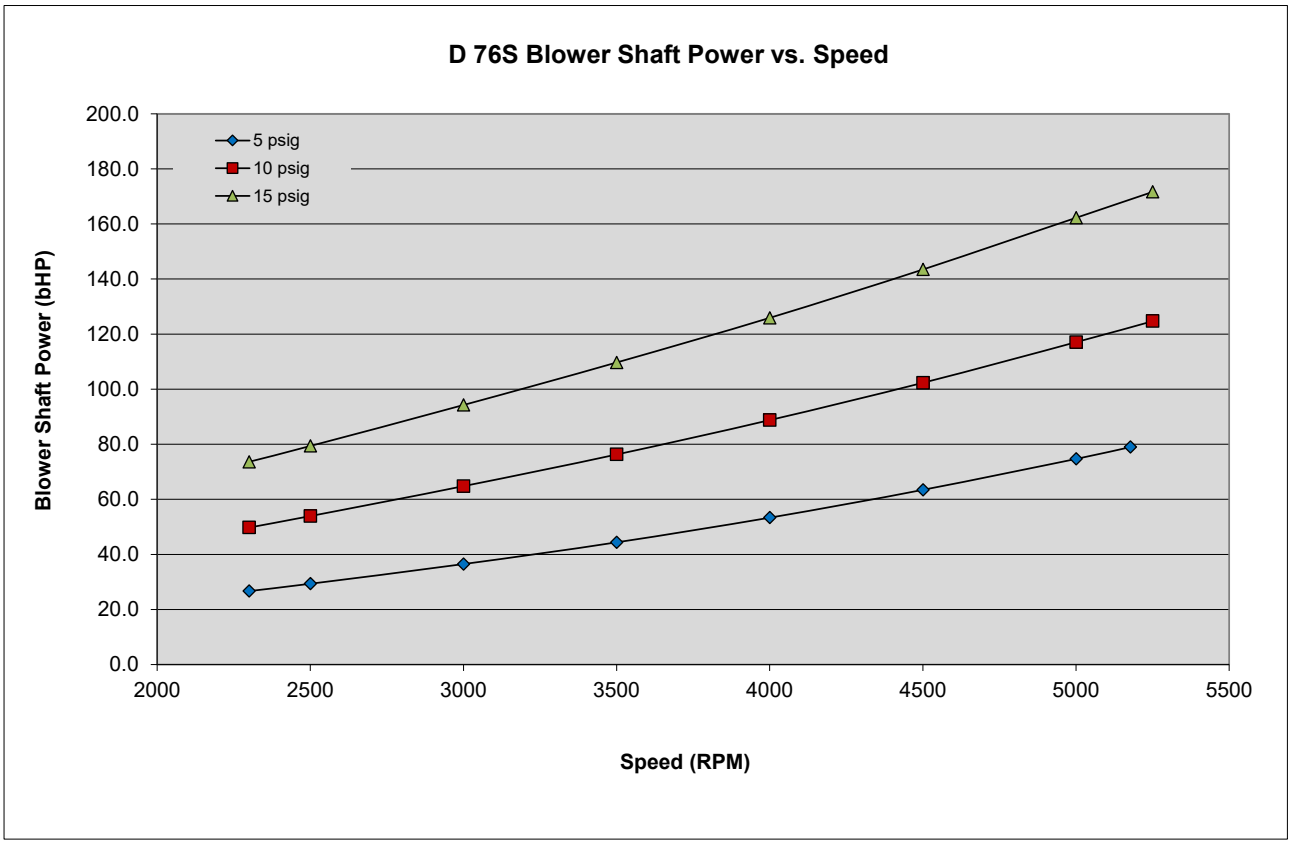
Aerzen D 76S
Performance Curves
Standard ASME Conditions

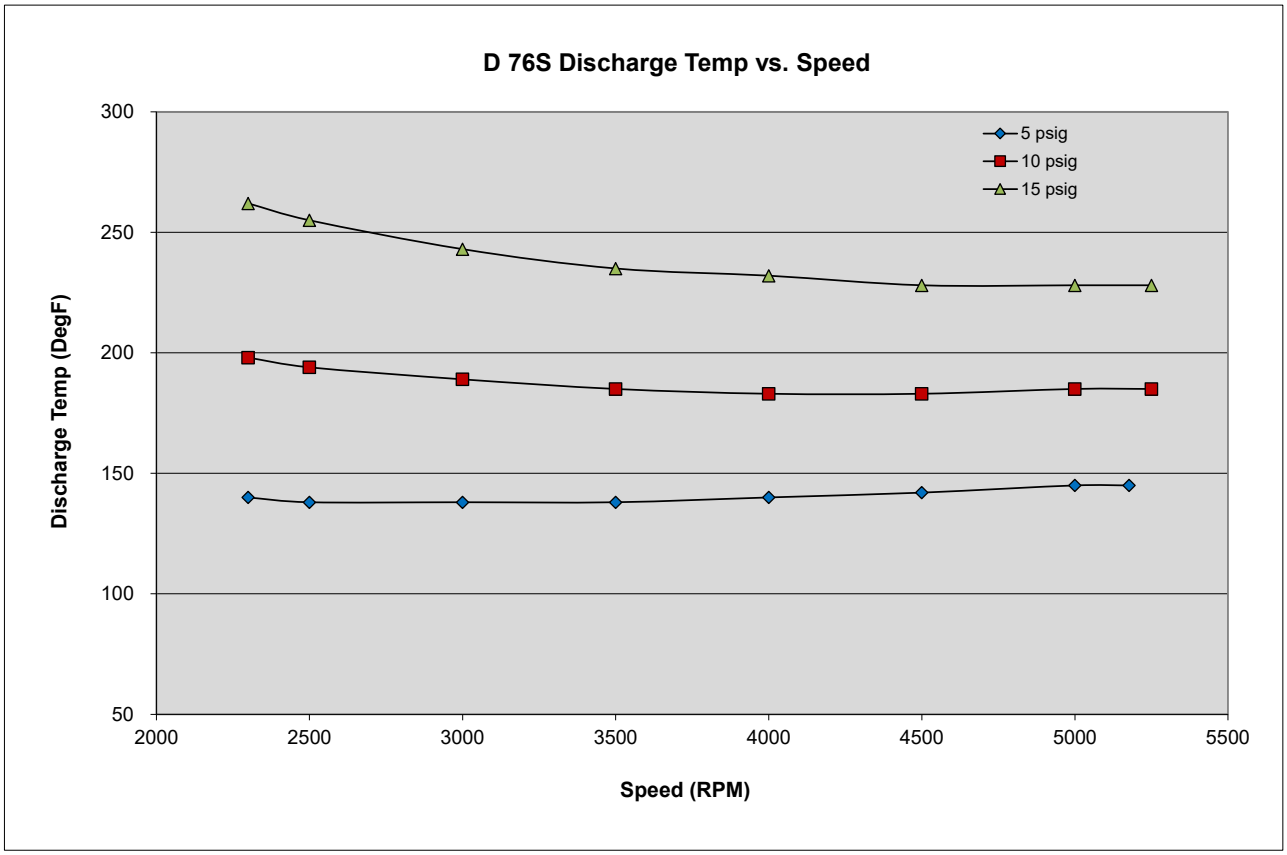




Standard (ASME) Inlet Conditions:
T1 = 68F
P1 = 14.696 PSIA
RH = 36%

Aerzen D 76S
Performance Curves
Standard ASME Conditions

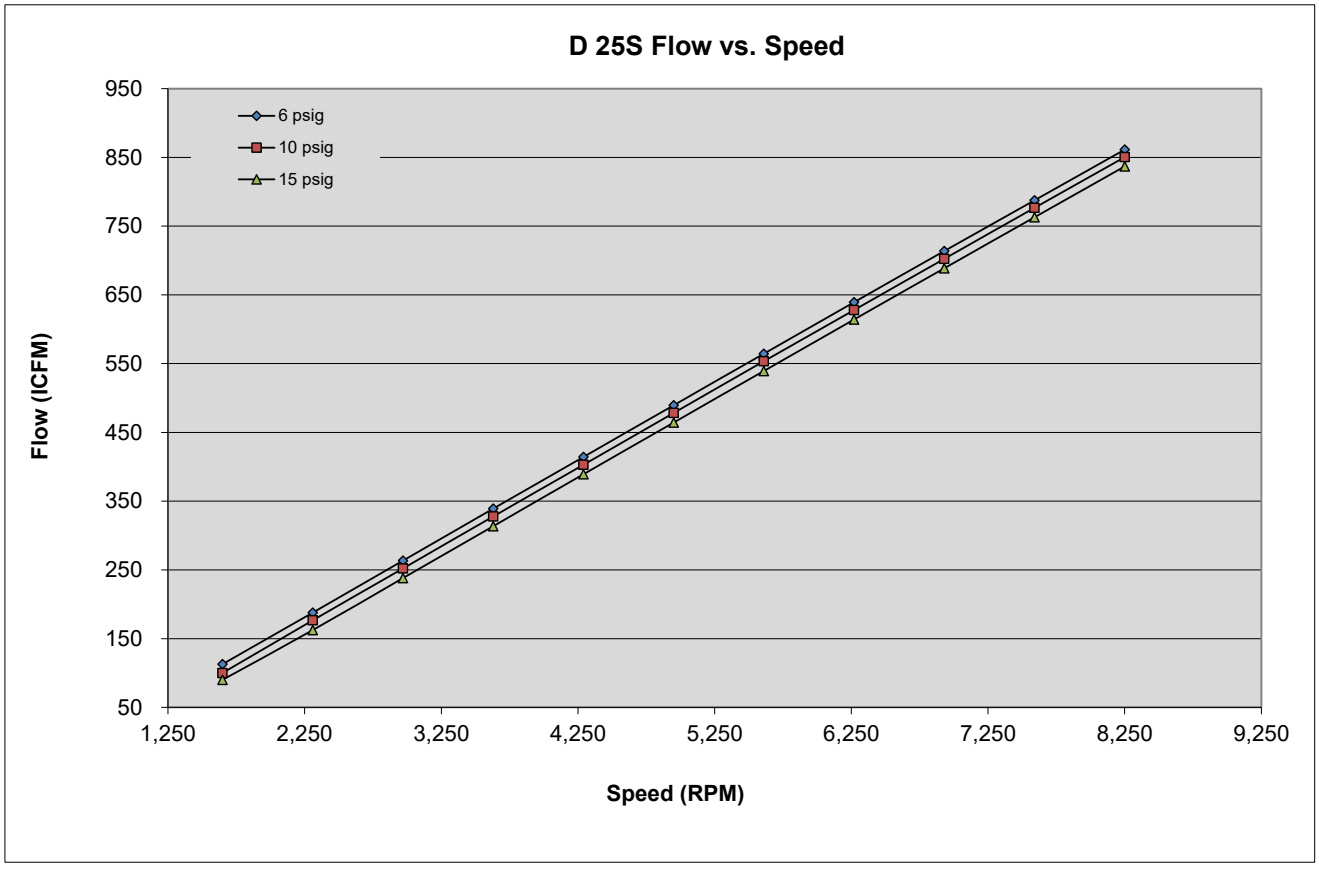


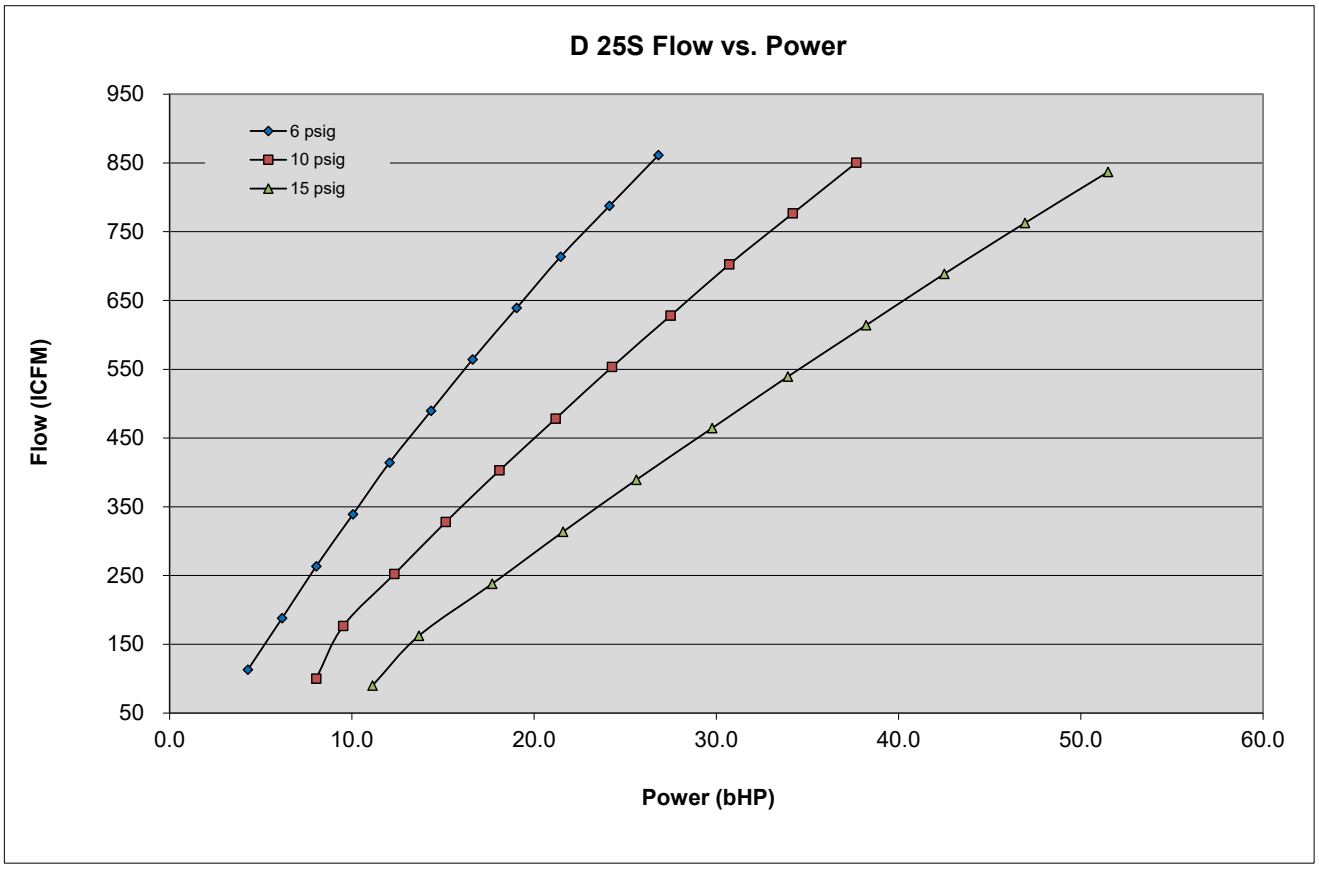


MTH Blower- Screw type -D 25S

Standard (ASME) Inlet Conditions:
T1 = 68F
P1 = 14.696 PSIA
RH = 36%

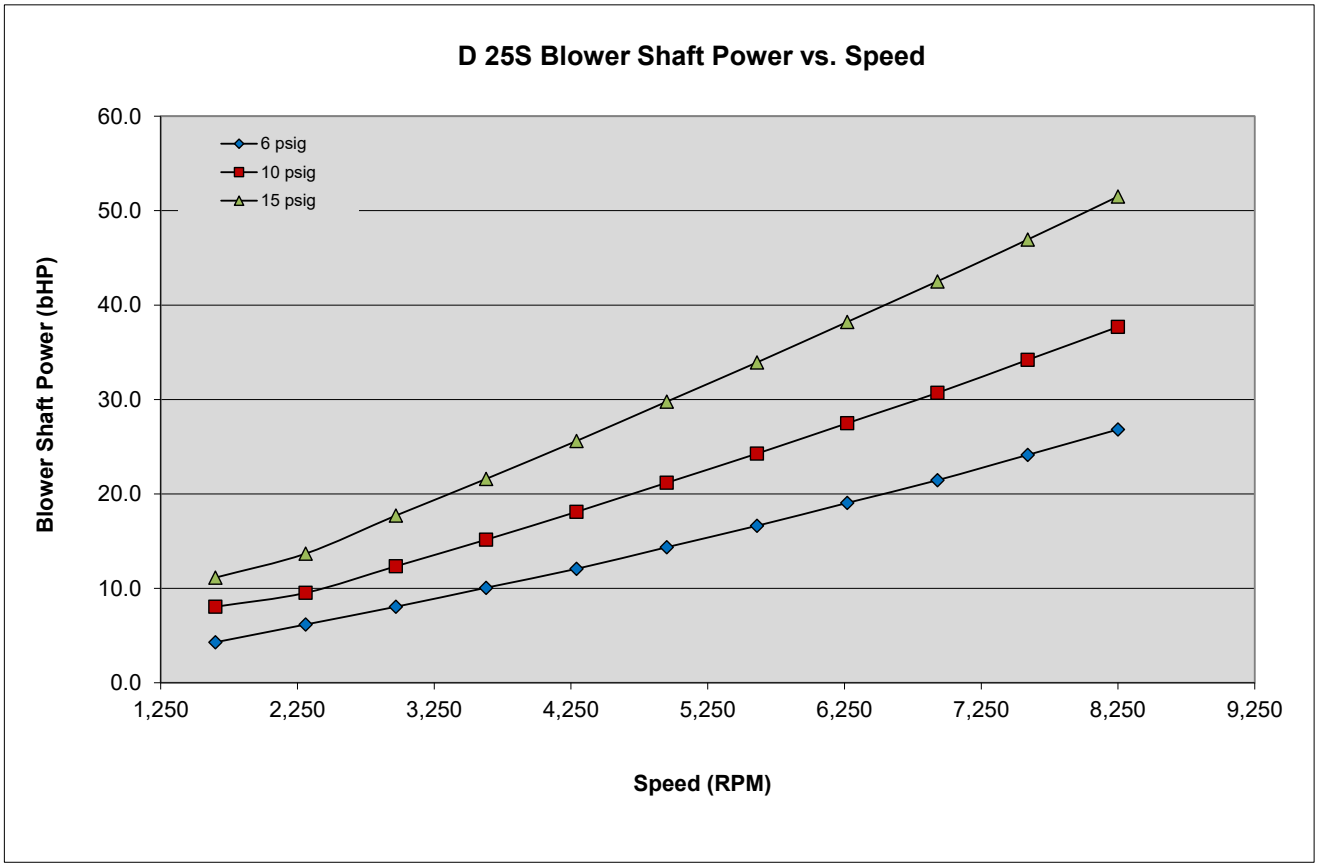
Aerzen D 25S
Performance Curves
Standard ASME Conditions

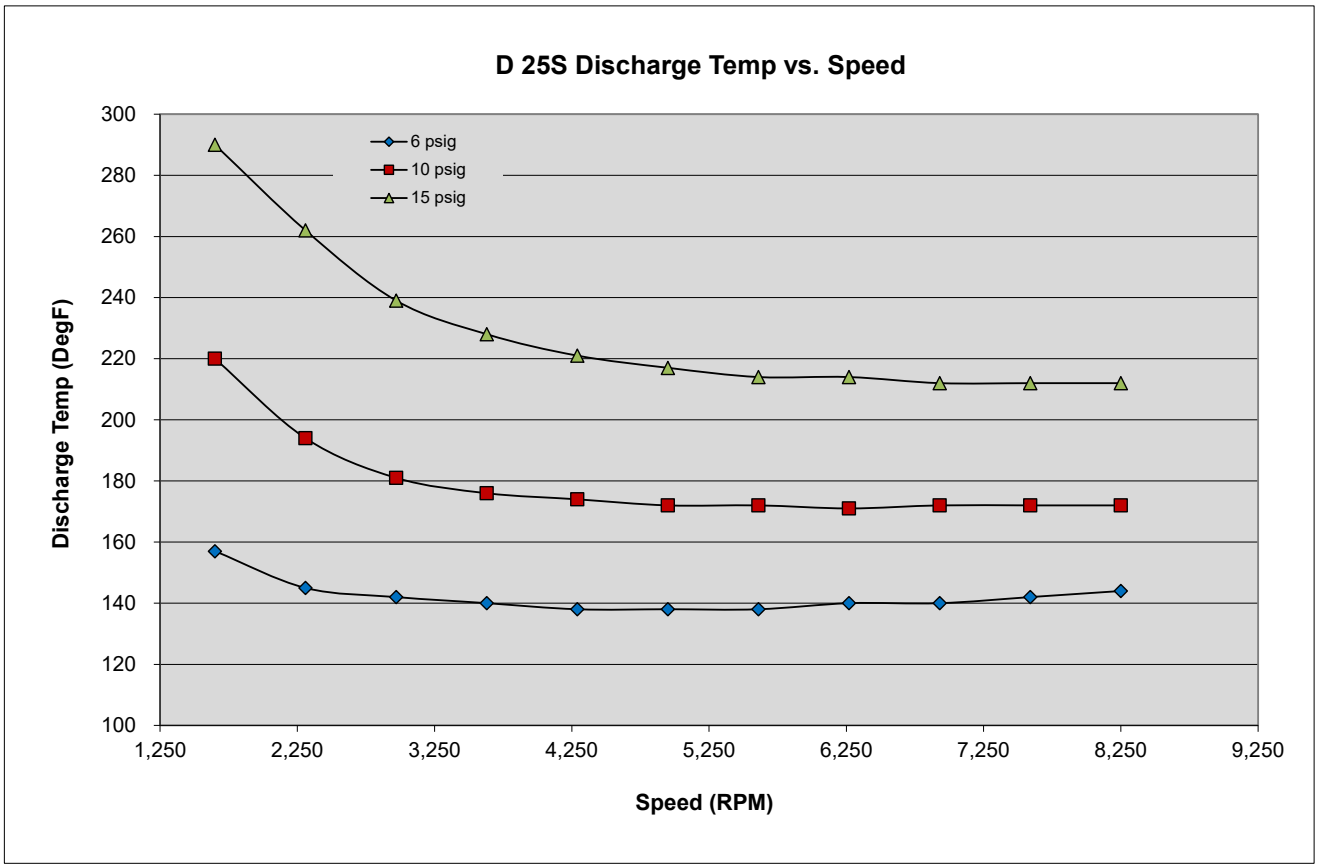




Standard (ASME) Inlet Conditions:
T1 = 68F
P1 = 14.696 PSIA
RH = 36%

Aerzen D 25S
Performance Curves
Standard ASME Conditions





Appendix C

ZeeWeed* 500 Ultrafiltration (UF) Hollow-Fiber Membranes for Large Municipal MBR

CUSTOMER BENEFITS

WATER TECHNOLOGIES

VEOLIA

Experience, Expand, Evolve with ZeeWeed MBR

For large municipal customers with operational capacities of over 5 MGD (>19 MLD), the ZeeWeed 500EV offers significant improvements in membrane density, energy and maintenance costs, and exceptional membrane life.

Addressing the everchanging needs of Large Municipal customers looking to:

- Lower the CAPEX associated with expanding capacity
- Increase treatment capacity by 50% in a smaller footprint
- Reduce annual energy and maintenance costs
- Enjoy longer membrane life with simplified maintenance

Performance

- High flux dedicated MBR membrane chemistry since 2007 with permeability > 900 lmh/bar
- True UF membrane for over 25 years with proven 0.035 µm nominal pore size
- Patented LEAPmbr aeration providing exceptional energy consumption savings
- Superior fiber strength, 60x greater than non-reinforced PVDF membranes

Reliability

Exceptional membrane reliability and product life with many municipal customers achieving 12 to 16 years operation; longest proven life 21 years!

Veolia stands by its products offering peace of mind with warranties up to 20 years in duration.

Proven Experience

Over 2500 MBRs globally running with ZeeWeed 500 membranes. More than 1.5 million operating modules treating over 32000 MLD (8325 MGD) daily.

Flexibility & Simplicity

Configurable product to provide plant layout versatility for easy future expansion even for those with footprint constraints.

Demonstrated simple retrofit solutions for conventional upgrades and more than 15 other MBR membrane suppliers.

ZeeWeed 500 in Action

Henriksdal WWTP, Sweden

ADF 536 MLD (142 MGD)

MDF 864 MLD (228 MGD) PH1

Commissioned 2020

Luo Fang WWTP, China

ADF 400 MLD (106 MGD)

MDF 462 MLD (122 MGD)

Commissioned 2018

Seine Aval WWTP, France

ADF 218 MLD (59 MGD)

MDF 348 MLD (92 MGD)

Commissioned 2017

Euclid WWTF, USA

ADF 83 MLD (22 MGD)

MDF 250 MLD (66 MGD)

Commissioned 2018

Beijin Shunyi WWTP, China

ADF 180 MLD (48 MGD)

MDF 234 MLD (62 MGD)

Commissioned 2016

Brussels Sud WWTP, Belgium

ADF 86 MLD (23 MGD)

MDF 190 MLD (44 MGD)

Commissioned 2018

Oxford WWTP, Canada

ADF 13 MLD (3.6 MGD)

ADF 13 MLD (3.6 MGD)

Commissioned 2008

Proven membrane life 17 years

Traverse City WWTP, USA

ADF 27 MLD (7.1 MGD)

MDF 64 MLD (17 MGD)

Commissioned 2005, Upgraded 2014

Proven membrane life 16 years

Brescia WWTP, Italy

ADF 30 MLD (8 MGD)

MDF 60 MLD (16 MGD)

Commissioned 2002, Upgraded 2015

Proven membrane life 14 years

Cassette Properties

Membrane Filtration system Cassette and Modules

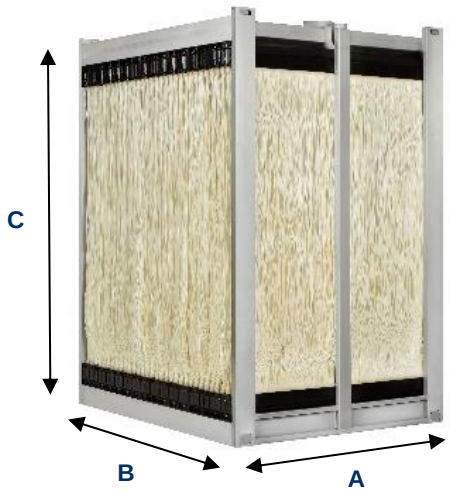


Table 1: Cassette Dimensions

Product	Width (A) mm (in)	Length (B) mm (in)	Height (C) mm (in)
500EV T-64M	1,744 (68.7)	2,136 (84.1)	2,735 (107.7)

Table 2: Cassette Tie Points and Weights

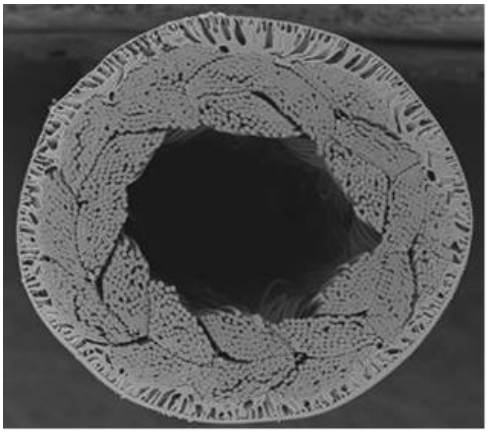
Application	Product	Max. # of Modules	Min. # of Modules	Permeate Connection	Air Connection	Max. Shipping Weight [1] kg (lb)	Wet Weight [2] kg (lb)	Lifting Design Weight [3] kg (lb)	Cassette Material
LEAPmbr	500EV T-64M	64	32	1 x 8” vert. pipe	1 x 3” FNPT half coupling	2,091 (4,610)	2,348 (5,165)	4,536 (10,000)	316L SS frame with engineered plastics

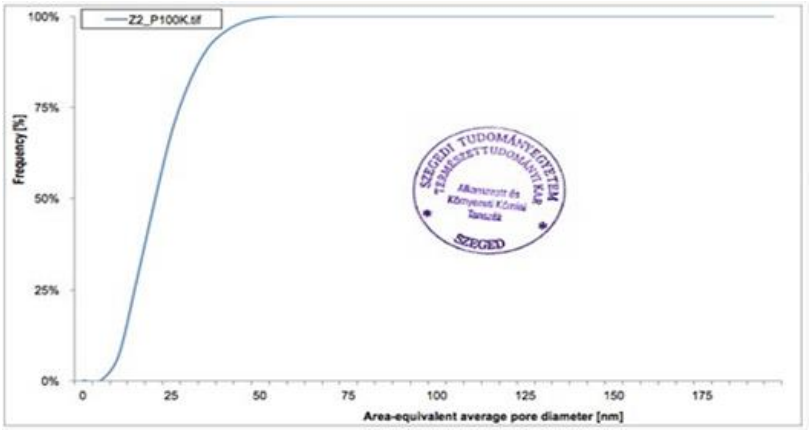
[1] Crated with maximum number of modules

[2] Wet weight of a clean, fully populated cassette. Lower module population will reduce this value. Cassette support method and lifting module can also vary this weight, depending on design. An estimate is used based on several standard designs

[3] Product lifting design weight assumes a fully populated cassette with solids accumulation, standard lifting module and hanging arms. Alternative support and lifting methods could vary this value

Membrane Properties





Membrane Cross-section and 3rd party certified UF pore size

Table 3: Module Dimensions

Application	Product	Width (A) mm (in)	Length (B) mm (in) Header-to-Header	Depth(C) mm (in)
LEAPmbr	TX12	861 (33.9)	2059 (81.0)	51 (2.0)

Table 4: Module Properties

Application	Membrane Surface Area m^2 (ft^2)	Lifting Weight [1] kg (lb)	Material	Nominal Pore Size [2] (µm)	Fiber Diameter [3] (mm)	Surface Properties	Fiber Tensile Strength [4] (N)	Flow Path
LEAPmbr	TX12 49.7 (535)	29 (64)	PVDF	0.04	2.2	Non-ionic & Hydrophilic	>600	Submerged, Outside-In

[1] Clean wet weight excluding any solids accumulation

[2] Nominal pore size is often rounded to 40nm (0.04 micron) for simplicity

[3] Fiber dimensions have been rounded to the nearest decimal place for simplicity

[4] Tensile strength measured using a modification of ASTM protocol (D 3822)

Table 5: Operating & Cleaning Specifications [1]

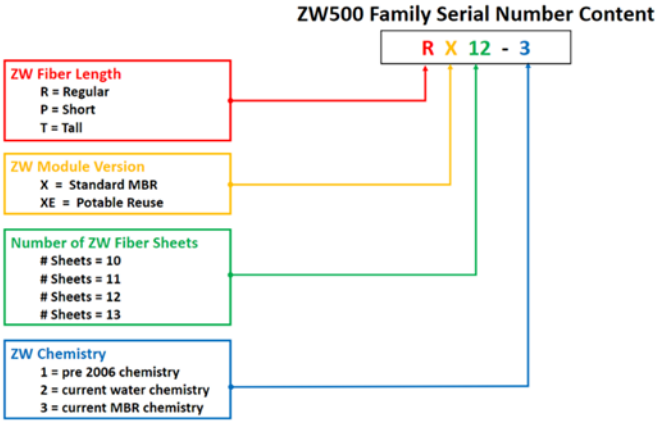
Application	TMP Range kPa (psig)	Typ. Aeration Nm^3/h/cassette (scfm/cassette)[2]	Max. Operating Temp. °C (°F)	Operating pH Range	Backpulse Type	Max. Cleaning Temp. °C (°F)	Cleaning pH Range	Max. lifetime exposure Cl_2 (ppm)
LEAPmbr	-55 to 55 (-8 to +8)	500EV TX12 223-447 (133-265	40 (104)	5.0-9.5	Relax Aeration (Standard) Backpulse-capable (as required)	40 (104)	2.0 – 10.5 (<30°C) 2.0 -10.0 (30-40°C)	1,000,000

[1] Normalized ADF flow for fully populated cassette at 150m ASL, 20°C wastewater temperature. Delivered value at modules will differ based on site conditions. Lower cassette populations will have a lower aeration rate

[2] Aeration rates reflect the variation in LEAP-LOW to LEAP-HIGH aeration

ZeeWeed 500 Series Products

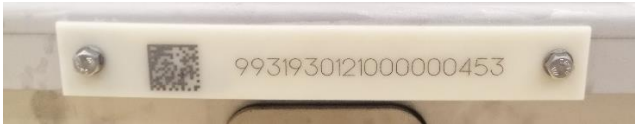
The ZeeWeed 500 series of membranes have been applied to MBR applications since 1997 when the ZW500A was introduced. There are four products within the current 5th generation – the ZW500M (laboratory use), ZW500S, ZW500D and ZW500EV. All ZeeWeed 500 series MBR products use the same PVDF chemistry formulation, designed specifically for membrane bioreactor application.



ZeeWeed 500 Product Identification

All ZeeWeed 500 series products have a product type identification code tied to the product specification. The code provides information on the version of the module, the fiber length, the number of sheets, and the membrane chemistry. It is typically found with the module serial number and takes the format of 1 to 3 letters, a number, and usually, but not always, a dash and third number.

Module Serial Number



Cassette Serial Number

Contact Us

If you would like to learn more about how Veolia can provide MBR solutions for your large municipal projects, contact your Veolia representative or visit our website.

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ZeeWeed* 500 Ultrafiltration (UF) Hollow-Fiber Membranes for Medium Municipal MBR

CUSTOMER BENEFITS

Experience, Expand, Evolve with ZeeWeed MBR

For medium municipal customers with operational capacities up to 5 MGD (≤19 MLD), the ZeeWeed 500 EV membrane bioreactor (MBR) offers significant improvements in membrane density, energy and maintenance costs, and exceptional membrane life.

Addressing the everchanging needs of medium municipal customers looking to:

- Lower the CAPEX associated with expanding capacity
- Increase treatment capacity by 15% in a smaller footprint
- Reduce annual energy and maintenance costs
- Enjoy longer membrane life with simplified maintenance

Performance

- High flux dedicated MBR membrane chemistry since 2007 with permeability > 900 lmh/bar
- True UF membrane for over 25 years with proven 0.035 µm nominal pore size
- Patented LEAPmbr pulsed aeration providing exceptional energy consumption savings
- Superior fiber strength, 60x greater than non-reinforced PVDF membranes

Reliability

Exceptional membrane reliability and product life with many municipal customers achieving 12 to 17 years operation; longest proven life 21 years!

Veolia stands by its products offering peace of mind with warranties up to 20 years in duration.

Proven Experience

Over 2500 MBRs globally with ZeeWeed 500 membranes. More than 1.5 million operating modules treating over 32000 MLD (8325 MGD) daily.

Flexibility & Simplicity

Configurable product to provide plant layout versatility for easy future expansion even for those with footprint constraints.

Demonstrated simple retrofit solutions for conventional upgrades and more than 15 other MBR membrane suppliers.

ZeeWeed 500 in Action

Creemore WWTP, Canada

ADF 0.86 MLD (0.23 MGD)

PHF 1.94 MLD (0.51 MGD)

Commissioned 2000

City of Duvall WWTP, USA

ADF 4.92 MLD (1.30 MGD)

MDF 12.50 MLD (3.30 MGD)

Commissioned 2005

Oroszlany WWTP, Hungary

ADF 5 MLD (1.30 MGD)

Commissioned 2005

Rotorua WWTP, New Zealand

ADF 25 MLD (6.60 MGD)

MDF 72 MLD (19 MGD)

Commissioned 2005, Upgraded 2015

Goyang Samsong STP, Korea

ADF 12.8 MLD (3.38 MGD)

MDF 16 MLD (4.23 MGD)

Commissioned 2018

EcoGlog WWTP, Poland

ADF 6 MLD (1.60 MGD)

Commissioned 2015

Oxford WWTP, Canada

ADF 13 MLD (3.60 MGD)

MDF 25 MLD (6.80 MGD)

Commissioned 2008

Proven membrane life 17 years

Traverse City WWTP, USA

ADF 27 MLD (7.10 MGD)

MDF 64 MLD (17 MGD)

Commissioned 2005, Upgraded 2015

Proven membrane life 16 years

Thetis Lake WWTP, Canada

ADF 0.026 MLD (0.007 MGD)

MDF 0.045 MLD (0.012 MGD)

Commissioned 1995

Proven membrane life 21 years

Cassette Properties

Membrane Thickener system cassette and modules

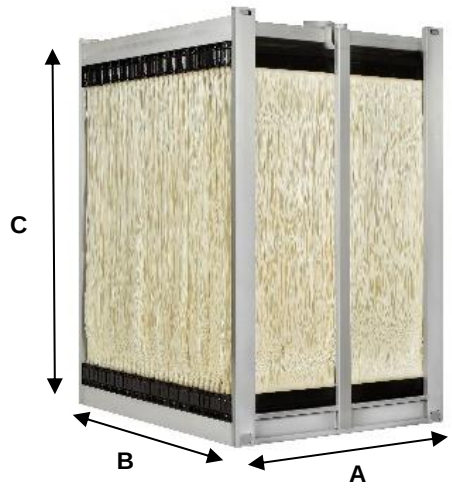


Table 1: Cassette Dimensions

Product	Width (A) mm (in)	Length (B) mm (in)	Height (C) mm (in)
500EV R-56M	1,744 (68.7)	2,136 (84.1)	2,561 (100.8)
500EV R-16M	1,744 (68.7)	738 (29.1)	2,512 (98.9)

Table 2: Cassette Tie Points and Weights

Aeration Technology	Product	Max. # of Modules	Min. # of Modules	Permeate Connection	Air Connection	Max. Shipping Weight [1] kg (lb)	Wet Weight [2] kg (lb)	Lifting Design Weight [3] kg (lb)	Cassette Material [4]
LEAPmbr Pulsed Aeration	500EV R-56M	56	28	1 x 6" vert. pipe	1 x 3" FNPT half coupling	2,091 (4,610)	2,190 (4,828)	4,536 (10,000)	316L SS frame with engineered plastics
LEAPmbr Pulsed Aeration	500EV R-16M	16	8	1 x 4" FNPT	1 x 3" FNPT half coupling	759 (1,673)	797 (1,757)	2,268 (5,000)	316L SS frame with engineered plastics

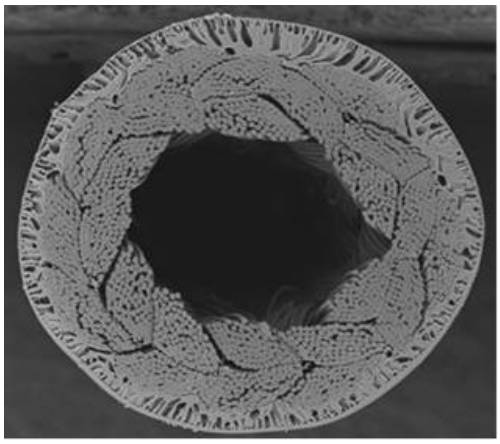
[1] Crated with maximum number of modules

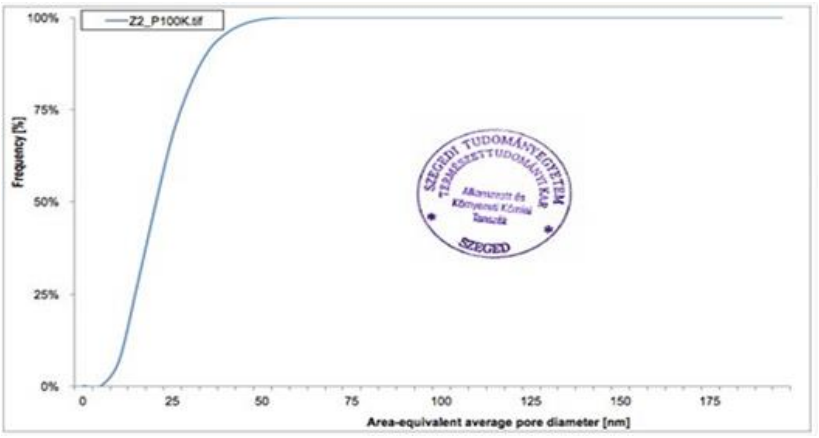
[2] Wet weight of a clean, fully populated cassette. Lower module population will reduce this value. Cassette support method and lifting module can also vary this weight, depending on design. An estimate is used based on several standard designs

[3] Product lifting design weight assumes a fully populated cassette with solids accumulation, standard lifting module and hanging arms. Alternative support and lifting methods could vary this value

[4] Alternative grades of stainless steel offered for cassettes are 2205 and SMO254 as required

Membrane Properties





Membrane Cross-section and 3rd party certified UF pore size

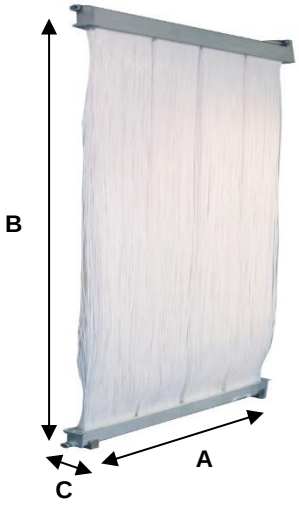


Table 3: Module Dimensions

Aeration Technology	Product	Width (A) mm (in)	Length (B) mm (in) Header-to-Header	Depth (C) mm (in)
LEAPmbr Pulsed Aeration	RX12	861 (33.9)	1888 (74.3)	51 (2.0)

Table 4: Module Properties

Aeration Technology	Membrane Surface Area m^2 (ft^2)	Lifting Weight [1] kg (lb)	Material	Nominal Pore Size [2] (µm)	Fiber Diameter [3] (mm)	Surface Properties	Fiber Tensile Strength [4] (N)	Flow Path
LEAPmbr Pulsed Aeration	RX12 42.7 (460)	25.5 (56)	PVDF	0.04	2.2	Non-ionic & Hydrophilic	>600	Submerged, Outside-In

[1] Clean wet weight excluding any solids accumulation

[2] Nominal pore size is often rounded to 40nm (0.04 micron) for simplicity

[3] Fiber dimensions have been rounded to the nearest decimal place for simplicity

[4] Tensile strength measured using a modification of ASTM protocol (D 3822)

Table 5: Operating & Cleaning Specifications [1]

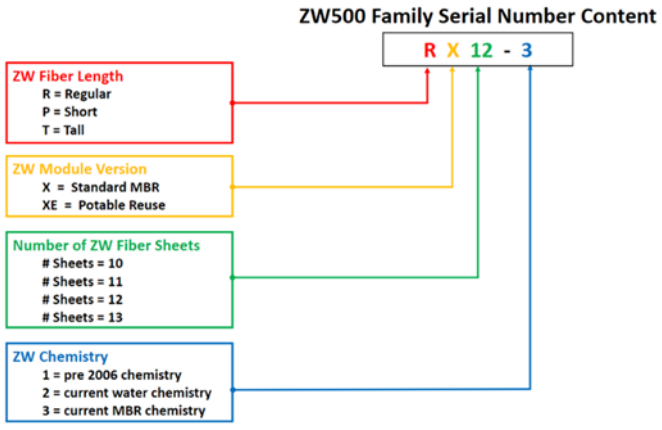
Aeration Technology	TMP Range kPa (psig)	Typ. Aeration Nm^3/h/cassette (scfm/cassette)[2]	Max. Operating Temp. °C (°F)	Operating pH Range	Backpulse Type	Max. Cleaning Temp. °C (°F)	Cleaning pH Range	Max. lifetime exposure Cl2 (ppm)
LEAPmbr Pulsed Aeration	-55 to 55 (-8 to +8)	500EV RX12 195-391 (117-233)	40 (104)	5.0-9.5	Relax Aeration (Standard) Backpulse-capable (as required)	40 (104)	2.0 – 10.5 (<30°C) 2.0 -10.0 (30-40°C)	1,000,000

[1] Normalized ADF flow for fully populated cassette at 150m ASL, 20°C wastewater temperature. Delivered value at modules will differ based on site conditions. Lower cassette populations will have a lower aeration rate

[2] Aeration rates reflect the variation in LEAP-LOW to LEAP-HIGH aeration

ZeeWeed 500 Series Products

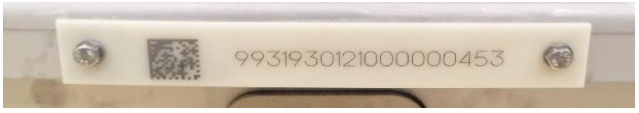
The ZeeWeed 500 membrane series have been applied to MBR applications since 1997 when the ZW500A was introduced. There are four products within the current 5th generation – the ZW500M (laboratory use), ZW500S, ZW500D and ZW500EV. All ZeeWeed 500 series MBR products use the same PVDF chemistry formulation, designed specifically for membrane bioreactor application.



ZeeWeed 500 Series Product Identification

All ZeeWeed 500 membrane series have a product type identification code tied to the product specification. The code provides information on the version of the module, the fiber length, the number of sheets, and the membrane chemistry. It is typically found with the module serial number and takes the format of 1 to 3 letters, a number, and usually, but not always, a dash and third number.

Module Serial Number



Cassette Serial Number

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Positive Displacement Blower
Delta Blower Generation 5

Volume flows from
30 m^3/h to 15,000 m^3/h

AERZEN
EXPECT PERFORMANCE

Delta Blower
A tough endurance runner in countless compression processes

Delta Blower Generation 5

Positive displacement blowers of the Delta Blower Generation 5 act as the driving force behind many processes, and are the beating heart of a strong machine combination. This generation of assemblies from AERZEN compresses more than 150 years of experience as world market leader in blower development. And it is more innovative than ever. AERZEN has introduced many innovations with this young se-ries. They stand for Blower Power in the oil-free transport of air and neutral gases. They provide a large volume-fow range from 30 to 15,000 m 3/h. With reduced life-cycle costs. For easier handling. For even quieter operation. But one thing remains the same: This blower class remains highly robust, thoroughly reliable and has an extremely long service life. No wonder then that customers choose it for continuous, long-term applications - over years and decades.

Universal geniuses for each application

The versatile compact power packages of the Delta Blower series can be used in all climate zones of the world. Just as safe under the most difficult environmental conditions as in indoor installation. They work stand-alone or in a machine combination. In earthquake areas as reliable as with ship or other mobile installations.

Versatility in figures.

Delta Blowers are strong all-rounders: The smallest assemblies are mounted on silo trucks. The largest machines operate in lifting systems. They unload transport vessels. With an hourly performance of up to 1,000 tons.

Control range between 25 % and 100 %

Volume flows from approx. 30 to 15,000 m^3/h

Pressures up to 1,000 mbar
Negative pressures down to -500 mbar

Nominal diameters DN 50 to DN 400

Applications

- Water and
- Waste water treatment
- Aeration
- Backwash of filters
- Pneumatic conveying of bulk materials
- Gas conveying
- Degassing
- Dedusting
- Generation of negative pressure
- Biogas treatment
- Vehicle operation
- Ship unloading
- Tunnel boring and much more

Industries

- Wastewater treatment plants
- Chemistry and process engineering
- Power plant
- Cement and lime
- Foodstuff technology
- Paper industry
- Pharmacy and many more

Goods conveyed

- Granules
- Sugar
- Cement
- Cereals
- Carbon and much more

Machines and services from AERZEN
In use worldwide and highly available

The extremely high load capacity of Delta Blower packages is legendary. Just like their already proverbial reliability, their durability or their intelligent operating and maintenance concept. Why are the services of AERZEN an issue at all? Because service is a must. And because our worldwide wellpositioned service teams are an important decision criterion for plant operators: for blowers made by AERZEN.

High availability

The best blower packages are those that you do not notice. Because they are steadfast in their work. For years and decades. The Delta Blowers from AERZEN are such assemblies. Their proven robust nature and durability have a reason. AERZEN manufactures all core components itself. From the assembly to the control system. From the idea to engineering and configuration. And thus ensures the high productivity of its machines. Our value contribution to the quality standard made in Germany.

On site worldwide

Typical for AERZEN: The reliable availability of its solutions. This refers to our machines. And to our services. The fact that our service teams look after your systems over their entire life cycle protects the value of your investment. The fact that we have a dense network of 50 subsidiaries and agencies in more than 100 countries around the globe guarantees short distances. So we are quickly there for you - in case we are needed.

Safely AERZEN

- Commissioning by qualified personnel
- Individual training of your specialist personnel
- Customer-specific service and maintenance contracts
- Machine revision also directly on site

Intelligently designed

What does compact, easy handling or ease of maintenance mean? The value of these promises only becomes apparent in everyday practice. And there they cannot be weighed out with gold. Just like these tangible benefits:

- Small footprint
- Flexible machinery mountings
- Easy to transport with forklift/lift truck
- Space-saving side-by-side installation
- Plug&play installation and commissioning
- Easy access to all wearing parts
- Oil level check from the outside while the machine is running
- Maintenance work such as oil and filter change from the front
- Low sound pressure level
- Belt drive for optimum volume flow design, subsequent power adjustment is quick and easy

100 % clean

How do we offer food suitability, avoid expensive cleaning or even production restrictions? We do not use absorption material for sound absorption. “Therefore, AERZEN made the base support a discharge silencer and reduces the noise exclusively by means of air deflections.
100 % free of absorption material, because this could wear out and contaminate the downstream system. By the way, the AERZEN base support is patented and certified as spark arrester for ATEX applications.

Intelligent silencing: the AERZEN discharge silencer without absorption material

Made in Germany

It's the inner values that matter: the AERZEN blower stage

Blower is blower?
This is the end of prejudices

AERZEN belongs to the most innovative companies worldwide in the field of compressor technology. In 1868, we started manufacturing positive displacement blowers. By the way, we were the company that manufactured the first positive displacement blower in Europe. Since then, we have taken the performance features of this technology to the peak with every generation. Let yourself be surprised. Discover these special blowers: Delta Blower Generation 5.

Extremely robust blower package
- For a wide range of applications within a high control range from 25 to 100%
- Various modifications are possible

Compact design
- Space-saving side-by-side installation
- Small dimensioning of machine rooms

Easy operation and low-maintenance design
- Highly available at continuous operation even under oughest environmental conditions
- The front side is used for operation and maintenance

Plug&play Solution
- Completely configured, parameterised and ready for connection
- Integrated service kit with first oil fill

Oil-free as per class 0
- According to ISO 8573-1, certified by the TÜV (German technical inspection association)

Free from absorption material
- Suitability for use with foodstuffs in the pneumatic conveying of bulk materials (no impurities)
- Safety for energy-efficient productivity in the Water treatment (no sedimentation of absorption material in the aeration plates, no clogging of the aeration plugs, no pressure loss)

Integrated power supply panel (optional)
- Frequency converter, star-delta, direct, softstarter
- Intelligent AERZEN AERtronic control system

Smart oil system
- Oil level check while machine is running
- It can be read from the outside
- Oil instead of grease: Oil-lubricated bearings increase the service life

Advantages for the life cycle assessment
- Standard use of energy-efficient motors of class IE3
- Suction on the cold side of the assembly
- Base package to be found in a highly efficient machine combination of AERZEN rotary lobe compressors und AERZEN turbo blowers
- Belt drive for optimal volume flow design
- Subsequent power adaptations are easily and quickly possible

Belt tensioning hinged motor mounting plate
- Fully automatic and maintenance-free belt tension
- Inspection of V-belt tension no longer necessary
- Easy assembly or replacement of V-belts

Multifunctional hoist for hinged motor mounting plate
- Transport safety lock
- Easy and safe assembly of V-belts
- Mobile installation of assemblies (e.g. ship installation/earthquake design)
- Hinged motor mounting plate support for heavy motors

Low noise level
- Safe observance of the sound values, close to building areas and production areas
- Lowest sound values by optimised acoustic hood
- Integrated method for reducing pulsation (Patented AERZEN blower stage)

PED pressure-vessel guidelines approval (pressure safety valve)
- for overpressure operation

ATEX-compliant
- AERZEN base supports certified as spark suppressor for ATEX applications

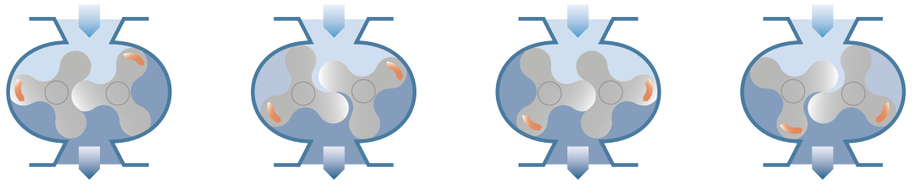
TÜV-certified zone separation filter (optional)

Interested in the inner vales?
Construction and design

It is good to know what is in the assemblies of the Delta Blower line from AERZEN: The wealth of experience of the world market leader. The quality standard of the traditional German family business. The innovation goal "Best solution provider for our customers". In addition first-class material selection. And a principle that has proven itself in tens of thousands of applications: Roots.

Innovation pulsation reduction.

Especially for its Delta Blower stages AERZEN has developed a unique process and integrated it into all sizes: the pulsation reduction. The patented AERZEN process prevents pulsations and noise already at the origin within the blower stage. For this purpose the AERZEN blowers equipped with 3-lobe pistons have two special channels cast in the cylinder. These control the backflow of the medium into the conveying chamber in such a way that the typical backstroke and squeezing pulses (typical for 2-lobe blowers) are eliminated. The end for pulsations due to patented interference method.



Conveying process in the AERZEN blower

Blower stage
- AERZEN Blowers with 3-lobe pistons and integrated pulsation reduction
- Housing consisting of: Cylinder (with two cylinder with cast-in pre-inlet channels at discharge side to minimise the sound by pulsation reduction), wheel housing, housing cover and side plates
- Material EN-GJL-200
- Ribbed surfaces

Pistons
- Sizes GM 3 S to GM 130 L:
- Pistons and shafts in one piece
- Sizes GM 150 S to GM 240 S:
- Pistons made of nodular cast iron, shafts made of tempered steel

Drive type
- Overhung via narrow V-belt
- Direct drive

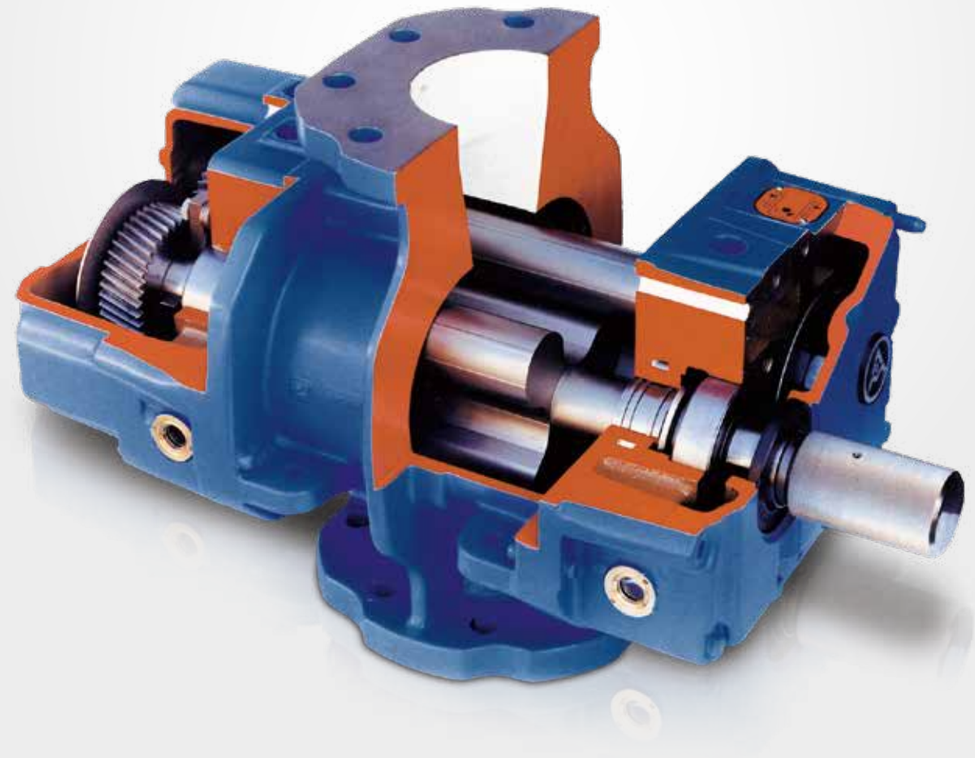
Cooling
- Convection cooling

Lubrication
- Oil splash lubrication for bearings and timing gears

Oil-free conveying
- The oil-free design according to ISO 8573-1 class 0 is guaranteed by the piston ring labyrinth seal, which has proven itself over decades, in combination with neutral chambers (open to the atmosphere)

Timing gears
- Hardened and ground, helically geared and made of case-hardened steel
- They are fitted to the shafts by taper interference fit
- maximum running smoothness and service life

Intelligent technical details ensure that the Delta Blower packages retain their value. One example of many: The patented pulsation reduction, an **AERZEN** innovation for longer bearing life.



It's the inner values that matter: the AERZEN blower stage

Already in the standard version extraordinary. The delivery concept of **AERZEN**

Some call it comfortable. The others efficient. We call it all-in: the delivery concept of AERZEN. When the Delta Blower package comes to you, it is already completely configured, parameterised and mounted ready for connection at the factory. Naturally, this is tailored to your processes. Including all standardised accessory components for trouble-free operation at the touch of a button.

1 3-lobe blower stage
- With integrated pulsation reduction (see page 10/11)

2 Base supports with integrated discharge silencer
- Certified as spark arrester
- Absorbent-free silencing through patented discharge silencer

3 Intake silencer with integrated air filter or strainer
- Standard suction from the atmosphere (overpressure)
- Suction via piping optional (standard for negative pressure)
- Suction via filter element for negative pressure optional

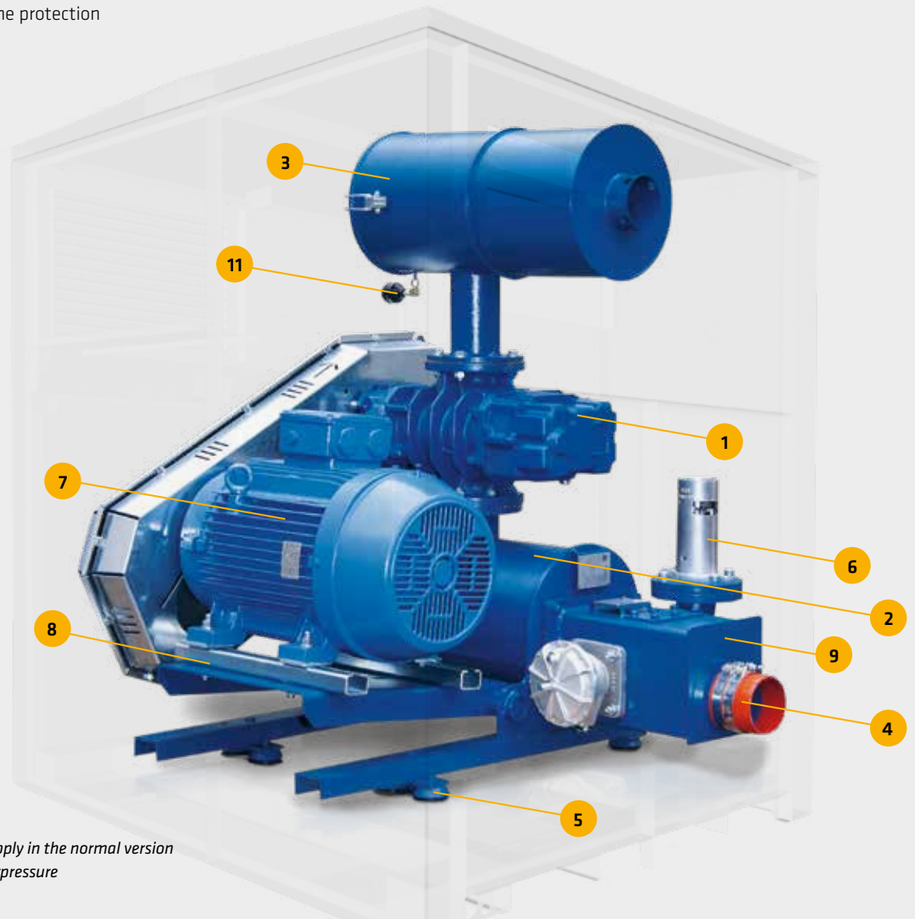
Overpressure

Negative pressure

4 Flexible rubber sleeve
- with clamps

5 Flexible machinery mountings
- For the decoupling of structure-borne noise

6 Pressure valve or suction valve
- For machine protection



All in: The scope of supply in the normal version
Assembly design: Overpressure

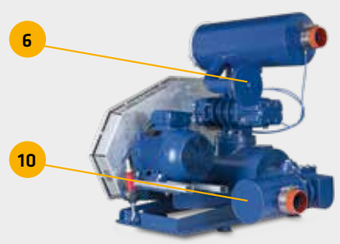
7 Drive
- Via high-performance narrow V-belt drive by means of three-phase motor
- Standard use of energy-efficient
- class IE3 motors (up to motor size 315)

8 Hinged motor mounting plate
- Automatic tensioning device for the belt drive
- Multifunctional hoist for hinged motor mounting plate

9 Connecting housing
- integrated check valve

10 Integrated blow-off silencer
- Horizontal version (up to DN 125)

11 Standard instrumentation
- Pressure gauge for indication of the conveying pressure (overpressure)
- Maintenance indicator for monitoring the intake filter (overpressure)
- Vacuum meter for indication of the conveying pressure (negative pressure)



Assembly design: Negative pressure

Modifications and accessories
The best for every application

Added value: The accessory components

- Acoustic hood for indoor and outdoor installation, forced ventilation via mechanical fan
- Start unloading device, required for star-delta starting of the motor (overpressure),
- Vertical blow-off silencer with base plate (negative pressure)
- discharge side expansion joint instead of flexible rubber sleeve
- Power cabinet Star-delta, frequency converter, soft starter
- AERZEN AERtronic blower control
- AERZEN original spare parts
- Other accessories on request

AERZEN Start unloading device

Modifications

- Special motors
- special varnish
- ATEX compliant design
- Acoustic hood for desert installation with special sand collector
- Acoustic hood for low temperatures down to minus 40°C with heating and gravity louvers
- Acoustic hood for earthquake resistance and increased wind loads
- Ship installation and vehicle deployment
- Use for special gases through the use of special materials
- Customised documentation
- Compliance with legal requirements for delivery e.g. in Eurasian customs union

Always the safe choice: ATEX compliant design from AERZEN

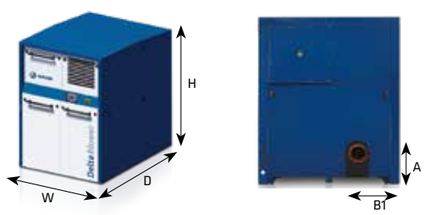
The new AERtronic - the way into the digital future

The new edition of the AERtronic control system offers a user-friendly and clear possibility for the analysis and processing of relevant process parameters and thus provides more transparency, safety and efficiency. All measured values converge in the new control system and can be transferred to the production control system via common interfaces in order to always operate the plant at the optimum operating point. The AERtronic is available in three versions:

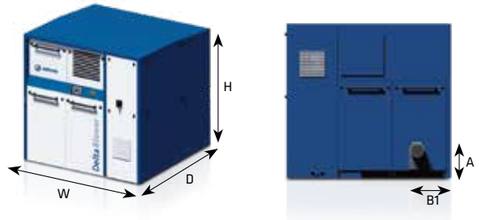
Basic: As a fully digital display instrument
Advanced: For active process control
Premium: As an intelligent interface with cloud compatibility.

Compact design can be set up side-by-side, of course

Dimensions and weights
(subject to technical changes - product is subject to technical change)



Delta Blower



Delta Blower with integrated power supply panel

Delta Blower

Type	W		D		H		A		B1		Nominal diameter DN	Weight without acoustic hood		Weight with acoustic hood	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm		lbs.	kg	lbs.	kg
GM 3 S	31	800	31	800	41	1,055	8	228	9	245	50	326	148	467	212
GM 4 S	36	925	44	1,135	50	1,280	10	258	10	258	80	456	207	659	299
GM 7 L	36	925	44	1,135	50	1,280	10	258	10	258	80	467	212	670	304
GM 10 S / DN 80	36	925	44	1,135	50	1,280	10	258	10	258	80	520	236	723	328
GM 10 S / DN 100	49	1,,250	53	1,350	59	1,500	11	294	14	375	100	740	336	1,093	496
GM 15 L	49	1,250	53	1,350	59	1,500	11	294	14	375	100	773	351	1,126	511
GM 25 S	49	1,250	53	1,350	59	1,500	11	294	14	375	125	897	407	1,250	567
GM 30 L	59	1,500	70	1,800	74	1,900	14	356	17	435	150	1,521	690	2,248	1,020
GM 35 S	59	1,500	70	1,800	74	1,900	14	356	17	435	150	1,719	780	2,447	1,110
GM 50 L	66	1,700	80	2,055	83	2,111	14	357	20	525	200	1,995	905	3,251	1,475
GM 60 S	66	1,700	80	2,055	83	2,111	14	357	20	525	200	2,281	1,035	3,538	1,605
GM 80 L	74	1,900	80	2,200	90	2,308	17	456	23	600	250	3,417	1,550	4,850	2,200
GM 90 S	74	1,900	80	2,200	90	2,308	17	456	23	600	250	3,571	1,620	5,004	2,270
GM 100 S	74	1,900	80	2,200	90	2,308	17	456	23	600	250	4,012	1,820	5,445	2,470
GM 130 L	82	2,100	112	2,850	92	2,345	16	410	25	635	300	5,370	2,436	7,517	3,410
GM 150 S	82	2,100	112	2,850	92	2,345	16	410	25	635	300	6,164	2,796	8,267	3,750
GM 220 L *	82	2,800	169	4,304	137	3,500	16	410	31	800	400	10,981	4,981	18,166	8,240
GM 240 S *	82	2,800	169	4,304	137	3,500	16	410	31	800	400	11,841	5,371	19,025	8,630

* Design in Compact IV

Weights without motor and belt drive

Delta Blower with integrated power supply panel.

Type	W		D		H		A		B1		Nominal diameter DN	Weight with acoustic hood	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm		lbs.	kg
GM 10 S	72	1,850	53	1,350	59	1,500	11	294	14	375	100	1,364	619
GM 15 L	72	1,850	53	1,350	59	1,500	11	294	14	375	100	1,457	661
GM 25 S	72	1,850	53	1,350	59	1,500	11	294	14	375	125	1,580	717
GM 30 L	82	2,100	70	1,800	74	1,900	14	356	17	435	150	2,914	1,322
GM 35 S	82	2,100	70	1,800	74	1,900	14	356	17	435	150	3,112	1,412
GM 50 L	82	2,300	80	2,055	83	2,111	14	357	20	525	200	4,023	1,825
GM 60 S	82	2,300	80	2,055	83	2,111	14	357	20	525	200	4,310	1,955

Weights without motor, power electrics and belt drive

Delta blower in figures
Sizes and pressures ranges

Type	Positive displacement blower
Design	Overpressure
Volume flow	30 bis 14,640 m³/h
Overpressure	up to 1,000 mbar
Conveying medium	Air, Neutral gases
Handling	oil-free

Figure:
Delta Blower GM 25 S - Assembly without acoustic hood

Performance data - DELTA BLOWER - overpressure operation

Blower size	Differential pressure		Volume flow		Motor rating		Sound pressure level
	max. Psi	max. mbar	max. CFM	max. m³/h *	max. hp	max. kW	max. dB(A) **
GM 3 S	14.5	1,000	141	240	15	11	70
GM 4 S	14.5	1,000	196	334	20	15	70
GM 7 L	10.2	700	287	488	20	15	70
GM 10 S / DN 80	14.5	1,000	353	600	30	22	72
GM 10 S / DN 100	14.5	1,000	402	684	40	30	72
GM 15 L	10.2	700	600	1,020	40	30	72
GM 25 S	14.5	1,000	851	1,446	75	55	75
GM 30 L	10.2	700	1,211	2,058	100	75	77
GM 35 S	14.5	1,000	1,405	2,388	125	90	77
GM 50 L	10.2	700	1,935	3,288	125	90	77
GM 60 S	14.5	1,000	2,076	3,528	200	132	80
GM 80 L	10.2	700	2,924	4,968	250	160	82
GM 90 S	14.5	1,000	3,150	5,352	300	200	81
GM 100 S	14.5	1,000	3,701	6,288	350	250	82
GM 130 L	10.2	700	4,661	7,920	350	250	84
GM 150 S	14.5	1,000	5,297	9,000	500	355	84
GM 220 L	8.7	600	7,398	12,570	450	315	84
GM 240 S	11.6	800	8,617	14,640	700	500	86

* Volume flow (corresponds to the delivery volume flow measured according to ISO 1217 and converted to the reference suction conditions according to the (informative) Annex F of ISO 1217 [inlet pressure = 1.0 bar / inlet temperature = 20°C, RH = 0%])
** Machine noise at a distance of 1m with acoustic hood and connected, insulated pipe, tolerance ± 2 dB(A)

Further pressure ranges can be requested for the AERZEN spectrum. Extensive performance data charts can be found in our Customer Net.

Type	Positive displacement blower
Design	Negative pressure
Volume flow	30 to 15,000 m3/h
Overpressure	down to -500 mbar
Conveying medium	Air, Neutral gases
Handling	Oil-free

Figure:
Delta Blower GM 15 L - Assembly without acoustic hood

Performance data - DELTA BLOWER - negative pressure operation

Blower size	Differential pressure		Volume flow		Motor rating		Sound pressure level
	max. Psi	max. mbar	max. CFM	max. m³/h *	max. hp	max. kW	dB(A) **
GM 3 S	-7.5	-500	147	250	10	7.5	68
GM 4 S	-7.5	-500	200	340	10	7.5	70
GM 7 L	-7.5	-500	306	520	15	11	73
GM 10 S / DN 80	-7.5	-500	353	600	20	15	70
GM 10 S / DN 100	-7.5	-500	429	730	20	15	70
GM 15 L	-7.5	-500	635	1,080	30	22	73
GM 25 S	-7.5	-500	888	1,510	40	30	73
GM 30 L	-7.5	-500	1,247	2,120	60	45	75
GM 35 S	-7.5	-500	1,424	2,420	75	55	75
GM 50 L	-7.5	-500	2,030	3,450	100	75	78
GM 60 S	-7.5	-500	2,142	3,640	100	75	78
GM 80 L	-7.5	-500	3,031	5,150	148	110	80
GM 90 S	-7.5	-500	3,296	5,600	148	110	80
GM 100 S	-7.5	-500	3,884	6,600	177	132	80
GM 130 L	-7.5	-500	4,750	8,070	215	160	82
GM 150 S	-7.5	-500	5,709	9,700	268	200	82
GM 220 L	-7.5	-500	7,534	12,800	335	250	82
GM 240 S	-7.5	-500	8,829	15,000	422	315	80

* Volume flow (corresponds to the delivery volume flow measured according to ISO 1217 and converted to the reference suction conditions according to the (informative) Annex F of ISO 1217 [inlet pressure = 1.0 bar / inlet temperature = 20°C, RH = 0%])
** Machine noise at a distance of 1m with acoustic hood and connected, insulated pipe, tolerance ± 2 dB(A)

Further pressure ranges can be requested for the AERZEN spectrum. Extensive performance data charts can be found in our Customer Net.

Matured to perfection in 160 years:
The service world of AERZEN

The best kind of service is the kind you don't need. But every technology involves wear and tear. Our machines are designed to do their job for as long and efficiently as possible. If necessary, for decades. The goal of AERZEN Services is to extend service life and availability – simple added value for your investment!

With your OEM's best recommendations

We have been manufacturing quality products for over 150 years. At the same time, we also developed a corresponding service world. With tailor-made offers for every phase of your machine's lifespan. With OEM original parts, reliable logistics and excellent service at its core. And with decentralised service centres in your vicinity, which guarantee fast provision of spare parts and competent service - worldwide.

AERZEN on-site service

Our service teams work where our machines are. All over the world. Onshore or offshore. Often under extreme conditions. How do we do it? With short distances. AERZEN has a dense network of service centres and decentralised parts warehouses around the globe. More than 200 excellently trained service technicians can come to your aid from there. Any time and anywhere you need us.

Contact worldwide
2,900 employees work for AERZEN. On every continent. With six sales offices in Germany alone, we're there for you. And with more than 50 subsidiaries in over 100 countries around the world. Hence we're never far away – should you ever need us. Give us a call:
+49 5154 81 0

Service-Infoline
Our German Service Centre is available for customers and operators. We are happy to help you. We look forward to your call:
+49 700 49318551

Customer Net
Where you can learn more about the company and the leading compressor technologies from Aerzen? It's simple: In our Customer Net on our website, where we have stored everything that is worth knowing for you:
www.aerzen.com

LET'S TALK
Find your local contact
www.aerzen.com/worldwide

AERZEN. Compression is the key to our success

The Aerzener Maschinenfabrik GmbH was founded in 1864. In 1868, we built Europe's first positive displacement blower. The first turbo blowers followed in 1911, the first screw compressors in 1943, and in 2010 the world's first rotary lobe compressor package. Innovations "made by AERZEN" keep driving forward the development of compressor technology. Today, AERZEN is among the world's longest established and most significant manufacturers of positive displacement blowers, rotary lobe compressors, screw compressors and turbo blowers. And among the undisputed market leaders in many areas of application.

In more than 50 subsidiaries around the world, more than 2,900 experienced employees are working hard on shaping the future of compression technology. Their technical competence, our international network of experts and the continual feedback from our customers are the basis of our success. AERZEN products and services set standards. In particular, with regard to reliability, stability of value and efficiency. Challenge us.

LET'S TALK

Find your local contact

www.aerzen.com/worldwide

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AERZEN
EXPECT PERFORMANCE

Delta Blower (G1-068-12)_EN
04|2025

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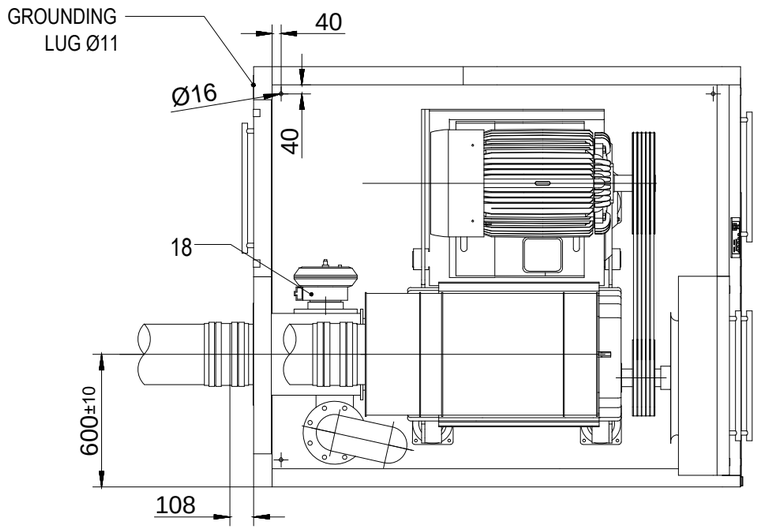
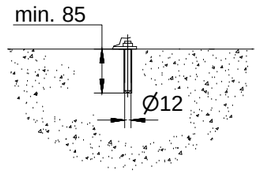
MFS Blower

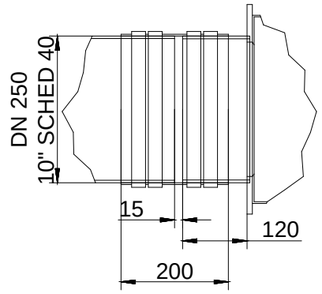


ANCHORING DETAILS

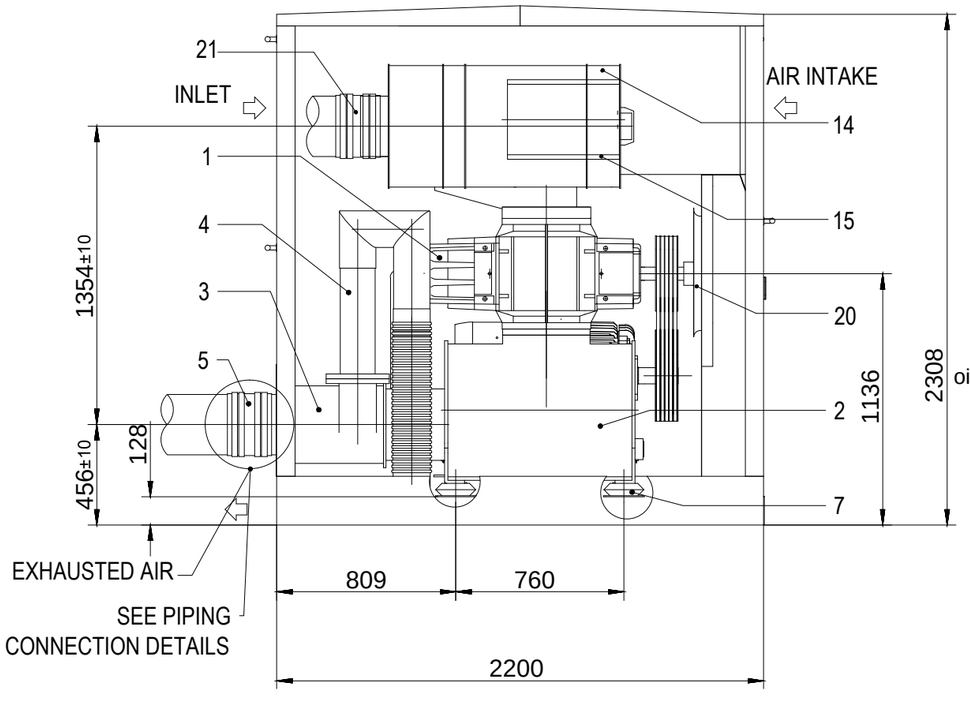
for straddling dowels A/B 15/15 Liebig-dowel
(not includet in Aerzen´s scope of supply)

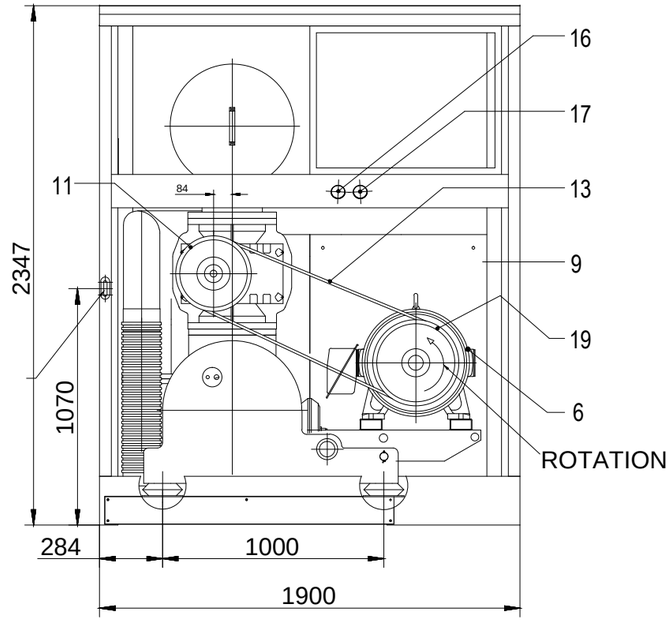


PIPING CONNECTION DETAILS



NOTE	QTY.	POS	DESCRIPTION
	1	1	BLOWER - GM 80 L - 550 KG
	1	2	BASEFRAME / DISCHARGE SILENCER - DN 250
	1	3	CONNECTION HOUSING WITH CHECK VALVE - DN 250
	1	4	PRESSURE RELIEF VALVE - DN 150 - SET AT 750 mbar
	1	5	DISCHARGE FLEXIBLE SLEEVE - WITH 4 CLAMPS - DN 250
D	1	6	MOTOR: TBC
	4	7	VIBRATION ISOLATORS - DN 250
E	1	8	BELT GUARD - DN 250
	1	9	DRIVER SHEAVE
E	1	10	DRIVER BUSHING
	1	11	DRIVEN SHEAVE
E	1	12	DRIVEN BUSHING
	1	13	V-BELT SET
	1	14	INLET FILTER / SILENCER - DN 250
	1	15	INLET FILTER ELEMENT - DN 250
	1	16	FILTER MAINTENANCE INDICATOR - WIKA
	1	17	DISCHARGE PRESSURE GAUGE - WIKA
G	1	18	UNLOADING VALVE
	1	19	ACOUSTIC ENCLOSURE - DN 250
	1	20	FAN - MOUNTED ON BLOWER SHAFT - GM 80L
G	1	21	INLET FLEXIBLE SLEEVE - WITH 4 CLAMPS - DN 250





NOTES:

A. ASSEMBLY WEIGHT WITHOUT MOTOR: 2250 KG
B. PAINT: AERZEN STANDARD BLUE
C. 1M CLEARANCE IS RECOMMENDED AT THE FRONT OF THE PACKAGE FOR MAINTENANCE ACCESS
D. ELECTRIC MOTOR - INVERTER DUTY RATED - WEG 405T REPRESENTED (OTHER SIZE AND MANUFACTURER AVAILABLE)
E. INCLUDED BUT NOT SHOWN ON DRAWING
F. FOR VARIABLE SPEED APPLICATIONS, CONSTANT TORQUE VFD ARE REQUIRED
G. OPTIONAL

REVISION DETAILS

REV	DRAWN BY	DATE	REVIEWED	DATE	DETAILS	AREA
B	-	18-10-12	-	18-10-12	UPDATE ON GENERAL ARRANGMENT DRAWING	
A	-	08/02/11	-	08/02/11	RELEASE	-

AERZEN
AERZEN CANADA
1995 MONTEE LABOSSIERE, VAUDREUIL QC J7V 8P2
(450) 424-3966 PH, (450) 424-3985 FX

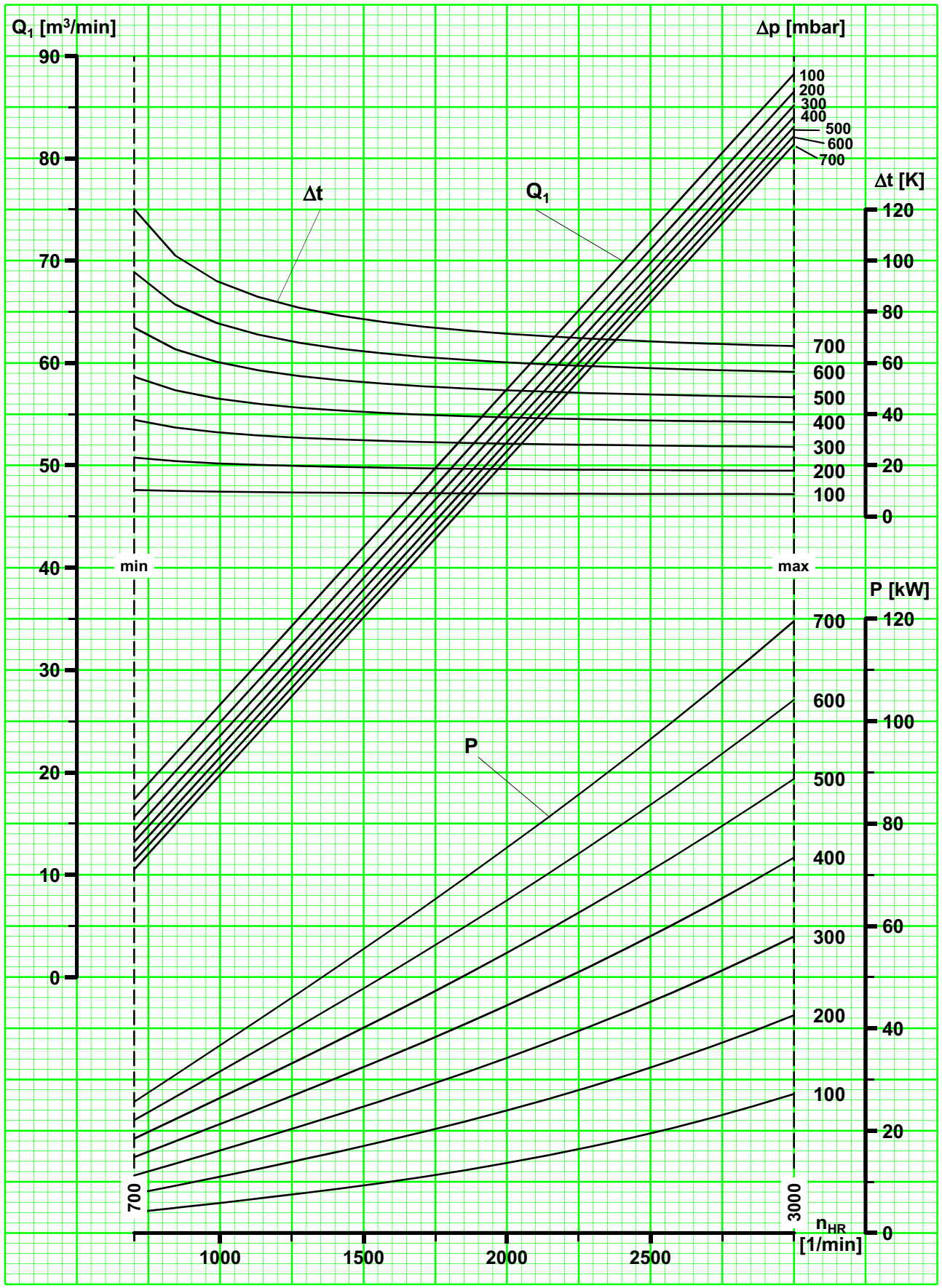
THIRD ANGLE PROJECTION

GEN 5 - GM 80L
DN 250 - PRESSURE

DWG NO.	
1ZG-5602	
DRAWN BY	REVIEWED BY
-	-
DATE	REV
30 APRIL 2012	B
SCALE: NONE	SIZE: A	SHEET: 1 OF 1

Aerzener Maschinenfabrik GmbH
Reherweg 28 - D-31855 Aerzen - Telefon (0 51 54) 81 0 - info@aerzener.de - www.aerzener.com

4000323949 | ZTD | 00



Q_1 : Ansaugvolumenstrom (Luft) bei p_1 = 1,0 bar und t_1 = 20°C	intake volume flow (air) at p_1 = 1.0 bar and t_1 = 20°C	débit aspiré (air) pour p_1 = 1,0 bar et t_1 = 20°C
n_{HR} : Hauptrotordrehzahl	main rotor speed	vitesse du rotor principal
n_V : Antriebswellendrehzahl	drive shaft speed	vitesse de l'arbre d'entraînement
P : Leistungsbedarf an der Kupplung	power required at the coupling	puissance absorbée à l'accouplement
Δt : Temperaturerhöhung	temperature rise	élévation de température
Δp : Druckerhöhung	pressure difference	pression différentielle

Leistungsdiagramm - Überdruck - für Drehkolbengebläsestufe
performance diagram - overpressure - for stage of rotary piston blower
courbes de fonctionnement - fonctionnement en pression - pour étage de surpresseur à pistons rotatifs

GM 80 L

nV / nHR = 1	04/2016 TRD / Hallemann	G2-422 - XL SAP 4000323949 - 00

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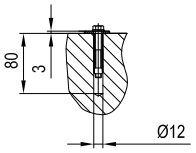
MTS Blower

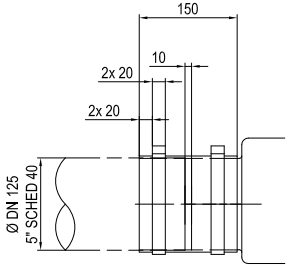
for straddling dowels A/B 12/15 - Liebig - dowel

(not included in Aerzen's scope of supply)

PERFORMANCE DATA	UNIT	DESIGN FLOW	MIN. FLOW
INLET CAPACITY	m³/min ICFM	14.73 520	3.06 108
INLET PRESSURE	bar ab PSIA	0.985 14.3	0.985 14.3
PRESSURE RAISE	mbar PSIG	572 8.3	572 8.3
INLET TEMPERATURE	°C °F	30 86	30 86
DISCHARGE TEMPERATURE	°C °F	90 194	125 257
BLOWER SPEED	RPM	3110	1040
POWER CONSUMPTION	KW BHP	18.3 24.5	5.9 7.9
SOUND LEVEL	dB(A)	71	69

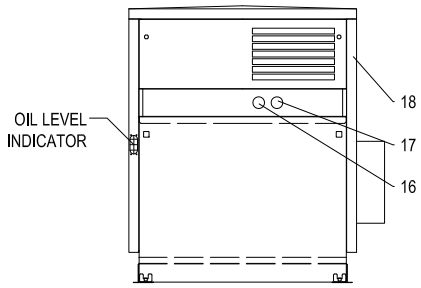


ANCHORING DETAILS

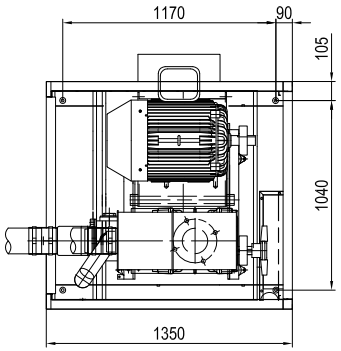


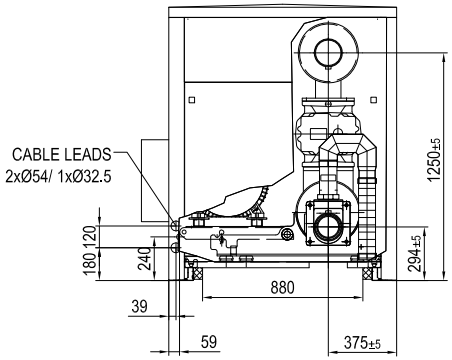
CONNECTION DETAILS

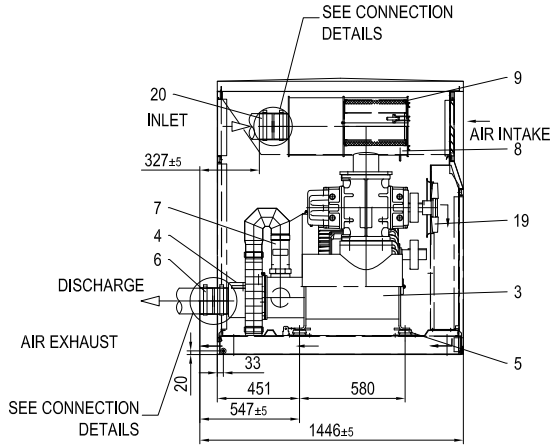
NOTE	QTY.	POS	DESCRIPTION
	2	1	BLOWER - GM 25S - 175 KG
D	2	2	MOTOR: GE X$D - 40/50 HP - 1800 RPM - 324/6T
	2	3	BASE FRAME / DISCHARGE SILENCER - DN 125
	2	4	CONNECTION HOUSING WITH CHECK VALVE - DN 125
	2	5	VIBRATION ISOLATORS - DN 125 - 6 FEET PER UNIT
	2	6	DISCHARGE FLEXIBLE EPDM SLEEVE - DN 125 / 5" SCHED. 40
	2	7	PRESSURE RELIEF VALVE - DN 80 - SET TO 10 PSI
	2	8	INLET FILTER / SILENCER ASSEMBLY - DN 125
	2	9	INLET FILTER ELEMENT
	2	10	BELT GUARD
	2	11	DRIVER SHEAVE, MODEL 5V11.8X2
E	2	12	DRIVER BUSHING, MODEL SK 2-1/8"
	2	13	DRIVEN SHEAVE, MODEL 5V6.7X2
E	2	14	DRIVEN BUSHING, MODEL SK 45MM
	2	15	V-BELT - 5VX780 - 2 PER SET - C.D. = 24.34"
	2	16	FILTER MAINTENANCE INDICATOR - WIKA
	2	17	DISCHARGE PRESSURE GAUGE - WITH BALL VALVE - ASHCROFT
	2	18	ACOUSTIC ENCLOSURE
	2	19	FAN - MOUNTED ON BLOWER SHAFT
	2	20	INLET FLEXIBLE EPDM SLEEVE - DN 125 / 5" SCHED. 40
E	2	21	DISCHARGE TEMPERATURE SWITCH UE, MODEL E100-3BC-W191, SET POINT 140°C
E	2	22	DISCHARGE PRESSURE SWITCH UE, MODEL J6-142, SET POINT 13 PSI

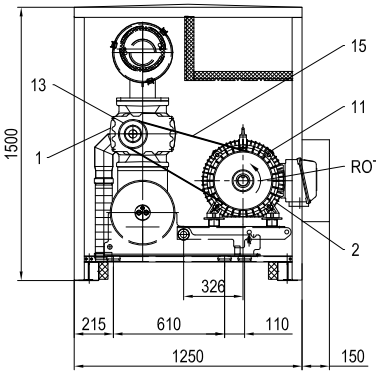


VIEW 'A-A' - FRONT OF UNIT









NOTES:

A. UNIT ASSEMBLY WEIGHT: 907 KG
B. PAINT: PACKAGE - AERZEN STANDARD BLUE
C. 1M CLEARANCE IS RECOMMENDED AT THE FRONT OF THE PACKAGE FOR MAINTENANCE ACESS
D. MOTOR-GE ENERGY $AVER, 40HP, 1780RPM, TEFC, 575/3/60, PREMIUM EFFICIENCY, SF=1.15, INVERTER DUTY RATED
E. INCLUDED BUT NOT SHOWN ON DRAWING
F. FOR VARIABLE SPEED APPLICATIONS, CONSTANT TORQUE VFD ARE REQUIRED

AERZEN REF: SO-13-12949-BP5

CLIENT REF.: U-500325 - PORT CARLING - TAG NO: MB-301 & MB-303

REVISION DETAILS

REV	DRAWN BY	DATE	REVIEWED	DATE	DETAILS	AREA
A	LPM	NOV.05, 2013	DL	NOV.05, 2013	PROJECT GENERAL ARRANGEMENT DRAWING	-

AERZEN
AERZEN CANADA INC
1995 MONTEE LABOSSIERE, VAUDREUIL QC J7V 8P2
(450) 424-3966 PH, (450) 424-3985 FX

THIRD ANGLE PROJECTION

TITLE: G5 - GM 25S DN 125 - PRESSURE

DWG NO. ZG-00789-5590

DRAWN BY: LP MILOT | REVIEWED BY: D. LEVESQUE

DATE: NOVEMBER5, 2013 | REV: A

SCALE: NONE | SIZE: A | SHEET: 1 OF 1

Aerzener Maschinenfabrik GmbH
Reherweg 28 - D-31855 Aerzen - Telefon (0 51 54) 81 0 - info@aerzener.de - www.aerzener.com

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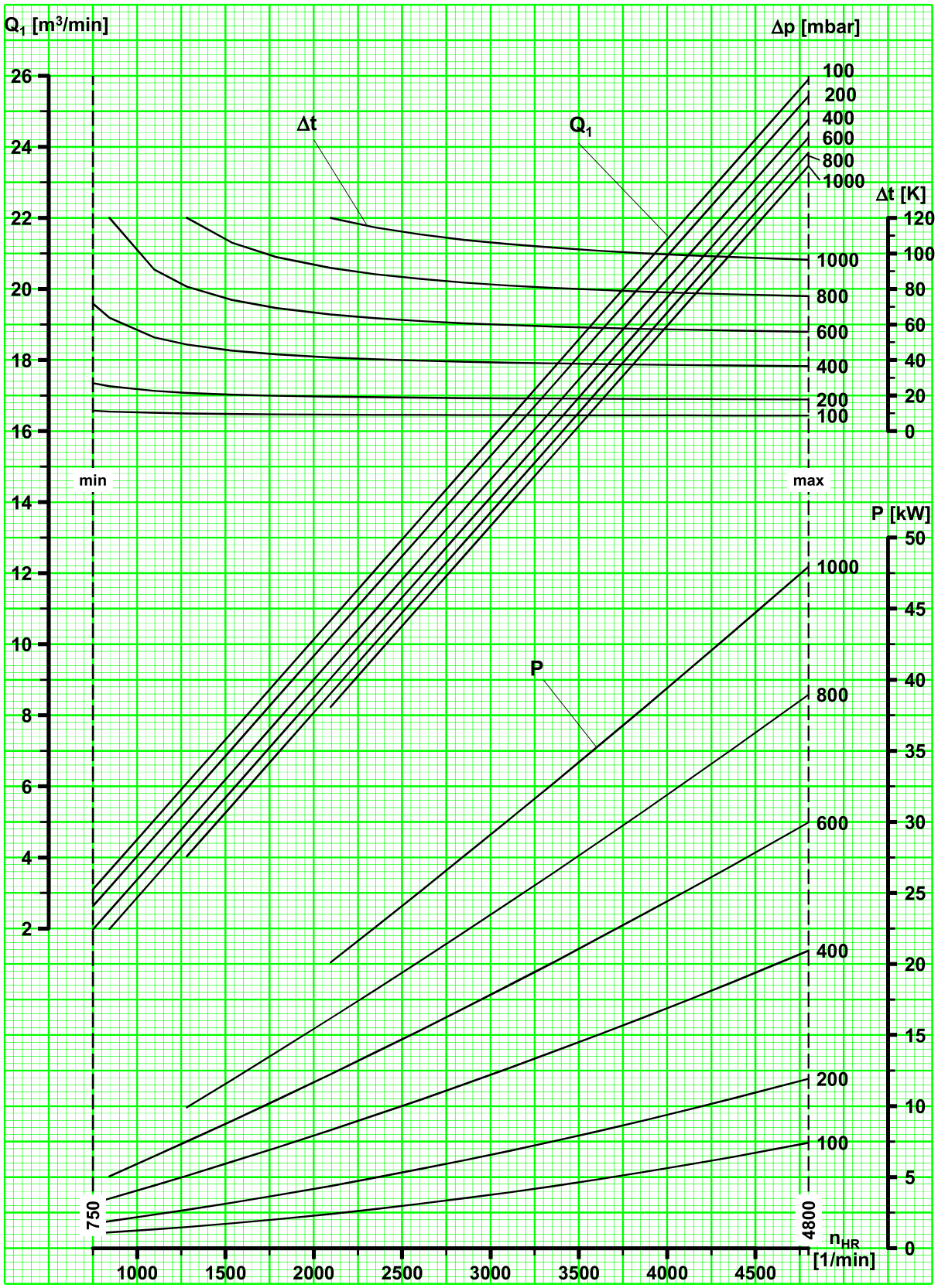


Q_1 : Ansaugvolumenstrom (Luft) bei p_1 = 1,0 bar und t_1 = 20°C	intake volume flow (air) at p_1 = 1.0 bar and t_1 = 20°C	débit aspiré (air) pour p_1 = 1,0 bar et t_1 = 20°C
n_{HR} : Hauptrotordrehzahl	main rotor speed	vitesse du rotor principal
n_V : Antriebswellendrehzahl	drive shaft speed	vitesse de l'arbre d'entraînement
P : Leistungsbedarf an der Kupplung	power required at the coupling	puissance absorbée à l'accouplement
Δt : Temperaturerhöhung	temperature rise	élévation de température
Δp : Druckerhöhung	pressure difference	pression différentielle

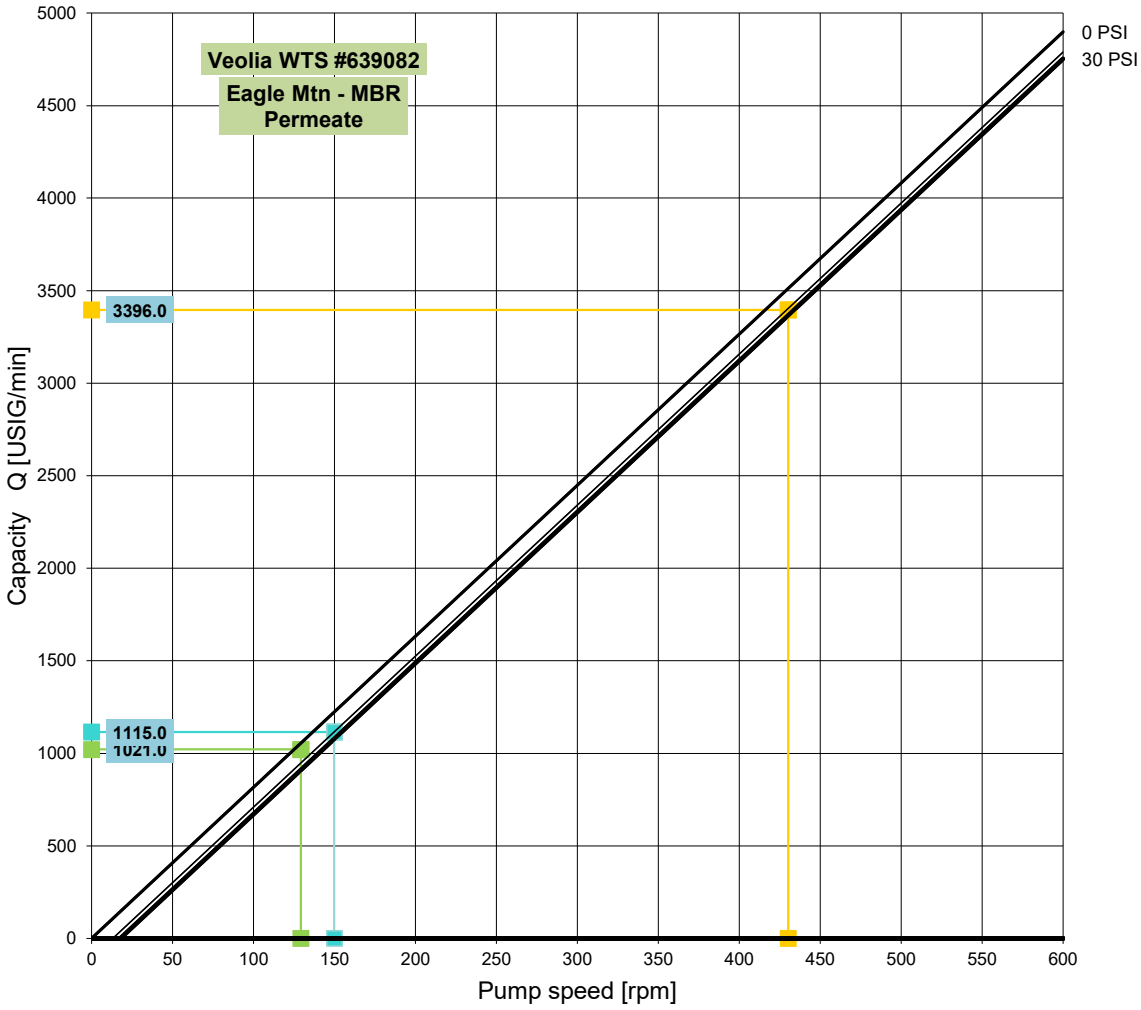
Leistungsdiagramm - Überdruck - für Drehkolbengebläsestufe
performance diagram - overpressure - for stage of rotary piston blower
courbes de fonctionnement - fonctionnement en pression - pour étage de surpresseur à pistons rotatifs

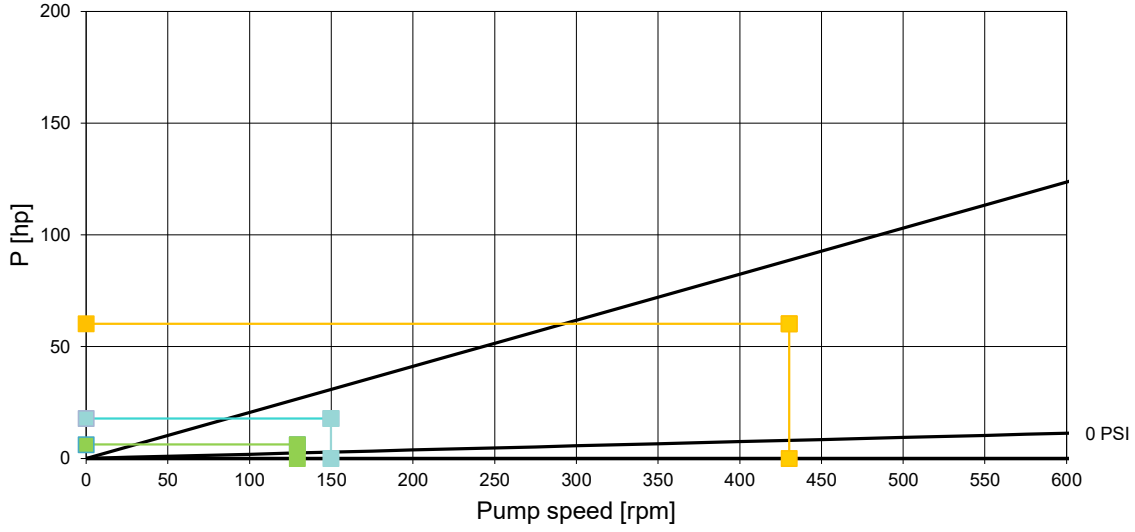
GM 25 S

n_V / n_{HR} = 1	04/2016 TRD - Hallemann	G2 - 412 - XL SAP - 4000323940 - 00

MFS Process Pump

Performance Curve
EL3050 Rotor Type G

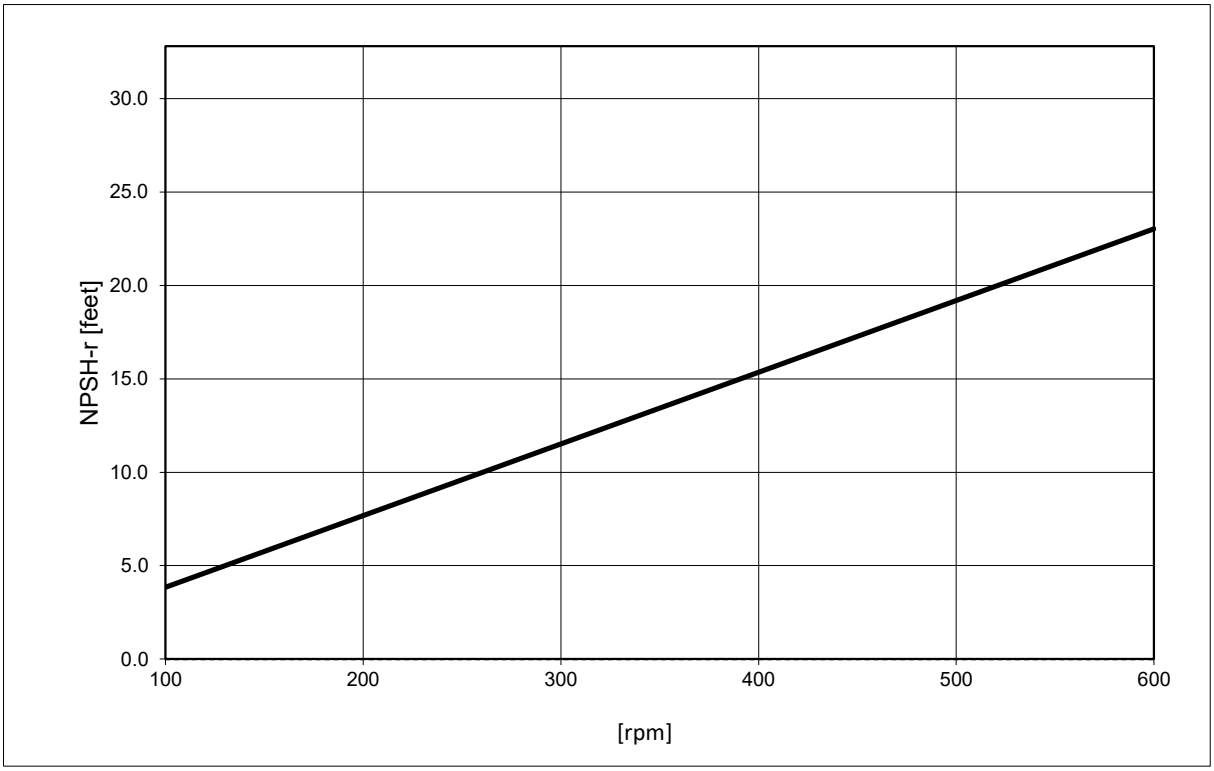




NPSH-Performance Curve

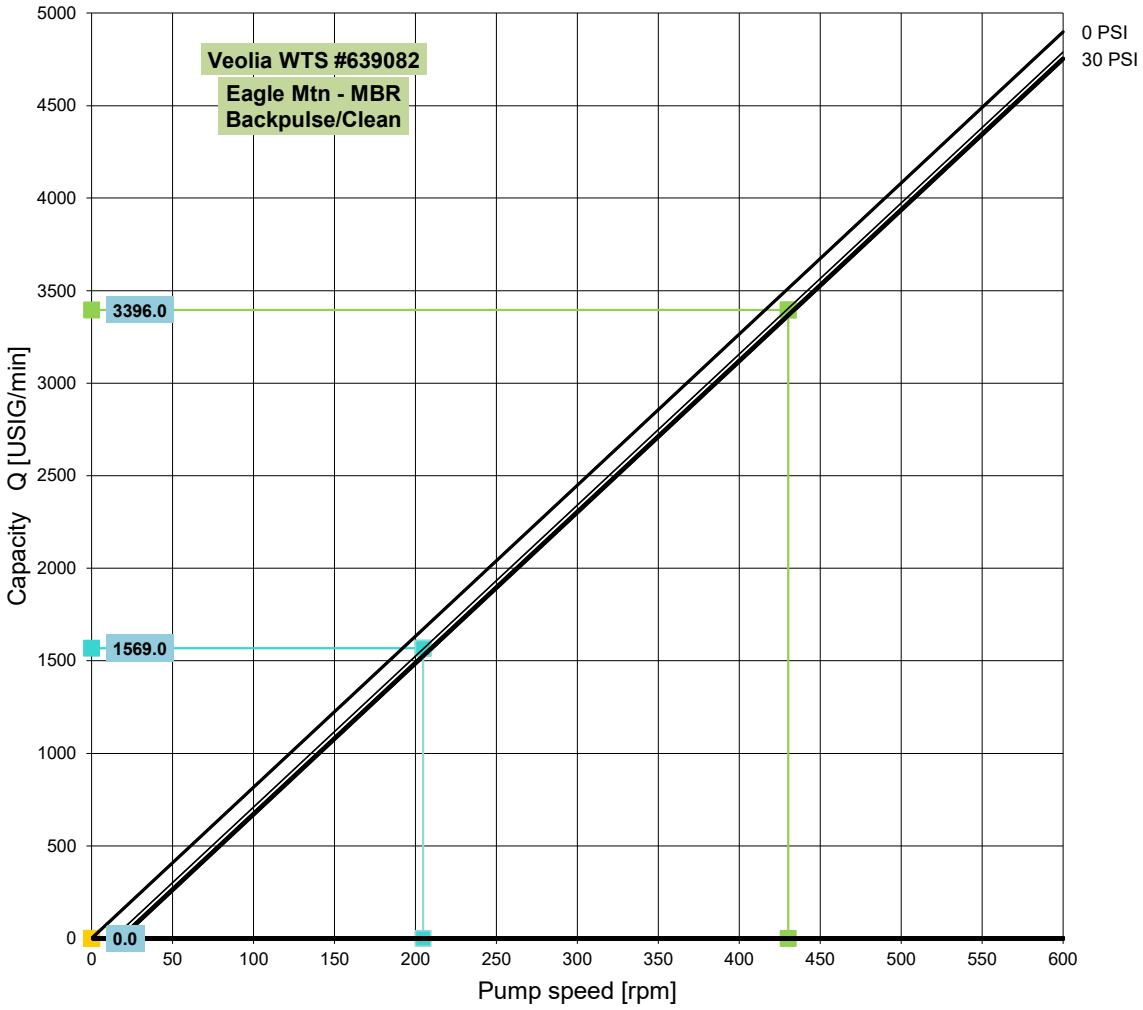
EL3050	G	Kennlinienrechner-JMO-V-2.12

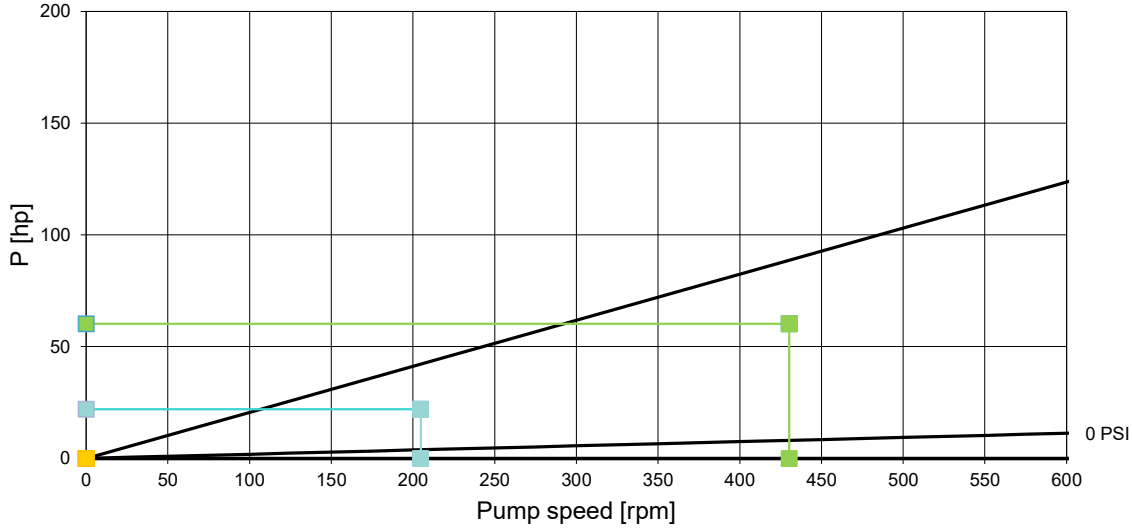
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**3.8**	**7.7**	**11.5**	**15.4**	**19.2**	**23.0**
NPSH-a [feet] OP1= 28.2	24.4	20.5	16.7	12.8	9.0	5.2
NPSH-a [feet] OP2= 28.2	24.4	20.5	16.7	12.8	9.0	5.2
NPSH-a [feet] OP3= 28.2	24.4	20.5	16.7	12.8	9.0	5.2



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible

Performance Curve
EL3050 Rotor Type G

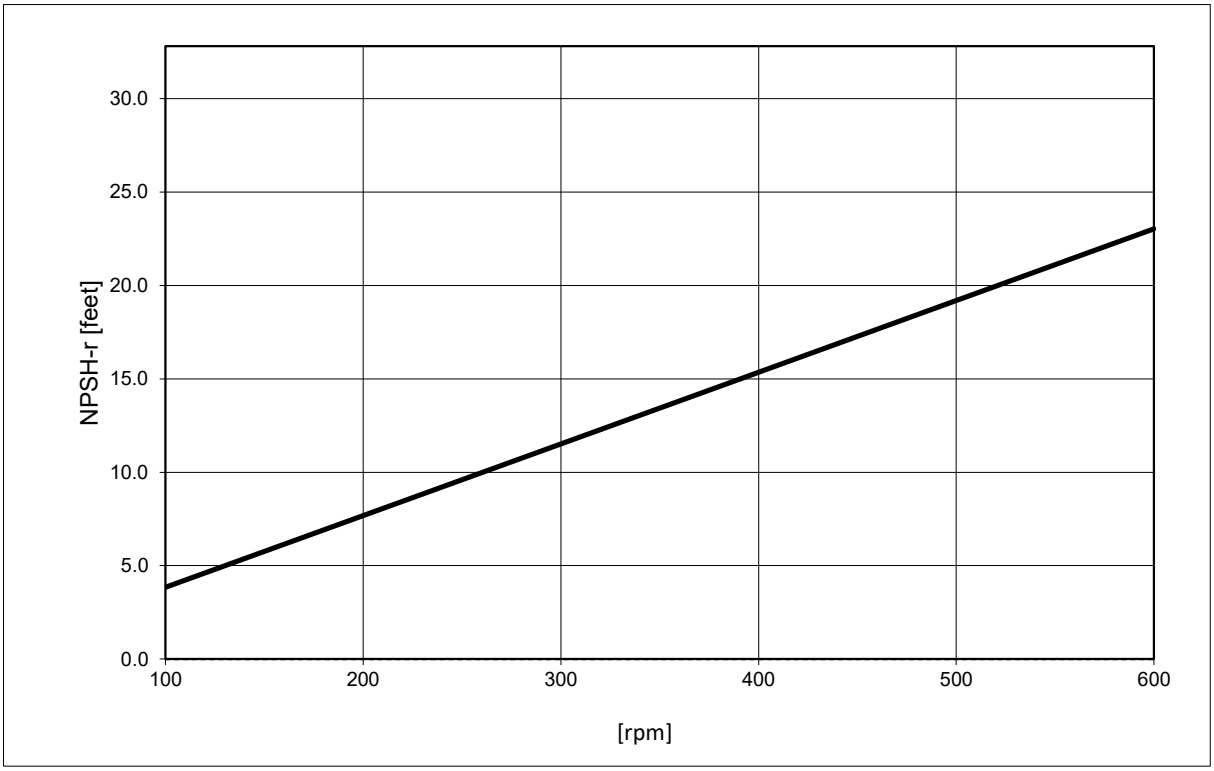




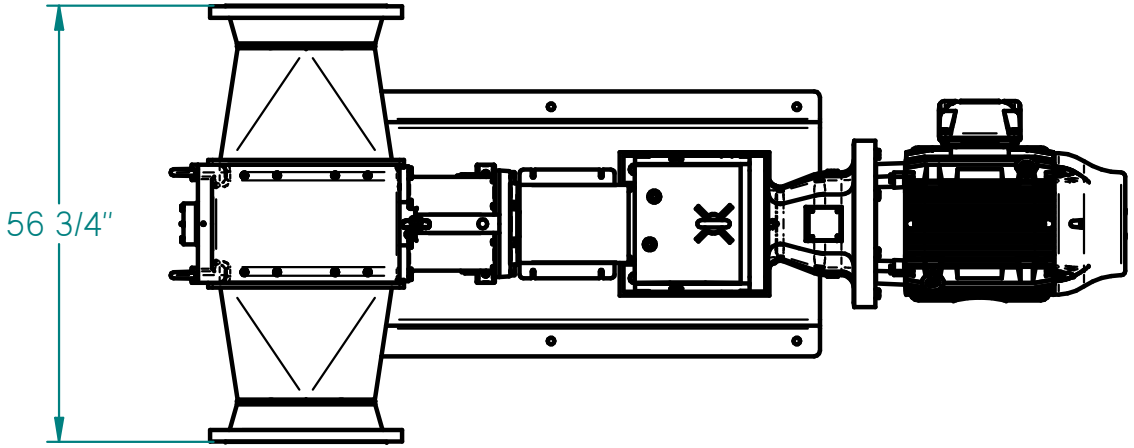
NPSH-Performance Curve

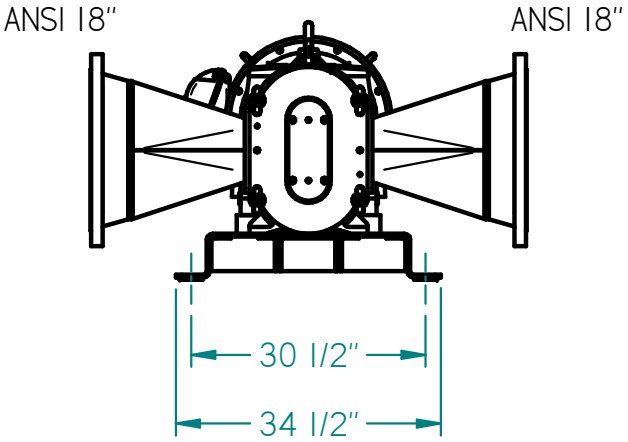
EL3050	G	Kennlinienrechner-JMO-V-2.12

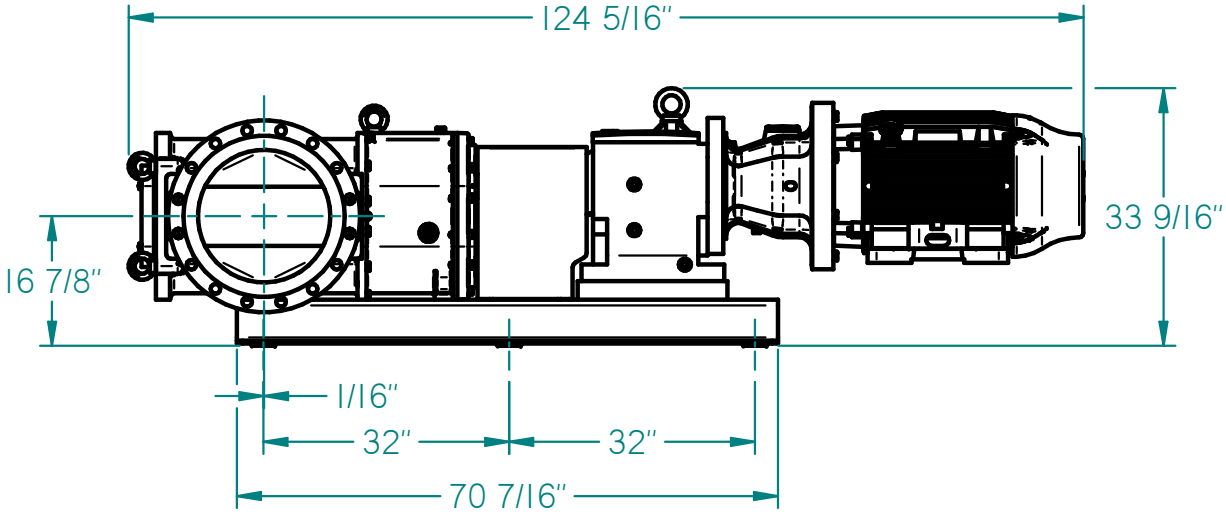
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**3.8**	**7.7**	**11.5**	**15.4**	**19.2**	**23.0**
NPSH-a [feet] OP1= 28.2	24.4	20.5	16.7	12.8	9.0	5.2
NPSH-a [feet] OP2= 28.2	24.4	20.5	16.7	12.8	9.0	5.2
NPSH-a [feet] OP3= 28.2	24.4	20.5	16.7	12.8	9.0	5.2



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible







NOTE:
1. TOTAL WEIGHT = 4,828 LBS

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BOERGER, LLC
2860 Water Tower Place
Chanhassen, MN 55317
TEL: 612-435-7300
FAX: 612-435-7301

THIRD-ANGLE PROJECTION

BÖRGER®

Model: EL 3050
Gear: Nord - In-Line SK82-AN400TC
Power: 100 HP

	NAME	DATE
DRAWN	mlindquist	01/29/26
CHECKED		

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED

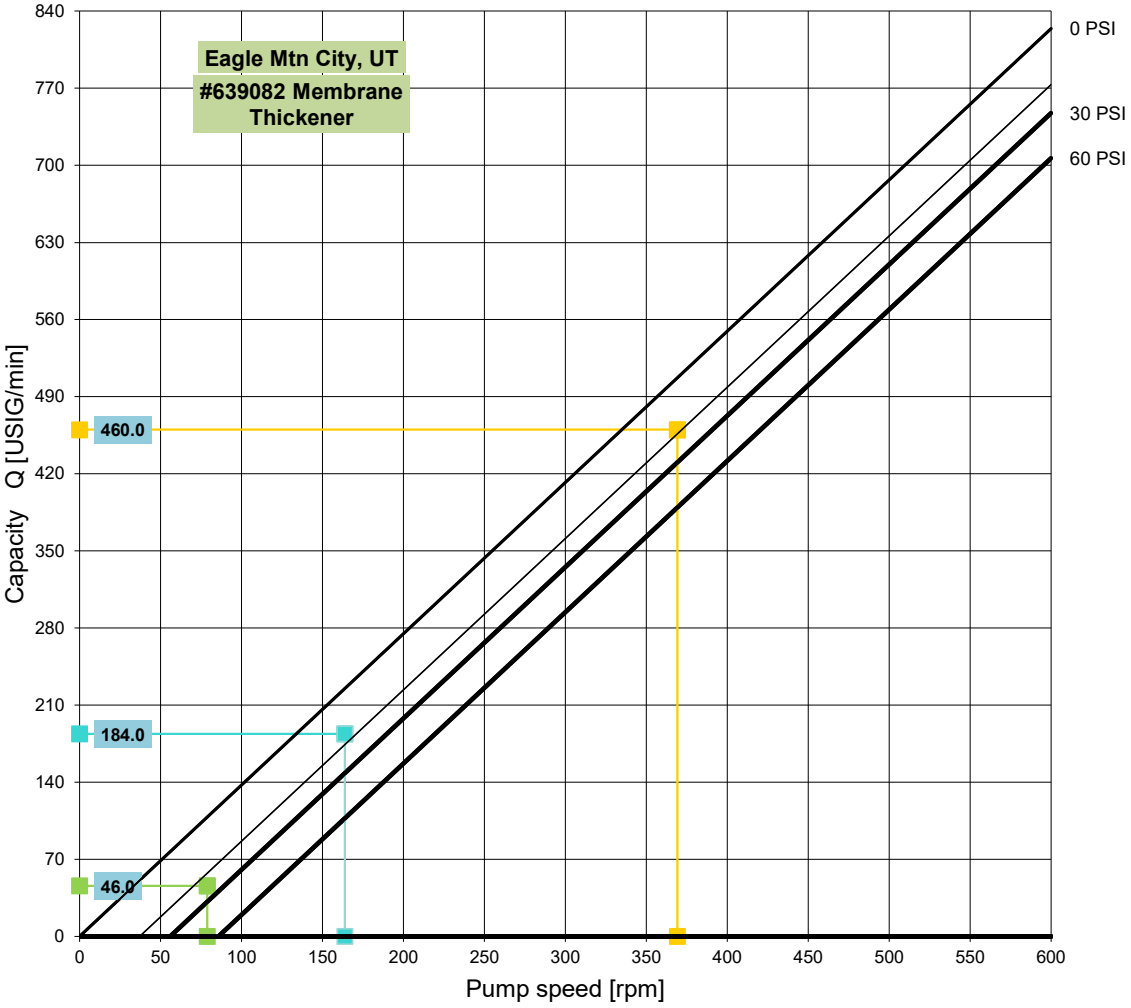
TOLERANCES ± 1/2"

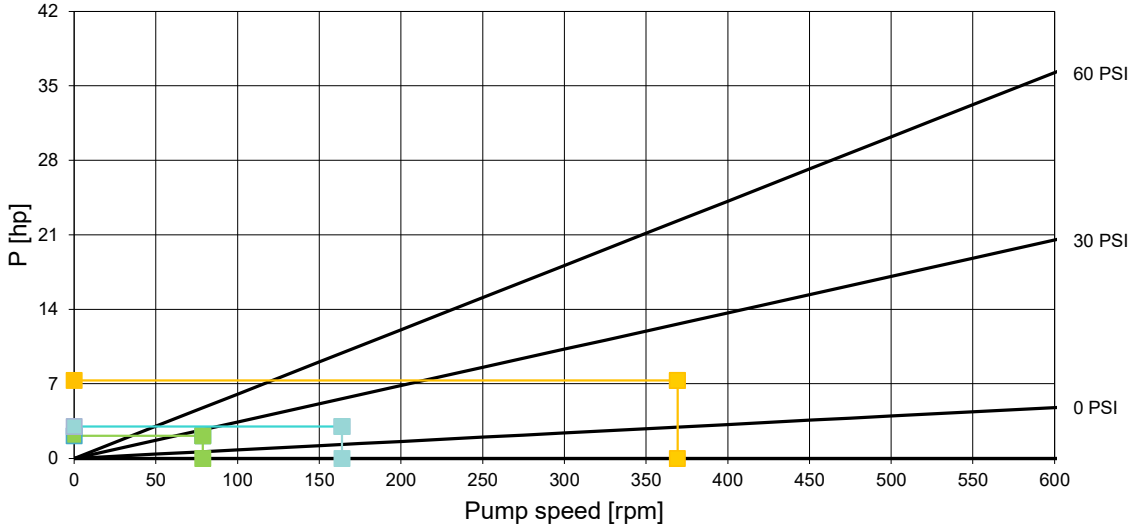
DO NOT SCALE DRAWING

SHEET 1 OF 1

SIZE	DWG. NO.	REV
A	SD-047-109	0

Performance Curve
CL520 Rotor Type G

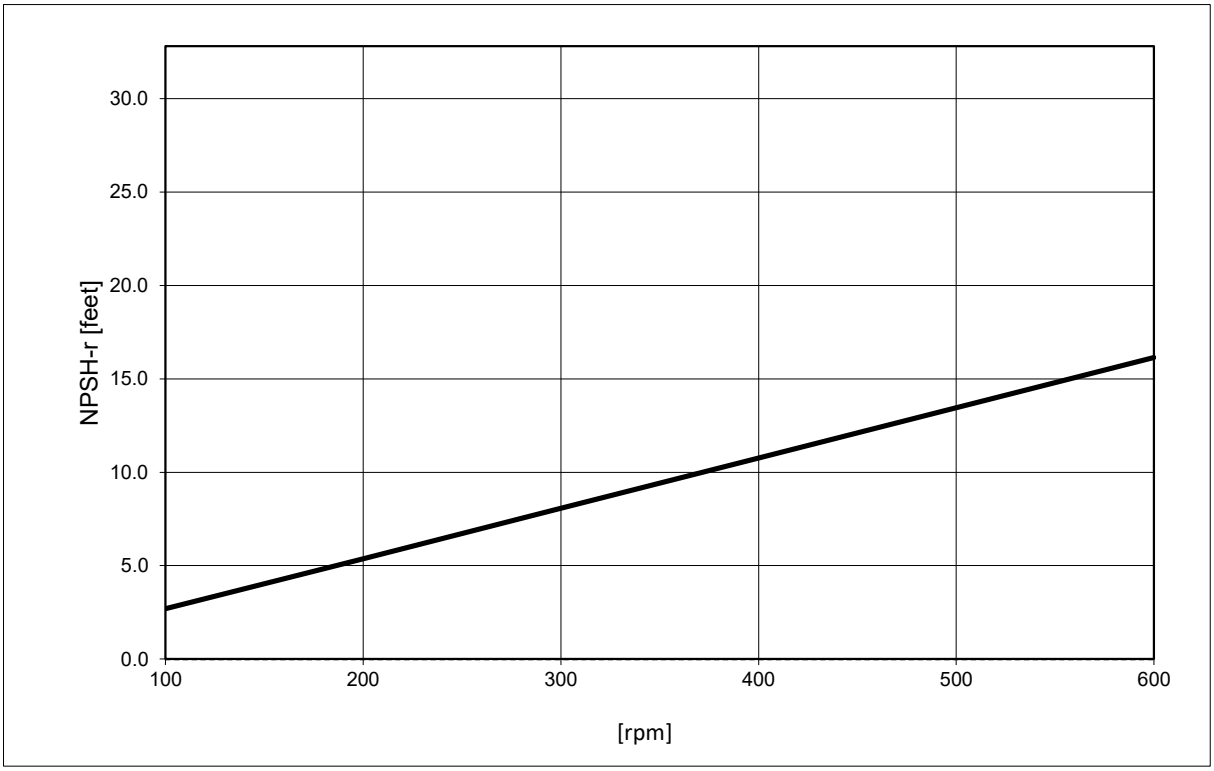




NPSH-Performance Curve

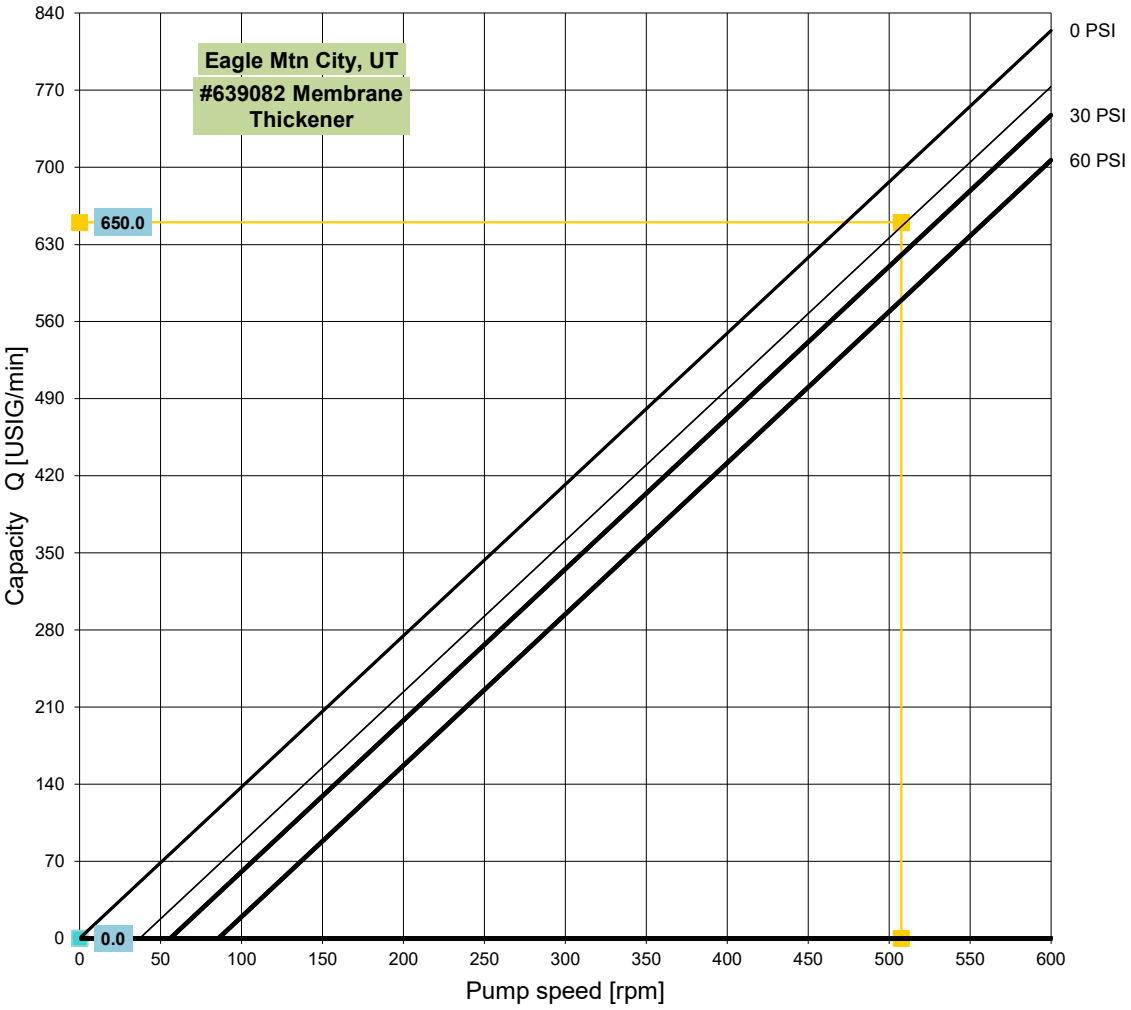
CL520	G	Kennlinienrechner-JMO-V-2.12

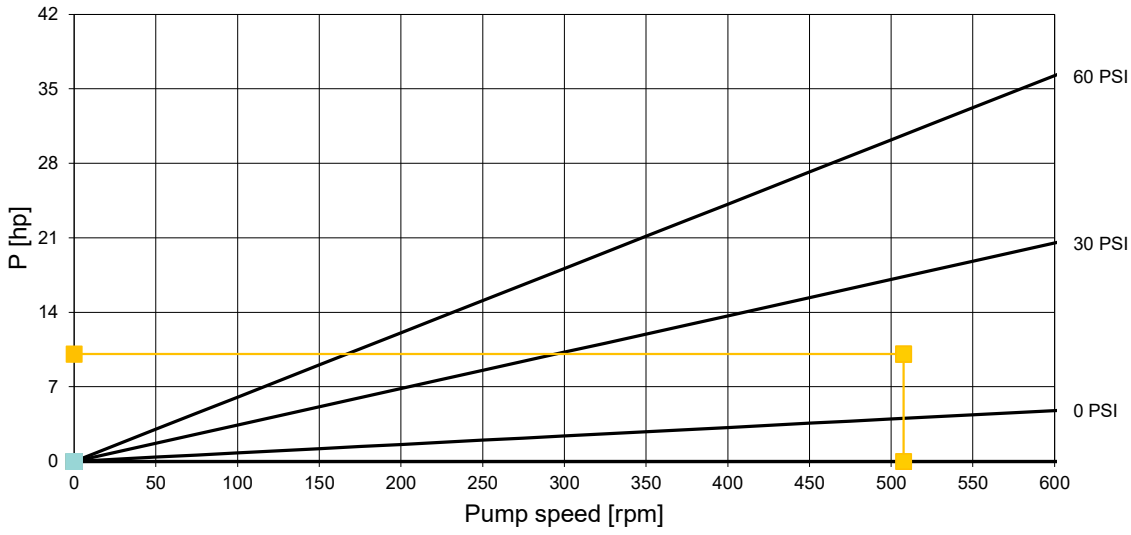
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**2.7**	**5.4**	**8.1**	**10.8**	**13.4**	**16.1**
NPSH-a [feet] OP1= 32.8	30.1	27.4	24.7	22.0	19.4	16.7
NPSH-a [feet] OP2= 32.8	30.1	27.4	24.7	22.0	19.4	16.7
NPSH-a [feet] OP3= 32.8	30.1	27.4	24.7	22.0	19.4	16.7



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible

Performance Curve
CL520 Rotor Type G

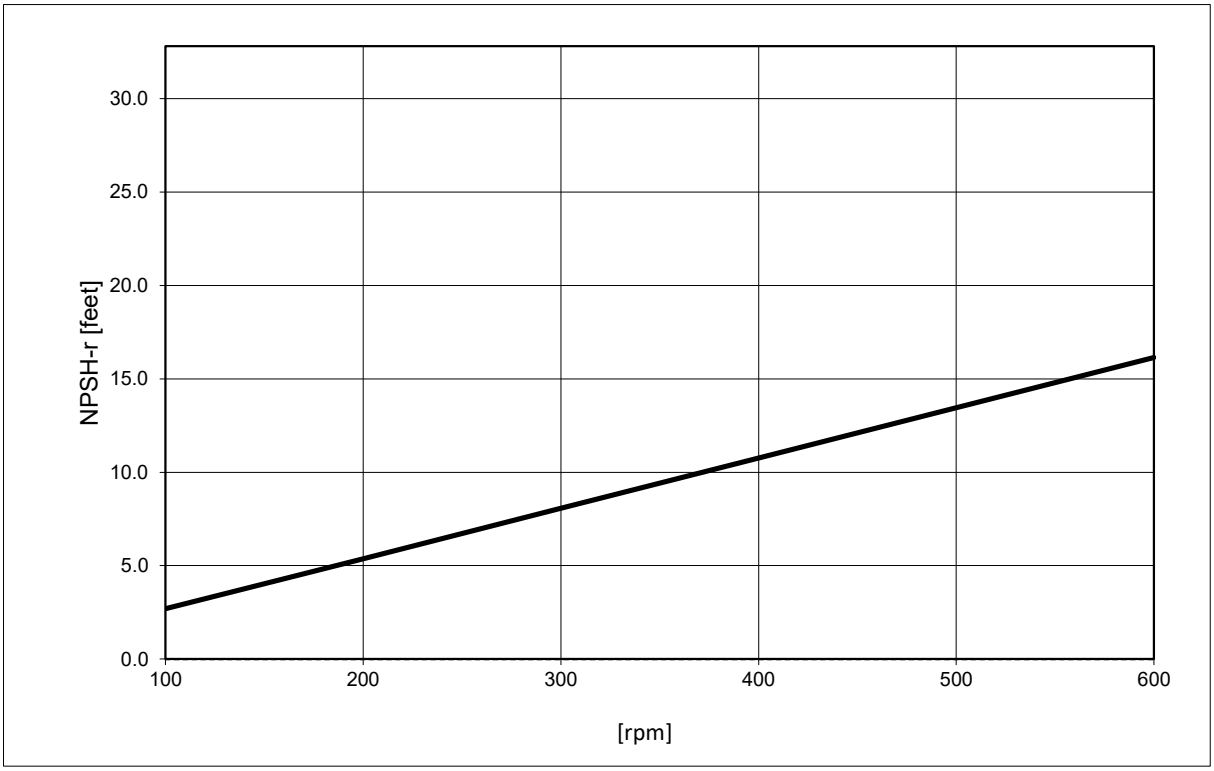




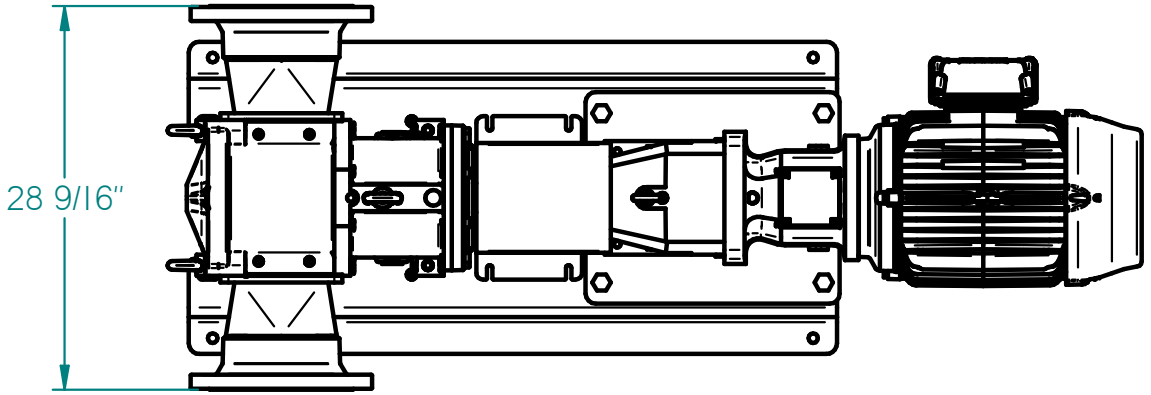
NPSH-Performance Curve

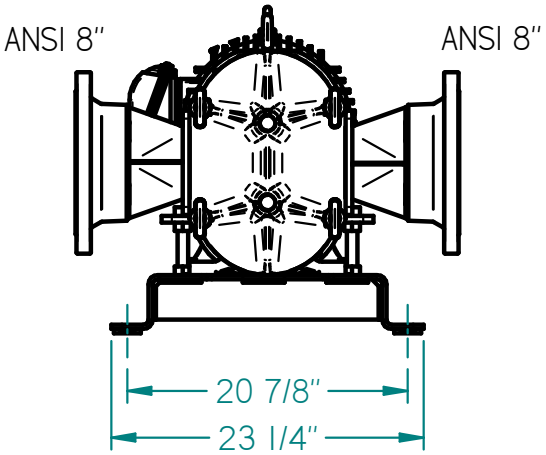
CL520	G	Kennlinienrechner-JMO-V-2.12

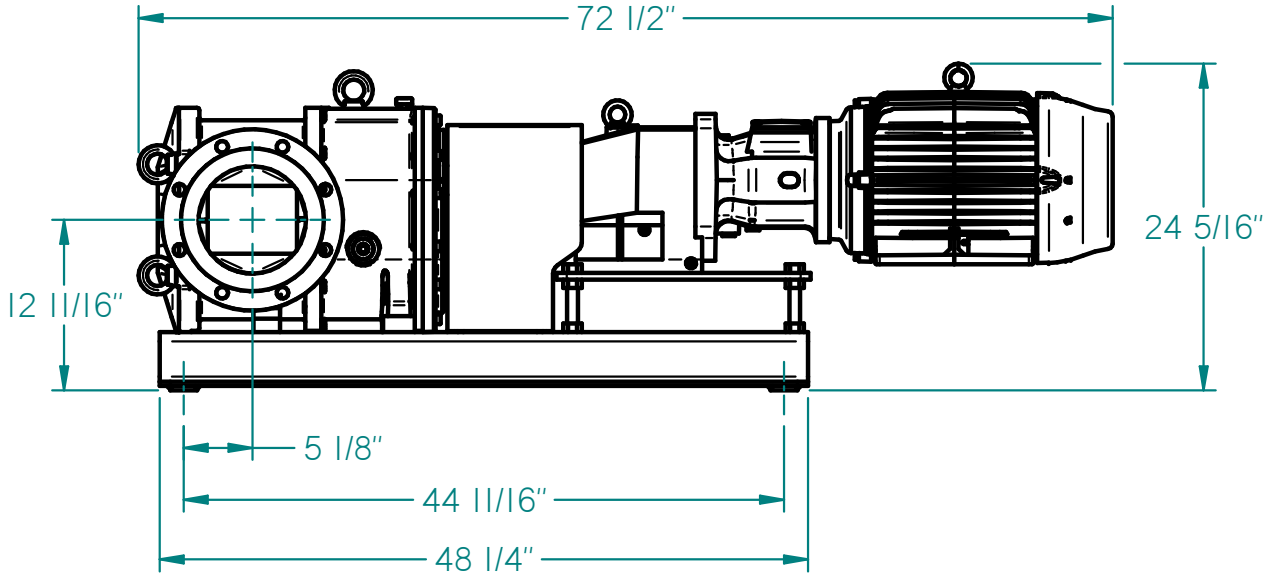
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**2.7**	**5.4**	**8.1**	**10.8**	**13.4**	**16.1**
NPSH-a [feet] OP1= 32.8						
NPSH-a [feet] OP2= 32.8						
NPSH-a [feet] OP3= 32.8	30.1	27.4	24.7	22.0	19.4	16.7



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible







NOTE:
1. TOTAL WEIGHT = 1,288 LBS

PROPRIETARY AND CONFIDENTIAL
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BOERGER, LLC
2860 Water Tower Place
Chanhassen, MN 55317
TEL: 612-435-7300
FAX: 612-435-7301

THIRD-ANGLE PROJECTION

BÖRGER®

Model: CL 520
Gear: Nord - In-Line SK42-AN250TC
Power: 20 HP

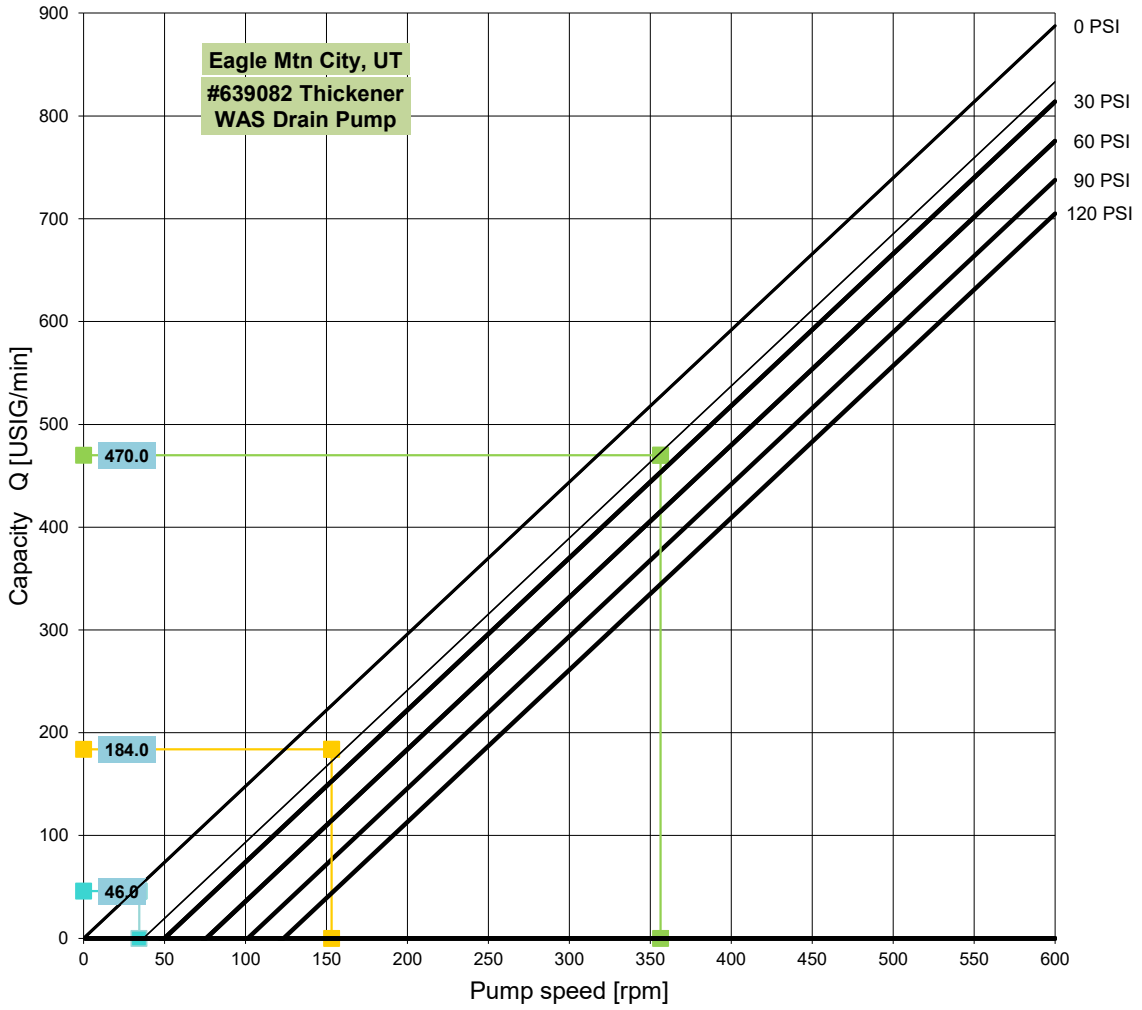
	NAME	DATE
DRAWN	mlindquist	01/29/26
CHECKED		

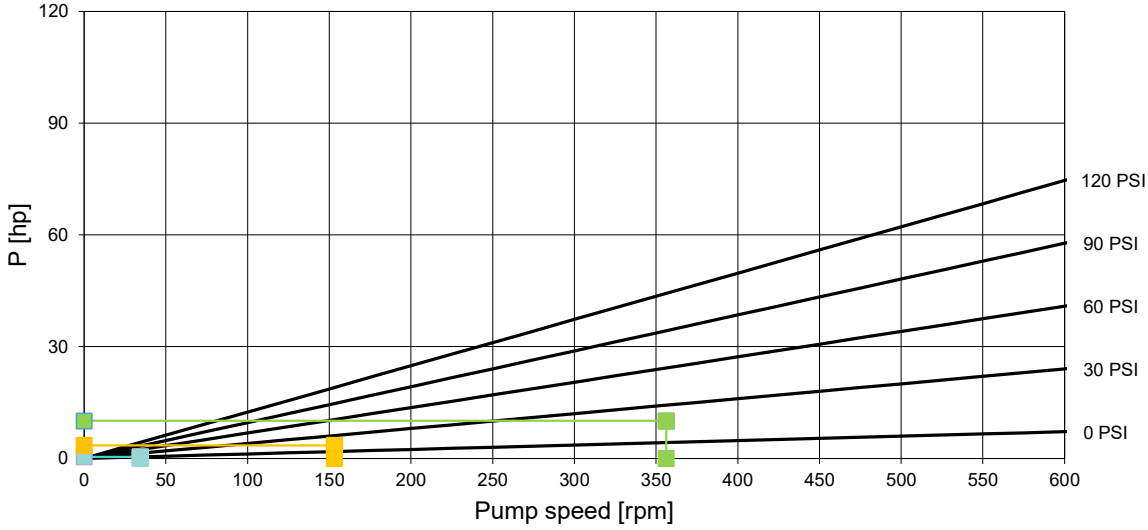
ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED
TOLERANCES ± 1/2"
DO NOT SCALE DRAWING

SHEET 1 OF 1

SIZE	DWG. NO.	REV
A	SD-047-112	0

Performance Curve
FL518 Rotor Type G

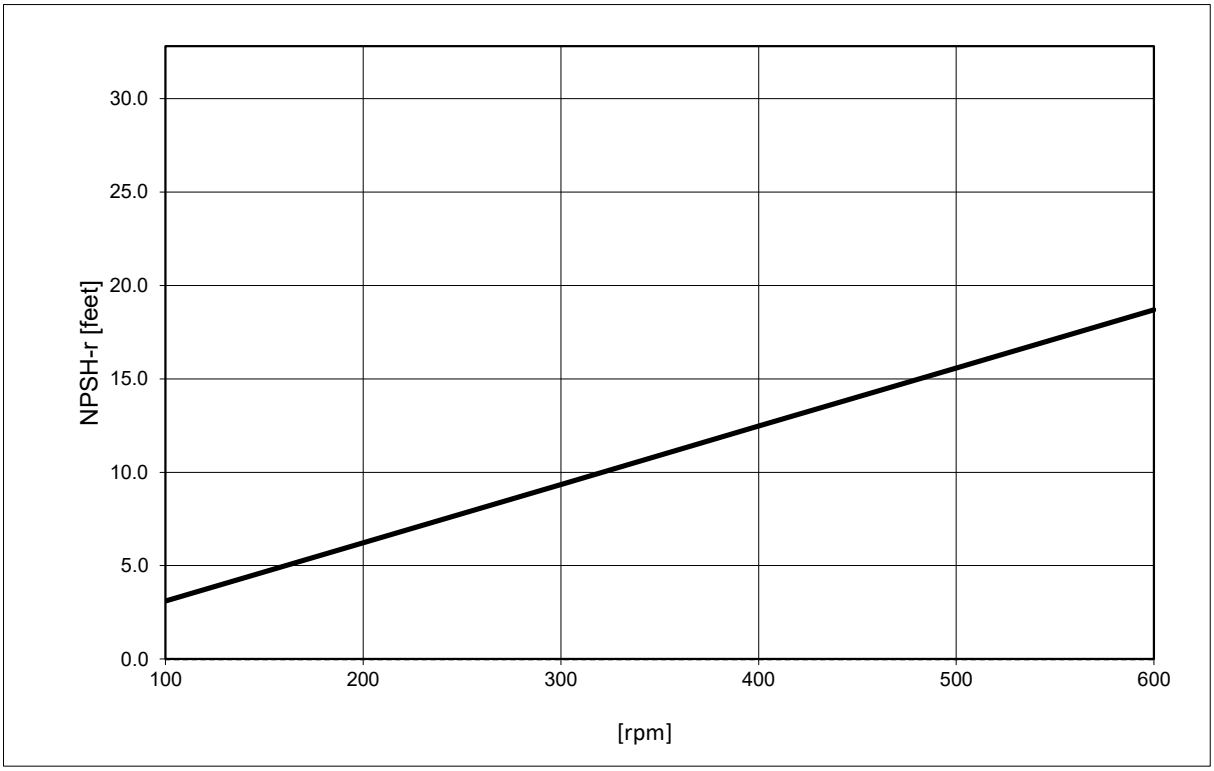




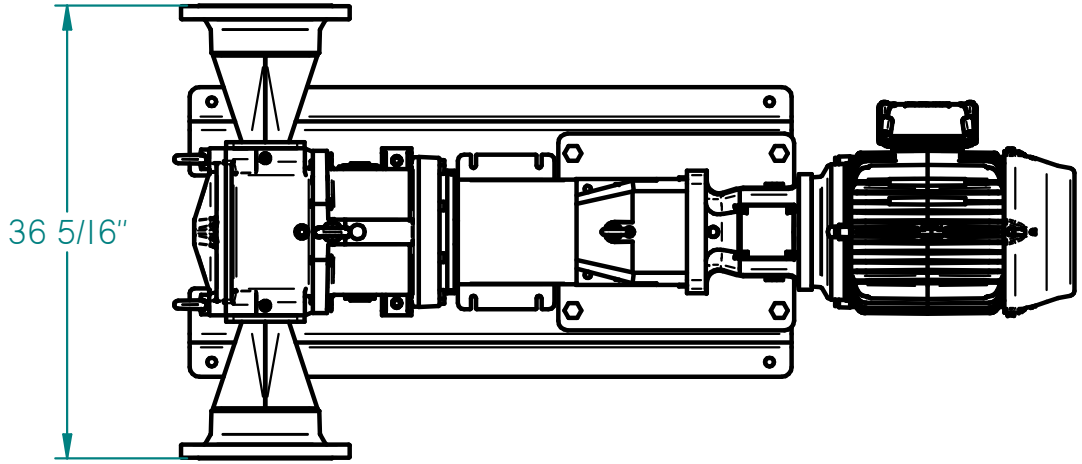
NPSH-Performance Curve

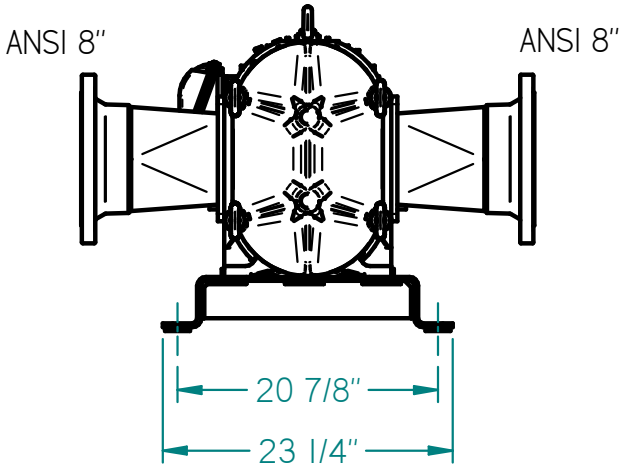
FL518	G	Kennlinienrechner-JMO-V-2.12

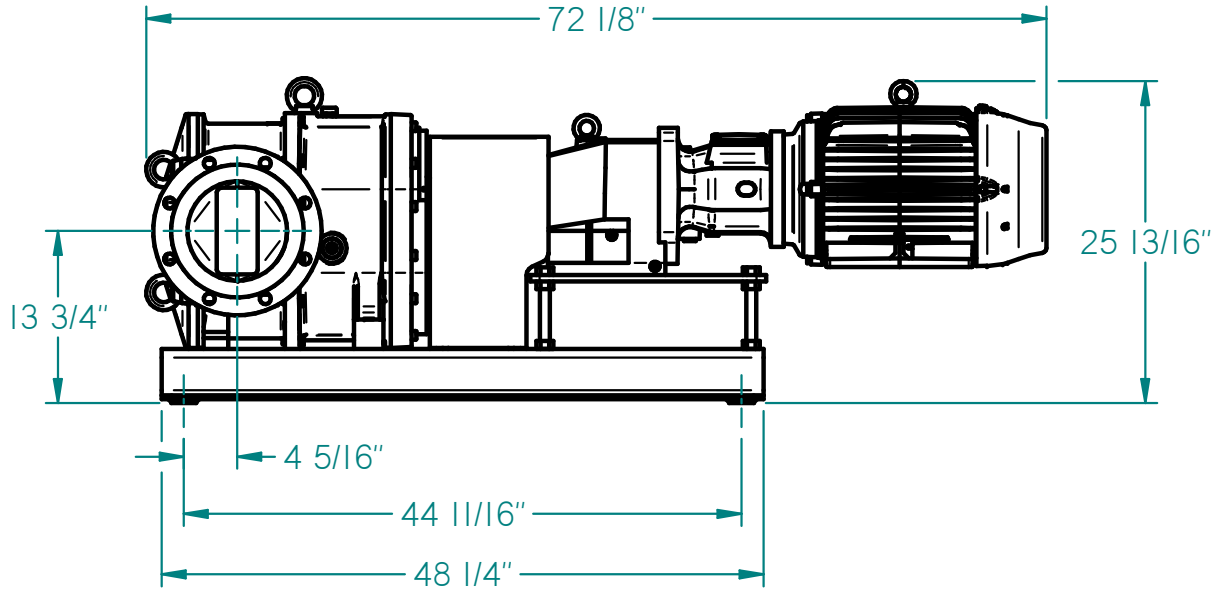
n [rpm]	100	200	300	400	500	600
NPSH-r [feet]	**3.1**	**6.2**	**9.3**	**12.5**	**15.6**	**18.7**
NPSH-a [feet] OP1= 32.8	29.7	26.6	23.5	20.3	17.2	14.1
NPSH-a [feet] OP2= 32.8	29.7	26.6	23.5	20.3	17.2	14.1
NPSH-a [feet] OP3= 32.8	29.7	26.6	23.5	20.3	17.2	14.1



NPSH-a	Fluid pressure at pump inlet in meter water columm [mws]
NPSH-r	Decrease of pressure due to fluid acceleration inside pump [mws]
NPSH-a > NPSH-r Delta > 0	Pump runs smooth and works with design flow
NPSH-a < NPSH-r Delta < 0	Runs with noise flow is beneath design flow - short-term operation allowed
NPSH-a < 0	flow of fluid impossible







NOTE:
1. TOTAL WEIGHT = 1,362 LBS

PROPRIETARY AND CONFIDENTIAL
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BOERGER, LLC
2860 Water Tower Place
Chanhassen, MN 55317
TEL: 612-435-7300
FAX: 612-435-7301

THIRD-ANGLE PROJECTION

BÖRGER®

Model: FL 518
Gear: Nord - In-Line SK42-AN250TC
Power: 15 HP

	NAME	DATE
DRAWN	mlindquist	05/02/24
CHECKED		

ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED
TOLERANCES ± 1/2"
DO NOT SCALE DRAWING

SHEET 1 OF 1

SIZE	DWG. NO.	REV
A	SD-036-927	0

Scope of Supply

Customer	VEOLIA WATER TECHNOLOGIES & SOLUTIONS CANADA GP	Sulzer Reference ID	CAN.2329-YYZ.26.2329-F0
Project Name		Inquiry Date	
Customer reference		Bid Submitted Date	
Item number	001	Date Last Saved	20 Jan 2026 9:31 PM
Application	Not specified	Type / Size / Stages	APT52-16 (SO) / 1
Pump speed	706 rpm		

Pump and Accessories

Qty	Description
4	*APT52-16 (SO)*
	End suction single stage centrifugal pump
	Quality Requirement
	CE 2006/42/EC
	EN ISO 5199:2002 Class II
	Pump and accessories
	Hydraulic performance acceptance grade
	Hydraulic performance acceptance grade option: ISO 9906:2012 / HI 14.6-2011 Grade 2B
	Impeller
	Impeller type: Special open
	Impeller holes: Balance holes
	Materials of construction
4	Volute case : Grey cast iron (ASTM A48 CL35B)
	Impeller : Duplex steel (ASTM A890 3A)
	Wetted non casted alloys: 316 SS or better grade
	Shaft: Duplex steel (EN1.4460 / AISI 329 / SS2324)
	Bearing housing : Grey cast iron (ASTM A48 CL30B)
	Surface treatment
	Inside surface treatment: Standard
	Painting method: Standard, atmospheric-corrosivity C4, ISO 12944-2
	Color shade: Light grey (NCS1700)
	Volute case
	Flange drilling : ASME B16.1 CLASS 125
	Casing connections
	Casing Drain
	Recirculation Pipe (Discharge)
	Pressure (Suction & Discharge)
	Note: The descriptions of casing connections are only indicative and can be used for other purposes (e.g. Recirculation pipe connection on pump discharge to measure the liquid temperature)
	Note: The recirculation pipe connection is plugged and available as future option.
	Draining piping: Not included (threaded and plugged connection)
	Shaft seal
	Sealing unit type: Cartridge single, open seal chamber, sleeve installation (MS33)
	Shaft seal fluid: Without fluid (N)
4	Mechanical seal type: John Crane, 5610 (FC16)
	Mechanical seal body: 316/329 SS
	Shaft seal material: SiC/ SiC
	Mechanical seal elastomer material: EPDM, Ethylene propylene
	Bearing unit
	Bearing lubrication type: Oil bath
	Bearing isolation: Standard labyrinth seal
	Other parts
	O-ring material: EPDM, Ethylene propylene
	Gasket material: REINZ AFM 34

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Pump and Accessories

Qty	Description
	Shaft seal guards material: Stainless steel
	Coupling
4	Coupling size : Rex Omega ES60
4	Coupling guard : Painted galvanized steel
	Coupling guard colour shade: Yellow (RAL1023)
	Baseplate
4	Baseplate type: Standard baseplate for pump and motor (SLP)
	Baseplate material: Carbon steel
	Baseplate surface treatment: Hot galvanizing
	Packing
4	Packing type: Seaworthy packing, Case
	Product protection
	Plug for connections
	Board cover for flanges

Driver

Qty	Description
	Motor
4	Motor detail: NEMA Severe Duty, 10 Poles, 50HP, TEFC, 445T, 3/60/460Volt, Foot-mounted, Inverter Duty

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Pump Performance Datasheet

Customer	: VEOLIA WATER TECHNOLOGIES & SOLUTIONS CANADA GP	Sulzer Reference ID	: CAN.2329-YYZ.26.2329-F0
Customer reference	:	Type / Size	: APT52-16 (SO)
Item number	: 001	Stages	: 1
Service	: RAS Pumps	Based on curve number	: APP52-400_720_SO Rev 1
Quantity	: 4	Date of Last Update	: 20 Jan 2026 9:31 PM

Operating Conditions

Flow, rated	: 6,667.0 USgpm
Differential head / pressure, rated (requested)	: 19.40 ft
Suction pressure, rated / max	: 0.00 / 0.00 bar.g
NPSH available, rated	: 10.36 m
Site Supply Frequency	: 60 Hz

Performance

Speed criteria	: Variable speed
Speed, rated	: 706 rpm
Impeller diameter, rated	: 455 mm
Impeller diameter, maximum	: 533 mm
Impeller diameter, minimum	: 450 mm
Efficiency	: 79.06 %
NPSH (3% head drop) / margin required	: 5.53 / 0.00 m
Ns (imp. eye flow) / Nss (imp. eye flow)	: 3,919 / 9,191 US Units
MCSF	: 2,398.8 USgpm
Head, maximum, rated diameter	: 31.88 ft
Head rise to shutoff	: 63.75 %
Flow, best eff. point	: 6,046.0 USgpm
Flow ratio, rated / BEP	: 110.27 %
Diameter ratio (rated / max)	: 85.37 %
Head ratio (rated dia / max dia)	: 46.81 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Water
Additional liquid description	:
Solids diameter, max	: 0.00 mm
Solids concentration, by volume	: 0.00 %
Temperature, rated / max	: 20.00 / 20.00 deg C
Fluid density, rated / max	: 0.998 / 0.998 kg/dm3
Viscosity, rated	: 1.00 cSt
Vapor pressure, rated	: 0.02 bar.a

Material

Material selected	: Cast Iron - ASTM A48 CL35B (53 / F0067)

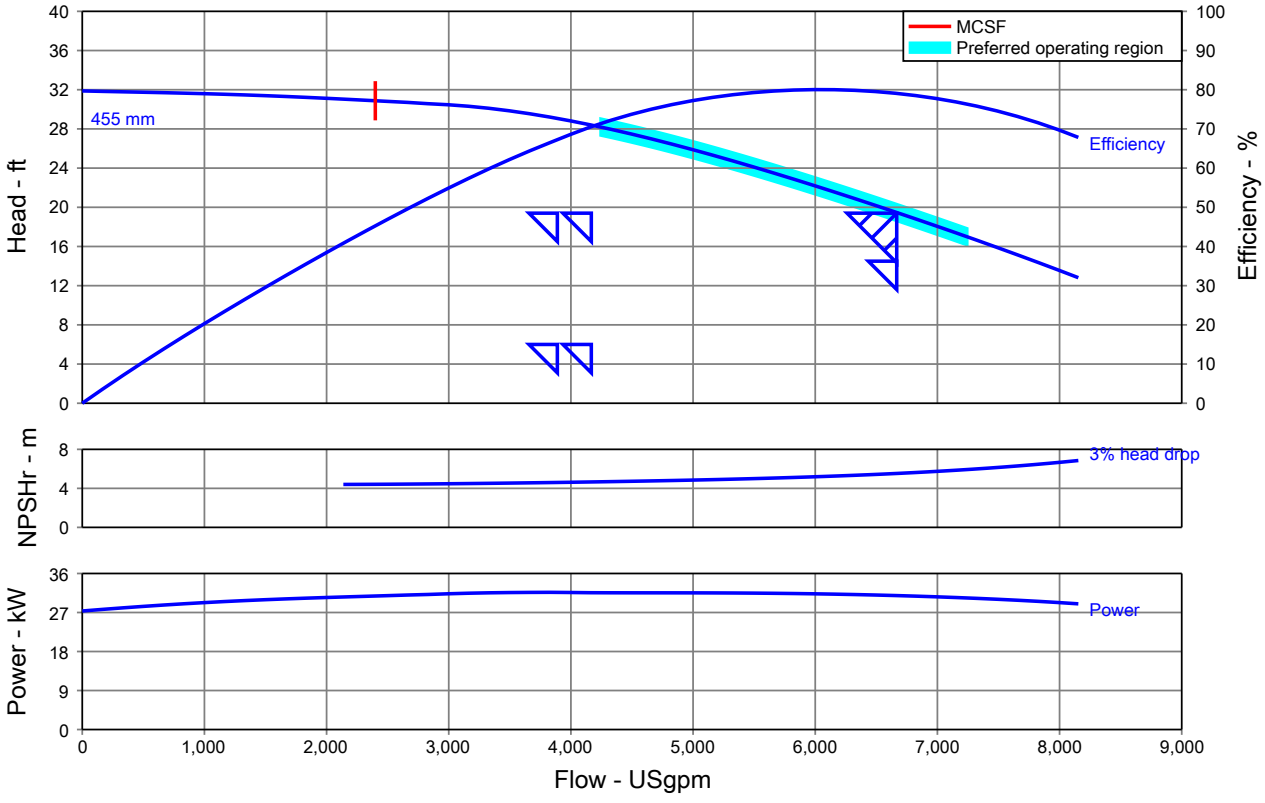
Pressure Data

Maximum casing/bowl working pressure	: 0.95 bar.g
Maximum allowable working pressure	: 10.00 bar.g
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: 15.00 bar.g

Driver & Power Data (@Max density)

Driver sizing specification	: Maximum power
Margin over specification	: 0.00 %
Service factor	: 1.00
Power, hydraulic	: 24.43 kW
Power, rated	: 30.90 kW
Power, maximum, rated diameter	: 31.66 kW
Minimum recommended motor rating	: 37.29 kW / 50.00 hp

Hydraulic Performance Acceptance Test: ISO 9906:2012 / HI 14.6-2011 Grade 2B



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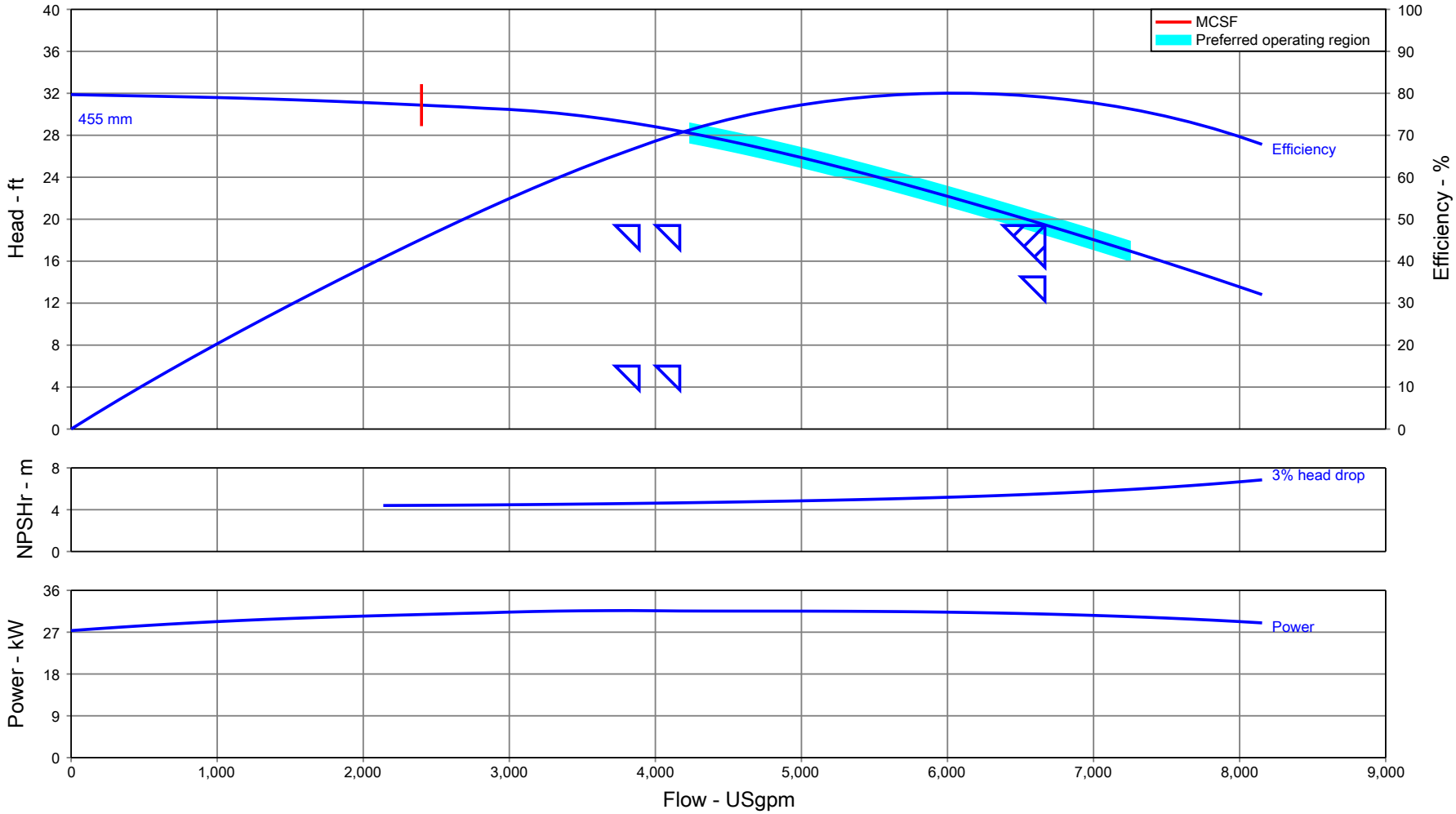
SULZER

Pump Performance Curve



Hydraulic Performance Acceptance Test: ISO 9906:2012 / HI 14.6-2011 Grade 2B

Customer	: VEOLIA WATER TECHNOLOGIES & SOLUTIONS CANADA GP	Type / Size	: APT52-16 (SO)	Flow, rated	: 6,667.0 USgpm
Customer reference	:	Stages	: 1	Differential head / pressure, rated	: 19.40 ft
Item number	: 001	Speed, rated	: 706 rpm	Liquid type	: Water
Service	: RAS Pumps	Based on curve number	: APP52-400_720_SO Rev 1	Additional liquid description	:
Quantity	: 4	Efficiency	: 79.06 %	Temperature, rated / max	: 20.00 / 20.00 deg C
Sulzer Reference ID	: CAN.2329-YYZ.26.2329-F0	Power, rated	: 30.90 kW	Fluid density, rated / max	: 0.998 / 0.998 kg/dm3
Date of Last Update	: 20 Jan 2026 9:31 PM	NPSH (3% head drop)	: 5.53 m	Viscosity, rated	: 1.00 cSt
				Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

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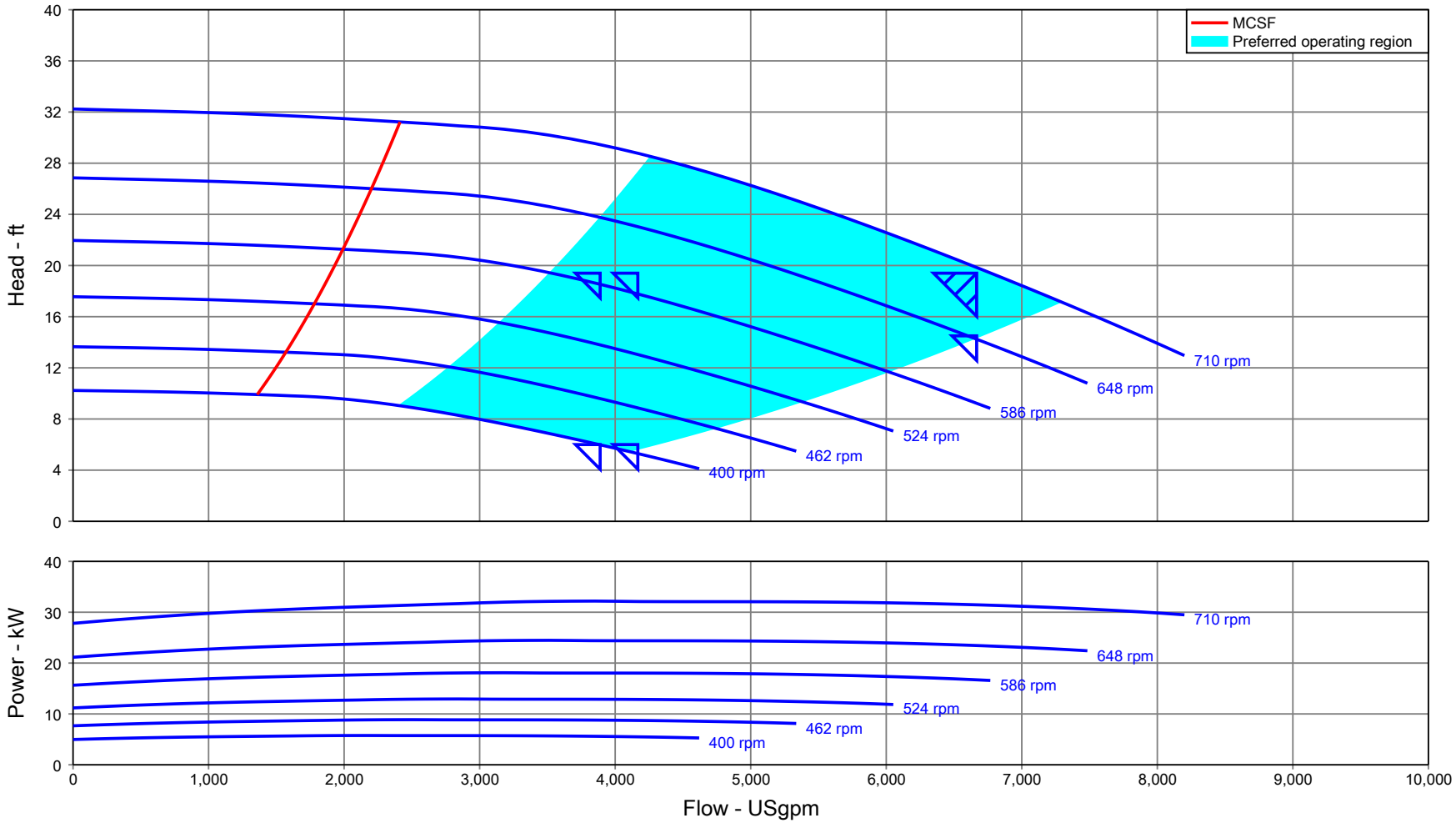
Multi-Speed Performance Curve



Customer	: VEOLIA WATER TECHNOLOGIES & SOLUTIONS CANADA GP	Stages	: 1	Nominal speed	: 706 rpm
Customer reference	:	Based on curve number	: APP52-400_720_SO Rev 1	Flow, rated	: 6,667.0 USgpm
Item number	: 001	Efficiency	: 79.06 %	Differential head / pressure, rated	: 19.40 ft
Service	: RAS Pumps	Power, rated	: 30.90 kW	Speed, rated	: 706 rpm
Quantity	: 4	NPSH (3% head drop)	: 5.53 m	Impeller diameter, rated	: 455 mm
Sulzer Reference ID	: CAN.2329-YYZ.26.2329-F0	Site Supply Frequency	: 60 Hz	Fluid density, rated / max	: 0.998 / 0.998 kg/dm3
Date of Last Update	: 20 Jan 2026 9:31 PM			Viscosity, rated	: 1.00 cSt
Type / Size	: APT52-16 (SO)			Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00

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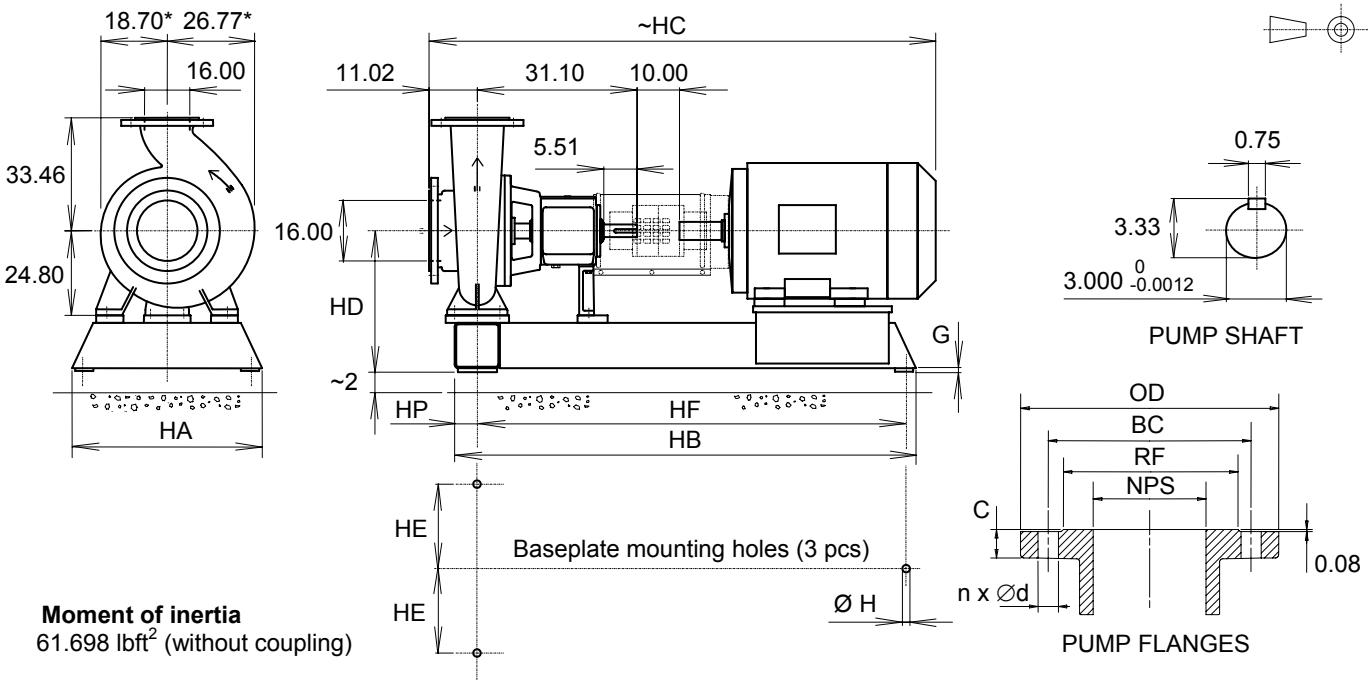
DIMENSIONAL DATA –AHLSTAR
General Arrangement – Pump + Motor + Baseplate – US Units

DRAWING FOR REFERENCE ONLY - NOT FOR CONSTRUCTION

SPP id: Version 04 > / 120601 / Replaces 981115 / en / **P20045** / 2

Product scope: Assembly (ASSE.0)
Pump type and size: APT52-16
Motor standard: NEMA motor, NEMA
Drive type: Direct drive, DD
Baseplate type: Baseplate for pump and motor, SLP
Pump mounting size: 56



Moment of inertia
61.698 lbft^2 (without coupling)

*) If sealing unit type = Air separating pump, please check the dimensions from bare pump dimensional drawing.

Dimensions in inches

DIMENSIONS													
Primary motor frame	Max motor frame (1	(2	Baseplate	HD	HC	HB	HP	HF	HA	HE	H	G	Weight lbs (3
445T	509LL	449T	12	36.50	97.00	106.25	5.00	99.00	52.75	24.00	1.50	0.69	3020
447T	5011LL	449T	12	36.50	100.00	106.25	5.00	99.00	52.75	24.00	1.50	0.69	3110
447TS	509LS	449TS	12	36.50	98.00	106.25	5.00	99.00	52.75	24.00	1.50	0.69	3020
449T	5011LL	-	12	36.50	106.00	106.25	5.00	99.00	52.75	24.00	1.50	0.69	3110
449TS	509LS	-	12	36.50	103.00	106.25	5.00	99.00	52.75	24.00	1.50	0.69	3020

1. Max. NEMA motor frame, which can be installed onto the baseplate.
2. Max. NEMA motor frame with the same shaft height as primary motor.
3. Weight without coupling and motor.

DRILLING OF FLANGES									
				ASME B 16.1 Class 125			ASME B 16.5 Class 150		
NPS	OD	RF	C	BC	d	n	BC	d	n
16.00	23.82	18.98	1.44	21.25	1.12	16	21.25	1.12	16

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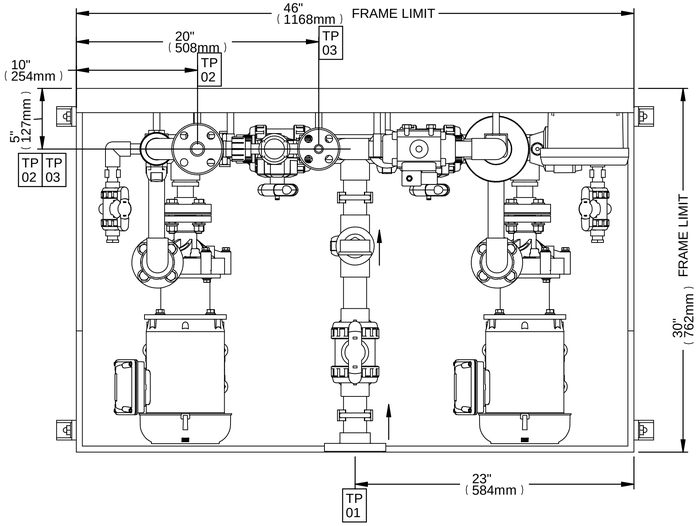
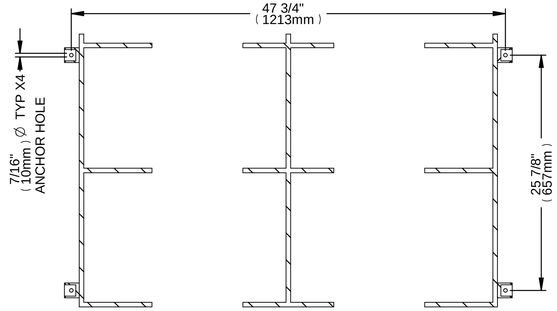
PN: 1142163



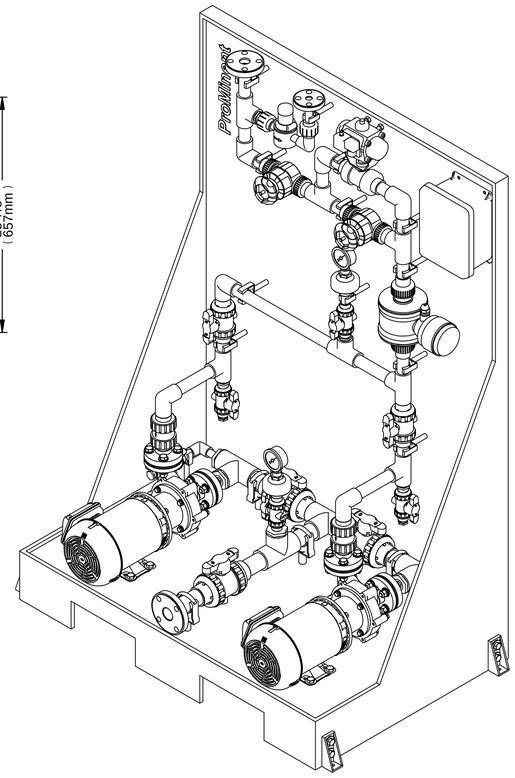
TERMINATION POINT SCHEDULE		
NOZZLE(TP)	SERVICE	CONNECTION
01	SUCTION / INLET	1-1/2" FF FLANGE, 150#, PVC
02	DISCHARGE / OUTLET	1" FF FLANGE, 150#, PVC
03	PSV RELIEF OUTLET	1/2" FF FLANGE, 150#, PVC

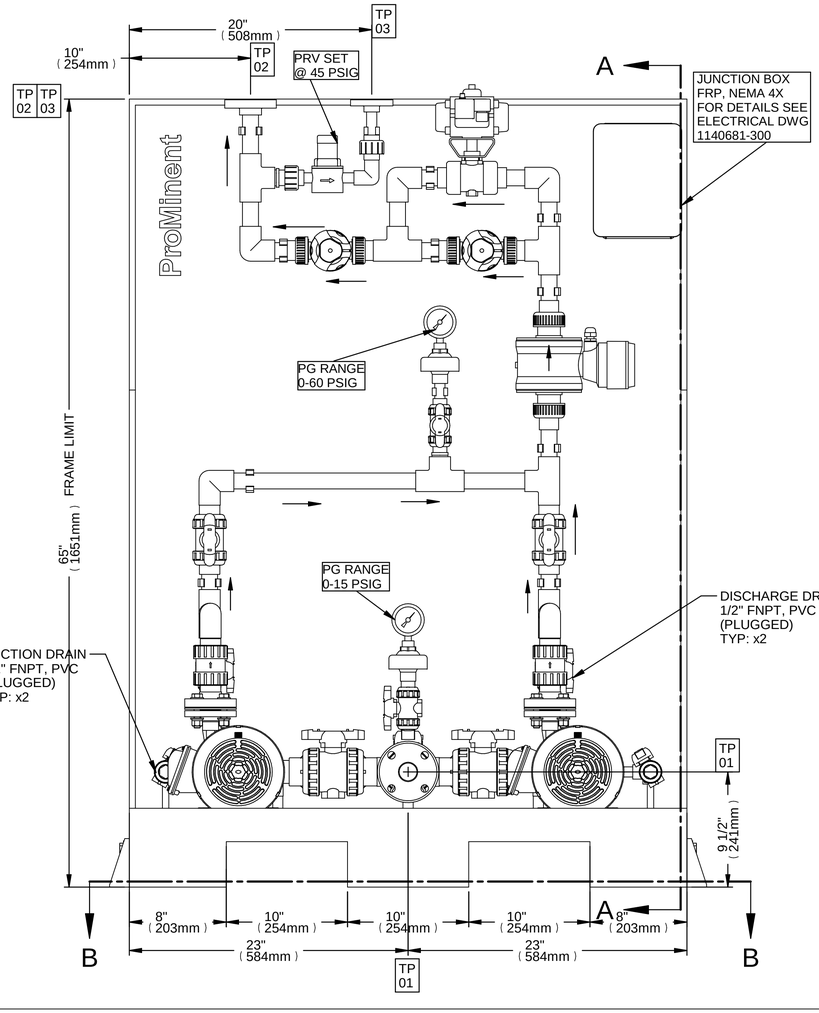
MAG DRIVE CENTRIFUGAL PUMP
MODEL: DB9V-R-E-FF-XX-M219
MAXIMUM FLOW: 46 USGPM @ HEAD 11FT
MINMUM FLOW: 0.5 USPGM @ HEAD 67FT
CONSTRUCTION MATERIALS: PVDF/FRP/ EPDM O-RING
MOTOR: 3435 RPM,1 HP (0.75 kW), 230/460V,60 Hz, 3 Ph
TYP: x2 (DUTY / STANDBY) PN: 1140175

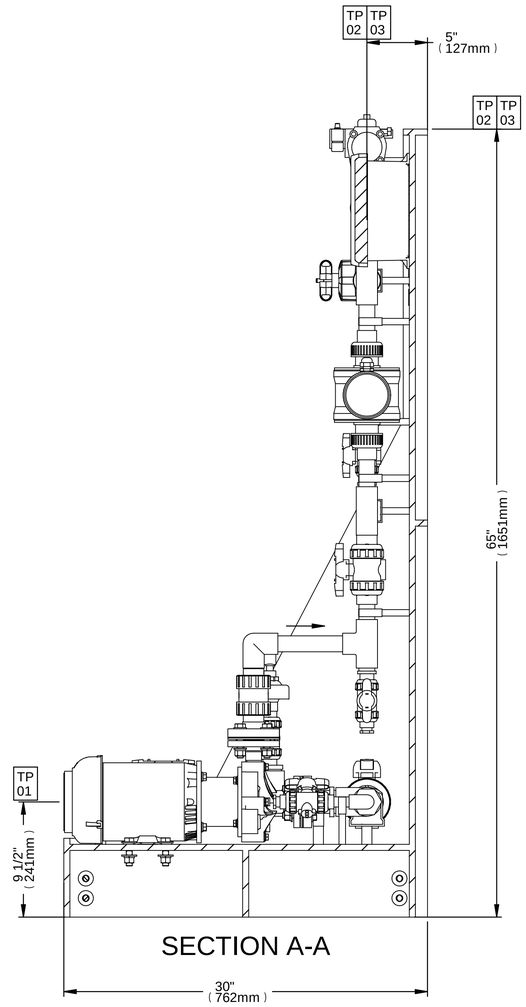
NOTE:SYSTEM OPERATING CONDITIONS ARE DIFFERENT FROM PUMP PERFORMANCE CURVE.
PLEASE REFER TO DRAWING NOTES ON SECOND PAGE FOR SYSTEM OPERATING & DESIGN CONDITIONS



SECTION B-B
FOOTPRINT
USE QTY:4, 3/8" BOLTS
(ANCHOR BOLTS NOT IN PROMINENT SCOPE)







SECTION A-A
30" (762mm)

REV	DATE (YYYY-MM-DD)	DESCRIPTION	BY	APPD	REVD
1	2025-07-21	REVISED NOTES	SM	HB	
0	2025-03-10	INITIAL RELEASE	SM	HB	

REVISIONS

CUSTOMER
VEOLIA WATER TECHNOLOGIES & SOLUTIONS

SUBJECT

PFC PROSIP No
1142163

PURCHASE ORDER No
--

PURCHASER'S EQUIP. No

TITLE
MAGDRIVE-F PVC-EPDM, 2P 460V
- GENERAL ARRANGEMENT DRAWING -

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ENGINEERS SEAL

ProMinent®
THE PROMINENT GROUP OF COMPANIES
GUELPH - ONTARIO - CANADA
PROMINENT FLUID CONTROLS LTD.
490 SOUTHGATE DRIVE.
GUELPH, ONTARIO, CANADA
N1G 4P5
TEL. 519 836 5692 FAX. 519 836 5226
PROMINENT FLUID CONTROLS INC.
136 INDUSTRY DRIVE,
PITTSBURGH P.A., USA.
15275
TEL. 412 787 2484 FAX. 412 787 0704

DESIGNED	GB	APPROVED	
DRAWN	SM	SCALE	NTS
CHECKED		DATE (YYYY-MM-DD)	2025-03-10

SHEET No: 1/2

CUSTOMER DWG No

PFC DWG No
1142163-200- 1

REV
1

COMPONENT LIST

*PART IS HIDDEN FROM VIEW

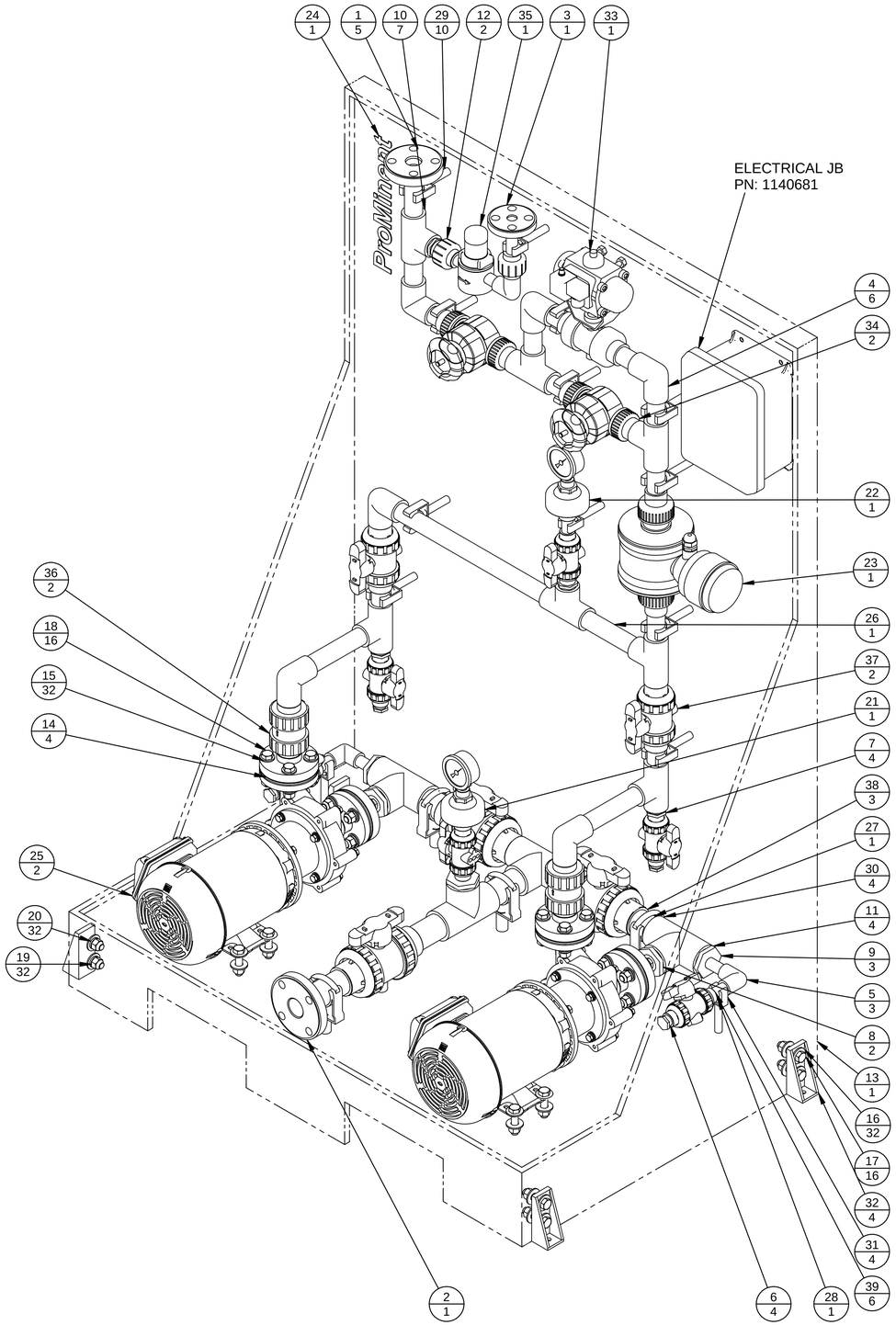
ITEM	PART #	DESCRIPTION	QTY
1	7740695	FITTING: 1" SW FLANGE, 1PC, 150#, SCH80, PVC, ASTM D 1784	5
2	7900948	FITTING: 1-1/2" SW FLANGE, 1PC, 150#, SCH80, PVC, ASTM D 1784	1
3	7741396	FITTING: 1/2" SW FLANGE, 1PC, 150#, SCH80, PVC, ASTM D 1784	1
4	7741327	FITTING: ELBOW, 1" SWxSW, PVC, SCH 80	6
5	7260006	FITTING: ELBOW, 1/2" SWxSW, PVC, SCH 80	3
6	7000325	FITTING: PLUG 1/2" MNPT PVC SCH 80	4
7	7741358	FITTING: REDUCER BUSHING, 1" SPIG x 1/2" SW, PVC SCH80	4
8	7900952	FITTING: REDUCER BUSHING, 1-1/2" SPIG x 1" SW, PVC SCH80	2
9	7900950	FITTING: REDUCER BUSHING, 1-1/2" SPIG x 1/2" SW, PVC SCH80	3
10	7741333	FITTING: TEE, 1" SWxSWxSW, PVC, SCH80	7
11	7741442	FITTING: TEE, 1-1/2" SWxSWxSW, PVC, SCH 80	4
12	7260035	FITTING: UNION, 1/2" SWxSW, PVC, EPDM, SCH80	2
13	1122575	FRAME: MAG DRIVE 2 PUMP, 65" x 46" x 30", BLACK PE	1
14	7904559	GASKET: 1", FULL FACE, 150#, 1/8" THICK, EPDM	4
15	7902194	HARDWARE: FLAT WASHER, 1/2", 1.060" OD, 316 SS	32
16	7900011	HARDWARE: FLAT WASHER, 1/2", 316 SS	32
17	7902724	HARDWARE: HEX CAP SCREW, 1/2"-13, 2" LG, 18-8 SS, 1-1/4" THREAD LG	16
18	7900847	HARDWARE: HEX CAP SCREW, 1/2"-13, 2.5"LG, 18-8 SS, 1" THREAD LG	16
19	7900015	HARDWARE: HEX NUT, 1/2"-13, 18-8 SS	32
20	7900012	HARDWARE: LOCK WASHER, 1/2", 18-8 SS	32
21	1121677	INSTRUMENT: 2 -1/2" PRESSURE GAUGE, 0-15 PSIG, 304SS CASE, 316SS INTERNALS, REMOVEABLE BEZZEL 1/4" MNPT BOTTOM MOUNT, SILICONE OIL FILL WITH PVC ISOLATOR, 1/2" SOCKETWELD PROCESS CONNECTION, 1/4" FNPT GAUGE CONNECTION, GLYCERINE FILL, WIKA	1
22	1121678	INSTRUMENT: 2 -1/2" PRESSURE GAUGE, 0-60 PSIG, 304SS CASE, 316SS INTERNALS, 1/4" MNPT BOTTOM MOUNT, SILICONE OIL FILL WITH PVC ISOLATOR, 1/2" SOCKETWELD PROCESS CONNECTION, 1/4" FNPT GAUGE CONNECTION, GLYCERINE FILL, WIKA	1
23	1140180	INSTRUMENT: MAGNETIC FLOWMETER, 1" SOCKET UNION CONNECTION, EPDM SEALS, PVC BODY WITH HASTELLOY C ELECTRODES, 0.53-266.35 LPM, MAX OPERATING PRESSURE OF 10BAR @ 23C, 2581 SERIES, 4-20mA OUTPUT, 24VDC - GEORG FISCHER	1
24	7900315	LABEL: PROMINENT LOGO, WHITE & ORANGE x 1-7/8"H, VINYL	1
25	1140175	MAG DRIVE CENTRIFUGAL PUMP, 1" 150# RFSO, PVDF IMPELLER, FRP BODY, EPDM, 230/460V, 3 Ph, 60 Hz, FINISH THOMPSON INC	2
26	7741324	PIPE: 1", PVC, SCH80	8FT
27	7741447	PIPE: 1-1/2", PVC, SCH80	4FT
28	7741400	PIPE: 1/2", PVC, SCH80	2FT
29	7741318	SUPPORT: 1" (32mm) PIPE CLIP WITH 1/4" x 2-1/4" PVC PIPE STANDOFF	10
30	7741590	SUPPORT: 1-1/2" (50mm) PIPE CLIP WITH 1/2" x 1-1/2" PVC PIPE STANDOFF	4
31	7260010	SUPPORT: 1/2" (20mm) PIPE CLIP WITH 1/4" x 2-1/2" PVC PIPE STANDOFF	4
32	7900388	SUPPORT: FRP INSIDE CORNER GUSSET 1-5/8" x4", 3 HOLE	4
33	1122519	VALVE: 1" ACTUATOR PNEUMATIC, PA SERIES, PAS00, ON 1" PVC/EPDM, TYPE 21 UNION BALL VALVE, WITH PAD MOUNTED SOLENOID VALVE. 24 VDC - CHEMLINE,	1
34	1116853	VALVE: 1" DIAPHRAGM VALVE, PVC/EPDM, TYPE 514 PVC-U, SOCKET WELD ASTM, TRUE UNION. - GEORG FISCHER	2
35	1019883	VALVE: BACK PRESSURE VALVE, 1/2" SW CONNECTION, BODY MATERIAL PVC, PRESSURE RANGE 0-150PSI, PROMINENT	1
36	7903817	VALVE: BALL CHECK VALVE, 1" SW, TRUE UNION, BODY MATERIAL PVC, SEALS EPDM, CHEMLINE	2
37	7152157	VALVE: BALL VALVE, 1" SW, BODY MATERIAL PVC, SEALS EPDM, (COMES WITH SOCKET & FNPT ENDS), TYPE 21, CHEMLINE	2
38	7904867	VALVE: BALL VALVE, 1-1/2" SW, BODY MATERIAL PVC, SEALS EPDM, (COMES WITH SOCKET & FNPT ENDS), TYPE 21, CHEMLINE	3
39	7901183	VALVE: BALL VALVE, 1/2" SW, BODY MATERIAL PVC, SEALS EPDM, (COMES WITH SOCKET & FNPT ENDS), TYPE 21, CHEMLINE	6

SHIPPED LOOSE ITEMS

ITEM	PART #	DESCRIPTION	QTY
SL	1062205	DEVICE: 1-1/2" TRUE UNION Y SEDIMENT STRAINER, PVC/EPDM SW	1
SL	1142394	MAG DRIVE SYSTEM MANUAL (USB)	1

1/2 TOP SIDE = CHART NUMBER
BOTTOM SIDE = QUANTITY NUMBER

PN: 1142163



NOTES:

1. SYSTEM DESIGNED, FABRICATED, TESTED AND INSPECTED AS PER PROMINENT STANDARD
2. PIPING MATERIAL IS PVC SCH 80 IN CONFORMANCE WITH ASTM D 1785 (FOR PHYSICAL DIMENSIONS, TEST REQUIREMENTS AND MAXIMUM OPERATING PRESSURE) IN SIZES 1-1/2", 1" & 1/2" PIPE.
   ALL CONNECTIONS ARE 1-1/2", 1" & 1/2" SCH 80 PVC SOCKET WELD UNLESS OTHERWISE REQUIRED BY PIPELINE DEVICES. UNIONS ARE TRUE UNION STYLE, SCH80 PVC WITH EPDM O-RING SEAL RATED FOR 150 PSIG. FLANGES ARE PVC, FULL FACE, CLASS 150, ASME/ANSI B16.5.
3. GASKETS ARE FULL FACE TYPE, CLASS 150, EPDM, 1/8" THK FOR FLANGE CONNECTION, ASME B16.20.
4. BOLTING ARE 18-8 SS HEX CAP SCREW WITH FLAT WASHER, LOCK WASHER AND 18-8 SS HEX NUT.
5. PUMP AND PIPING SUPPORT FRAME IS CONSTRUCTED OF BLACK POLYETHYLENE. MATERIAL THICKNESS: 1/2" [13MM].AND IS FABRICATED BY WELD CONSTRUCTION.
6. ALL INTERCONNECTING PIPE & FITTINGS AND WIRING BY OTHERS.
7. ALL SEAL MATERIAL IS PTFE/EPDM OTHERWISE SPECIFIED BY CUSTOMER.
8. TOLERANCE ON ALL TERMINATION POINTS: +/-10mm (+/-3/8").

APPROX.SHIPPING WEIGHT: 285 LB (129 Kg).
APPROX.OPERATING WEIGHT: 310LB (140 Kg).

DESIGN NOTES:

SYSTEM OPERATING CONDITIONS ARE DIFFERENT FROM PUMP PERFORMANCE CURVE OPERATING FLOW MAY VARY WITHIN A TOLERANCE RANGE OF +/- 10%.

MAXIMUM SYSTEM OPERATING FLOW: 28 USGPM @ 12 PSIG
MINIMUM SYSTEM OPERATING FLOW: 0.5 USGPM @ 26 PSIG

UPSTREAM INJECTION PUMP-SUCTION:

- DESIGN TEMPERATURE: MIN. 15ºC TO MAX. 25ºC
- DESIGN PRESSURE: 14.7 PSIG
- MIN. TEST PRESSURE: 25 PSIG

DOWNSTREAM INJECTION PUMP-DISCHARGE:

- DESIGN TEMPERATURE: MIN. 15ºC TO MAX. 25ºC
- DESIGN PRESSURE: 45 PSIG
- MIN. TEST PRESSURE: 55 PSIG

TESTING CONDITION:

- TEST TYPE: HYDROSTATIC
- TEST MEDIUM: WATER
- TEST TEMPERATURE: AMBIENT 68ºF (20ºC)
- TEST DURATION: 10 MIN. (MINIMUM)

CORROSION ALLOWANCE: 0.0" (0.0mm).

REV	DATE (YYYY-MM-DD)	DESCRIPTION	BY	APPD	REVD
1	2025-07-21	REVISED NOTES	SM	HB	
0	2025-03-10	INITIAL RELEASE	SM	HB	

REVISIONS

CUSTOMER: VEOLIA WATER TECHNOLOGIES & SOLUTIONS

SUBJECT: ---

PFC PROSIP No: 1142163
PURCHASE ORDER No: --
PURCHASER'S EQUIP. No:

TITLE: MAGDRIVE-F PVC-EPDM, 2P 460V
- BILL OF MATERIALS -

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PROMINENT FLUID CONTROLS INC.
136 INDUSTRY DRIVE,
PITTSBURGH P.A., USA.
15275
TEL. 412 787 2484 FAX. 412 787 0704

DESIGNED	GB	APPROVED	
DRAWN	SM	SCALE	NTS
CHECKED		DATE (YYYY-MM-DD)	2025-03-10

SHEET No: 2/2

CUSTOMER DWG No: ---

PFC DWG No: 1142163-200- 2

REV: 1

SERIES 3W/3L

RESILIENT SEATED BUTTERFLY VALVES

TECHNICAL SALES MANUAL

Bray®

BRAY.COM

THE HIGH PERFORMANCE COMPANY

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OVERVIEW

The Bray Series 3W/3L features an optimized molded-in seat, a profiled disc sealing edge, and stem bearings. These features provide optimized performance and efficient automation solutions for a long cycle life without compromising bubble tight sealing.

SPECIFICATIONS

Size Range	NPS 2 to 24	
	DN 50 to 600	
Temperature Range	-20°F to 250°F	
	-29°C to 121°C	
Maximum Operating Pressure	High Pressure Disc	250 psi 17.2 bar
	Standard Disc	NPS 2-12 (DN 50-300) 175 psi (12 bar)
		NPS 14-24 (DN 350-600) 150 psi (10.3 bar)
	Low Pressure Disc	50 psi 3.4 bar
Body Style	3W - One-piece wafer	
	3L - One-piece lug	
Leakage Rate	Bubble tight	
Vacuum Rating	1 to 0.001 micron	

DESIGN STANDARDS

Valve Design	API 609 Category A
	EN 593
	MSS SP-67
Top Flange	ISO 5211
Flange Drilling	ASME B16.5 Class 125/150
	EN 1092-1 PN 6 | 10 | 16
	JIS 10K
	AS 2129 Table D & E
Seat Tightness Test	API 598
	EN 12266-1
	ISO 5208
	MSS SP-61
Face-to-Face	API 609
	EN 558 Series 20

MATERIAL OPTIONS[1]

Body	Cast Iron
	Ductile Iron
Disc	Nylon 11 Coated Ductile Iron
	316 Stainless Steel
	Aluminum Bronze
	Duplex Stainless Steel 4A
Stem	416 Stainless Steel
	Stainless Steel (EN 1.4057)
Seat	EPDM
	BUNA-N
	HT-EPDM

NOTES
[1]Materials available in ASME and EN grades

CERTIFICATIONS AND APPROVALS

Certifications	CE/PED
	ANSI/NSF 61 & 372
Approvals	EC 1935
	FDA Food Contact Approved
	ABS Type
	Bureau Veritas Type

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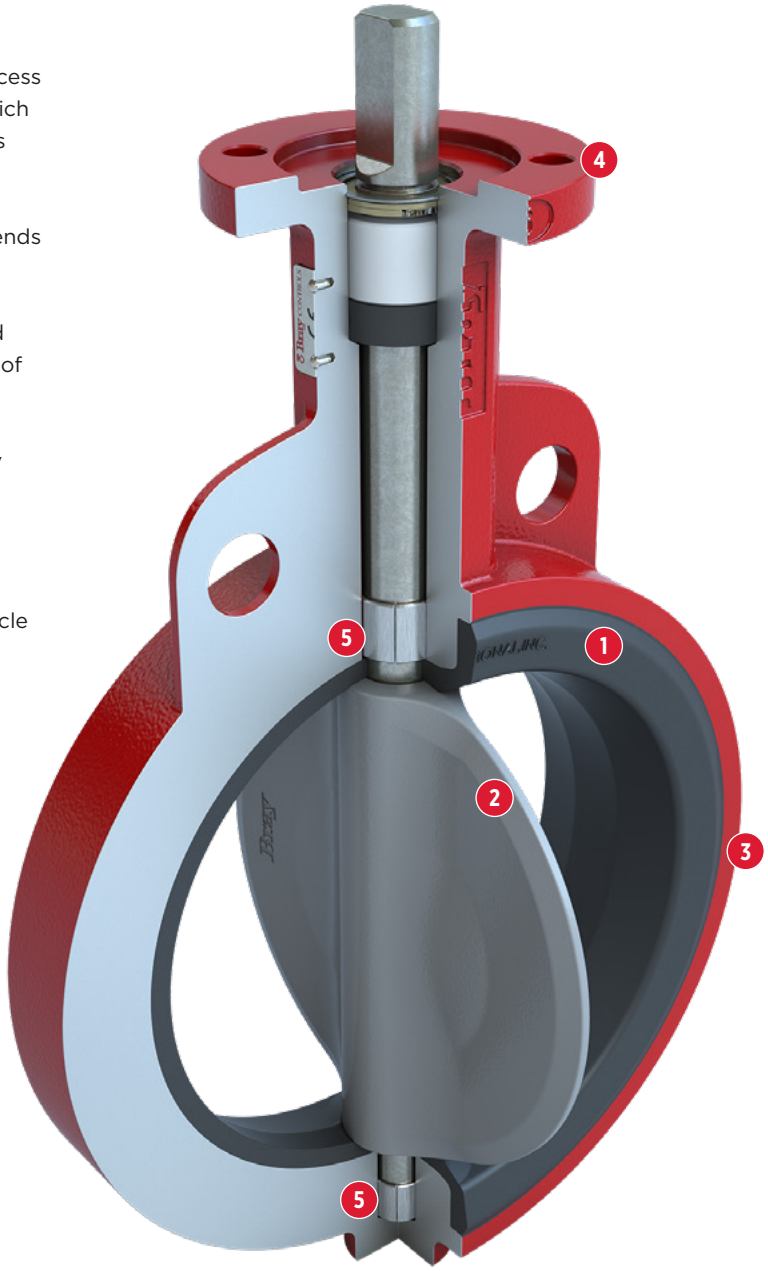
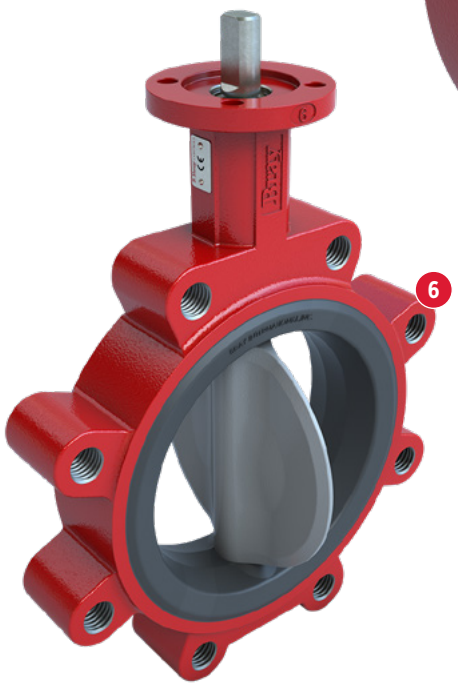
DESIGN FEATURES

1. **MOLDED-IN SEAT:** Tightly controlled molding process produces accurate and repeatable dimensions, which leads to consistently lower torques over the valve's lifetime.
2. **PRECISION PROFILED DISC SEALING EDGE:** Extends the valve life by reducing seat wear.
3. **ROBUST FLANGE SEALING:** Tear-dropped shaped seat face enables tight sealing with a wide variety of industrial flanges.
4. **ISO 5211 TOP FLANGE:** Direct mounting capability between the valve and Bray actuation reduces package height and complexity.
5. **UPPER AND LOWER STEM BEARINGS:** Reduce operating torque and increase reliability in high cycle applications.
6. **END OF LINE CAPABILITY:** Lug style valve allows for sealing at full rated pressure even when the downstream flange is removed.





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VALVE PART NUMBERING SYSTEM (ASME)

Select one code from each category to build a complete valve order number.

3X-XXXX-1XXXX-XXX

SERIES
3X

Code	Body Style
3W	Wafer
3L	Lug

SIZE
XXXX

Code	NPS	DN
0200	2	50
0250	2½	65
0300	3	80
0400	4	100
0500	5	125
0600	6	150
0800	8	200
1000	10	250
1200	12	300
1400	14	350
1600	16	400
1800	18	450
2000	20	500
2400	24	600

BASE NUMBER
1XXXX

Code	Description
11010	NPS 2-12 rated to 175 psi (12 bar) NPS 14-24 rated to 150 psi (10.3 bar)
11011	NPS 2-24 rated to 50 psi (3.4 bar)
13000	NPS 2-24 rated to 250 psi (17.2 bar)

TRIM[1]
XXX

Code	Item	Material
119	Body	Cast Iron, A126 Class B
	Disc	Nylon Coated Ductile Iron, A536 Gr. 65-45-12
	Stem	416 Stainless Steel, A582
	Seat	EPDM
169	Body	Cast Iron, A126 Class B
	Disc	316 Stainless Steel, A351 CF8M
	Stem	416 Stainless Steel, A582
	Seat	EPDM
390	Body	Ductile Iron, A536 Gr. 65-45-12
	Disc	Nylon Coated Ductile Iron, A536 Gr. 65-45-12
	Stem	416 Stainless Steel, A582
	Seat	EPDM
375	Body	Ductile Iron, A536 Gr. 65-45-12
	Disc	316 Stainless Steel, A351 CF8M
	Stem	416 Stainless Steel, A582
	Seat	EPDM

NOTES:

1 For a complete list of standard materials and descriptions, refer to MATERIALS OF CONSTRUCTION.Other materials are available, please contact Bray for additional information.

EXAMPLE

3L-1200-11010-390

- Lug body
- 12 inch (300 mm)
- 175 psi (12 bar) rated valve
- Trim 390

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VALVE PART NUMBERING SYSTEM (EN)

Select one code from each category to build a complete valve order number.

3X-XXXX-1XXXX-XXX

SERIES
3X

Code	Body Style
3W	Wafer
3L	Lug

SIZE
XXXX

Code	DN
M050	50
M065	65
M080	80
M100	100
M125	125
M150	150
M200	200
M250	250
M300	300
M350	350
M400	400
M450	450
M500	500
M600	600

BASE NUMBER
1XXXX

Code	Description
1100U	DN50 - 300 rated to 12 bar DN350 - 600 rated to 10.3 bar Multi-drilled flanges
11034	DN50 - 300 rated to 12 bar DN350 - 600 rated to 10.3 bar ISO PN10 flanges
13035	DN50 - 600 rated to 17.2 bar, ISO PN16 flanges

TRIM[1]
XXX

Code	Item	Material
D61	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
	Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
	Stem	Stainless Steel, EN 1.4057
	Seat	EPDM
D62	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
	Disc	Nylon Coated Ductile Iron
	Stem	Stainless Steel, EN 1.4057
	Seat	EPDM
D63	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
	Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
	Stem	Stainless Steel, EN 1.4057
	Seat	BUNA-N
D64	Body	Ductile Iron, EN 5.3106 (GGG 40) & A536 Gr. 65-45-12
	Disc	Nylon Coated Ductile Iron
	Stem	Stainless Steel, EN 1.4057
	Seat	BUNA-N
1JN	Body	Cast Iron, EN GJL-250 – EN 5.1301 (GG 25)
	Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
	Stem	Stainless Steel, EN 1.4057
	Seat	EPDM
1JM	Body	Cast Iron, EN GJL-250 – EN 5.1301 (GG 25)
	Disc	Nylon Coated Ductile Iron
	Stem	Stainless Steel, EN 1.4057
	Seat	EPDM
1JR	Body	Cast Iron, EN GJL-250 – EN 5.1301 (GG 25)
	Disc	Stainless Steel, Type 316 EN 1.4408 / A351 CF8M
	Stem	Stainless Steel, EN 1.4057
	Seat	BUNA-N
1JQ	Body	Cast Iron, EN GJL-250 – EN 5.1301 (GG 25)
	Disc	Nylon Coated Ductile Iron
	Stem	Stainless Steel, EN 1.4057
	Seat	BUNA-N

NOTES:

1 For a complete list of standard materials and descriptions, refer to MATERIALS OF CONSTRUCTION.Other materials are available, please contact Bray for additional information.

EXAMPLE

3L-M050-11034-D61

> Lug body
> DN 50
> PN10 flange drilling
> Trim D61

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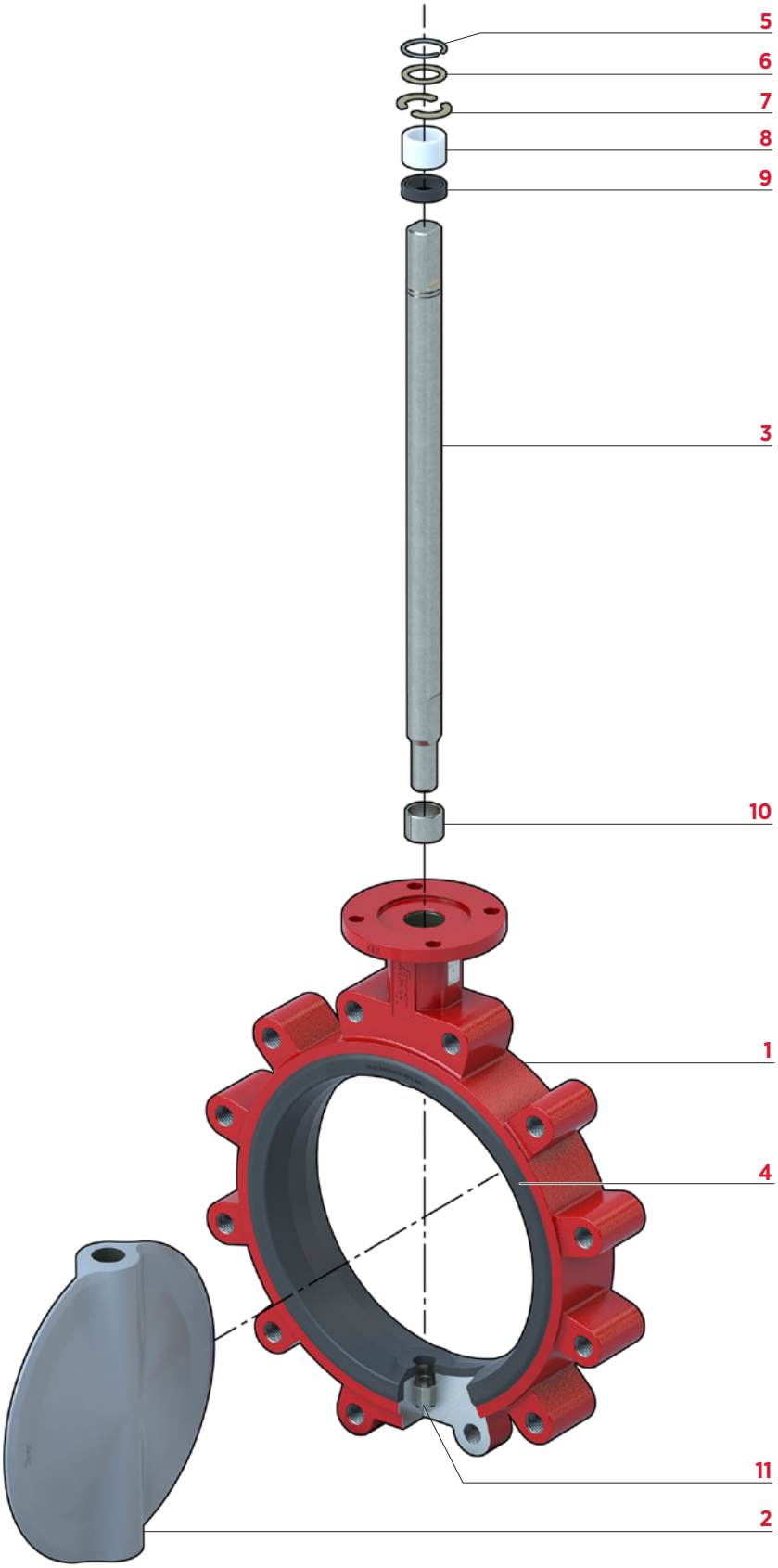
PARTS CALLOUT



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PARTS LIST AND MATERIAL SPECIFICATIONS

ITEM	DESCRIPTION	MATERIAL	
		ASME	EN Grade
1	Body	Cast Iron, A126 Class B	Cast Iron – EN 5.1301
		Ductile Iron, A536 GR. 65-45-12	Ductile Iron – EN 5.3106
2	Disc	Nylon Coated Ductile Iron, A536 Gr. 65-45-12	Stainless Steel – EN 1.4408
		316 Stainless Steel, A351 CF8M	
3	Stem	416 Stainless Steel, A582	Stainless Steel – EN 1.4057
4	Seat	EPDM	–
		BUNA-N	
		HT-EPDM	
5	Retaining Ring	Stainless Steel	–
6	Thrust Washer	Brass, Stainless Steel	–
7	Split Ring	Brass	–
8	Stem Bushing	Acetal	–
9	Stem Seal	BUNA-N	–
10	Upper Stem Bearing[3]	Steel/Bronze + PTFE Self-lubricating	–
11	Lower Stem Bearing[3]	Steel/Bronze + PTFE Self-lubricating	–
12	Key (14" and up)	Stainless Steel	–

NOTES
1 Material specifications provided for reference only, and are subject to change without notice.
2 Additional materials available upon request.
3 Stainless Steel/TFE available.

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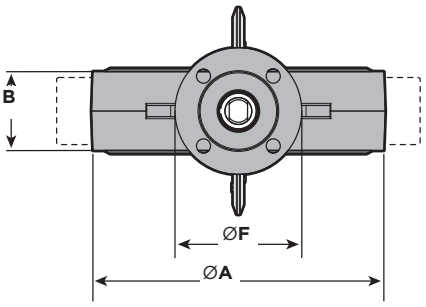
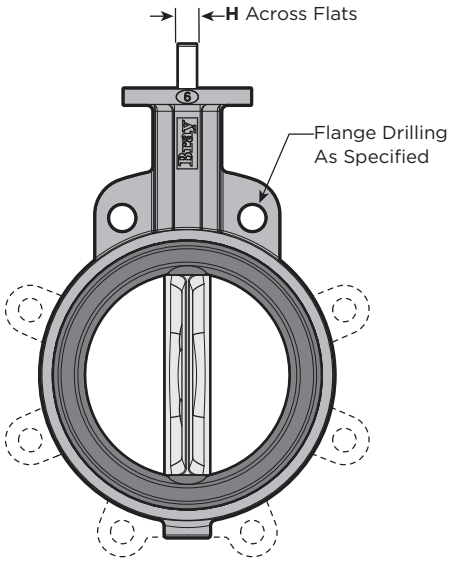
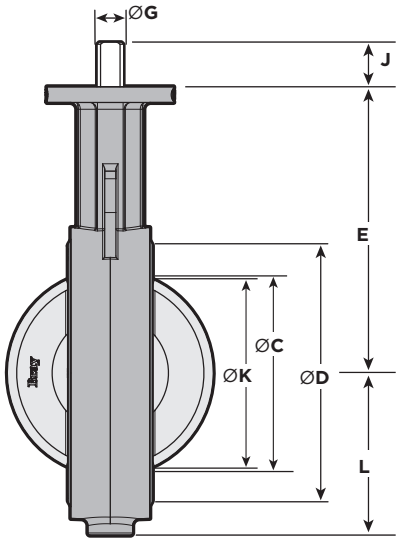
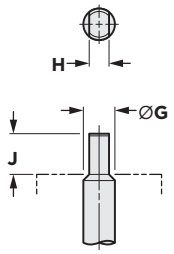


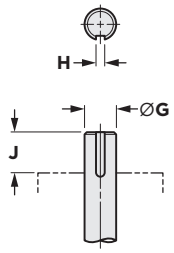




STEM DETAILS



Stem With Flats
≤ NPS 12



Stem With Keyway
≥ NPS 14

DIMENSIONS (inch)

NPS	A	B	C	D	E	F	Top Plate Drilling			G	H	J	K*	L		Adp. Code	Weight (lb)	
							Bolt Circle	Hole Qty	Hole Dia.					Wafer	Lug		Wafer	Lug
2	3.69	1.69	2.00	2.81	5.50	3.54	2.76	4	0.39	0.55	0.39	1.25	1.25	2.22	2.30	A	6	7
2.5	4.19	1.81	2.50	3.32	6.00	3.54	2.76	4	0.39	0.55	0.39	1.25	1.87	2.47	2.57	A	7	8
3	4.88	1.81	3.00	3.95	6.25	3.54	2.76	4	0.39	0.55	0.39	1.25	2.52	2.81	2.81	A	8	9
4	6.06	2.05	4.06	5.09	7.00	3.54	2.76	4	0.39	0.63	0.43	1.25	3.57	3.41	4.09	B	12	16
5	7.13	2.21	5.04	6.16	7.50	3.54	2.76	4	0.39	0.75	0.51	1.25	4.60	4.03	4.61	C	15	21
6	8.13	2.21	5.75	7.10	8.00	3.54	2.76	4	0.39	0.75	0.51	1.25	5.38	4.53	5.06	C	19	25
8	10.50	2.36	7.75	9.34	9.50	5.91	4.92	4	0.57	0.87	0.63	1.25	7.48	5.75	6.05	D	34	40
10	12.75	2.68	9.79	11.44	10.75	5.91	4.92	4	0.57	1.18	0.87	2.00	9.53	7.12	7.69	E	51	62
12	14.88	3.07	11.75	13.45	12.25	5.91	4.92	4	0.57	1.18	0.87	2.00	11.47	8.12	9.02	E	68	91
14	17.05	3.07	13.25	15.28	13.62	5.91	4.92	4	0.57	1.38	.39x.39	2.00	13.04	9.38	9.93	F	105	122
16	19.21	4.00	15.25	17.41	14.75	5.91	4.92	4	0.57	1.38	.39x.39	2.00	14.85	10.75	11.30	F	150	166
18	21.12	4.49	17.25	19.47	16.00	8.27	6.50	4	0.81	1.97	.47x.39	2.50	16.81	12.00	12.16	G	212	233
20	23.25	5.00	19.25	21.59	17.25	8.27	6.50	4	0.81	1.97	.47x.39	2.50	18.75	14.00	14.00	G	285	340
24	27.94	6.06	23.27	25.60	19.50	8.27	6.50	4	0.81	2.50	.62x.62	4.00	22.65	17.56	17.56	H	410	490

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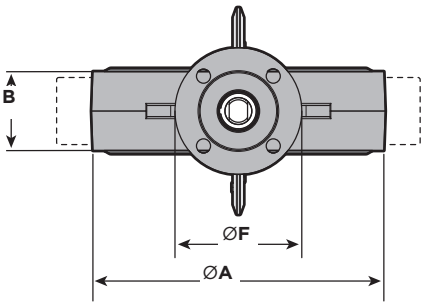
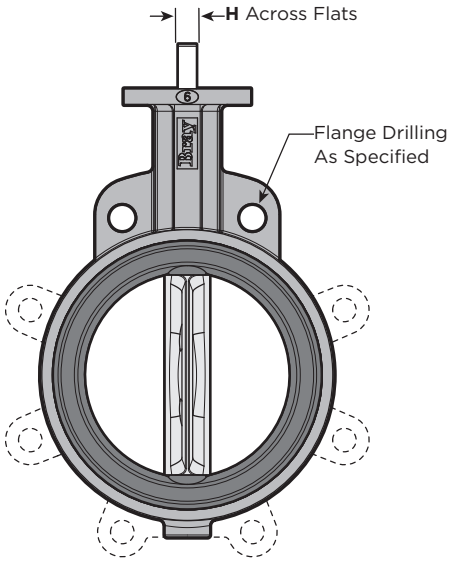
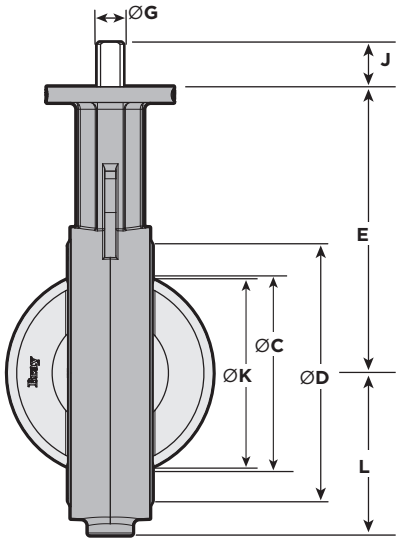
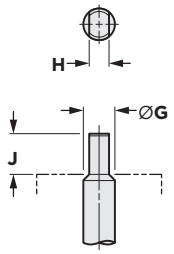
SERIES 3W/3L



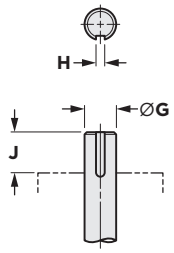




STEM DETAILS



Stem With Flats
≤ DN 300



Stem With Keyway
≥ DN 350

DIMENSIONS (mm)

DN	A	B	C	D	E	F	Top Plate Drilling			G	H	J	K*	L		Adp. Code	Weight (Kg)	
							Bolt Circle	Hole Qty	Hole Dia.					Wafer	Lug		Wafer	Lug
50	94	43	51	71	140	90	70	4	10	14	10	32	32	56	58	A	2.5	3
65	106	46	64	84	152	90	70	4	10	14	10	32	48	63	65	A	3.0	4
80	124	46	76	100	159	90	70	4	10	14	10	32	64	71	71	A	3.5	4
100	154	52	103	129	178	90	70	4	10	16	11	32	91	87	104	B	5.4	6
125	179	56	128	157	191	90	70	4	10	19	13	32	117	102	117	C	6.6	9
150	206	56	146	180	203	90	70	4	10	19	13	32	137	115	129	C	8.7	11
200	267	60	197	237	241	150	125	4	15	22	16	32	190	146	154	D	15.3	18
250	324	68	249	291	273	150	125	4	15	30	22	51	242	181	195	E	23	26
300	378	78	299	342	311	150	125	4	15	30	22	51	291	206	229	E	31	41
350	433	78	337	388	346	150	125	4	14	35	10x10	51	331	238	252	F	48	55
400	488	102	387	442	375	150	125	4	14	35	10x10	51	377	273	287	F	68	75
450	536	114	438	495	406	210	165	4	21	50	12x10	64	427	305	309	G	96	106
500	591	127	489	548	438	210	165	4	21	50	12x10	64	476	356	356	G	129	154
600	710	154	591	650	495	210	165	4	21	64	16x16	102	575	446	446	H	186	222

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Bray offers a low pressure disc for NPS 2-24 (DN 50-600) Series 3W/3L valves. The purpose of reducing the disc diameter is to decrease the seating/unseating torque and extend the seat life in low pressure applications.

By reducing the disc diameter, the interference between the disc outside diameter and seat inside diameter is decreased and the valve pressure rating, which is a function of this interference, is reduced to 50 psi (3.4 bar). Less interference between the disc and seat results in reduced seating/unseating torque. Lower seating/unseating torque may allow for the use of a smaller actuator on the valve. In other applications where abrasive dry bulk materials such as cement, sugar, plastic, pellets, flour, etc., are generally pneumatically conveyed at 50 psi (3.4 bar) or less, the reduced disc diameter not only reduces the seating/unseating torque but, increases the service life of the seat as well.

Bray does the following to differentiate low pressure discs from full diameter discs:

- Metal discs: An “R” is stamped above the part number to indicate a reduced diameter, low pressure disc.
- Nylon 11 coated discs: Discs are differentiated by the color of the Nylon 11:
  - Gray: Standard pressure
  - White: Low pressure

Gray Nylon 11 (standard pressure) | White Nylon 11 (low pressure) | Metal Disc “R” stamp (low pressure)

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Bray has developed seating/unseating torque charts for three classes of service for its valves with standard discs (rated for full pressure), for valves with low pressure discs (rated for 50 psi / 3.4 bar) and for valves with high pressure discs (rated for 250 psi / 17.2 bar).

The guidelines for selecting a class to be used for determining a valve's seating/unseating torque are given below. Each valve application should comply with all five class characteristics in order to be qualified for that class.

Characteristics of Application	Class A Non-Corrosive, Lubricating Service	Class B General Service	Class C Severe Service
Media Type	Lubricating hydrocarbons; aqueous processes and water **(See Note 1)**	Water; aqueous processes; all other aqueous liquids including salt water; lubricating gases	Dry, non-lubricating such as air, dry gas, cement, pneumatic conveying mediums
Corrosion by Media	Insignificant if any	No major corrosion or deposits from media	Can incur significant corrosion such as ductile iron disc in water
Chemical Reactions of Media with Seat	Insignificant if any	Only minor or insignificant in nature	Reactions causing swelling and hardness occur
Media Temperature	40°F to 160°F (4°C to 71°C)	Within seat temperature limits, not near limits	Near or at seat temperature limits
Frequency of Valve Cycling	Once weekly or more frequently	Minimum once every 3-6 weeks, or more frequently	Infrequently, sometimes not cycled for long periods

NOTES:

1. For aqueous processes and water, Class A torques may be used only if a Nylon 11 coated disc is selected and all other Class A characteristics apply. Otherwise, Class B torques should be used.

2. If a valve is used strictly in a throttling application, that is, it is never put in the closed position but throttled between 20° and 80°, then Class A torques may be used provided you have checked to see that dynamic torques do not exceed the Class A torque values.

3. With the exception of dry, non-lubricating medias, one is usually safe electing to use Class B torques for sizing actuators for all other valve service applications. Seating/ Unseating Torque values shown include friction bearing torques for stated differential pressure.

4. Dynamic torque values are not considered. See the Dynamic Torque chart in this manual for determination of dynamic torque.

5. Do not apply a safety factor to torque values when determining actuator output torque requirement.

6. For 3-way assemblies where one valve is opening and another is closing, multiply torque by a 1.25 factor.

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TORQUE VALUES (lb-In)

		Valve Differential Pressure (psi)									
		Low Pressure Disc	Standard Disc				High Pressure Disc				
	NPS	50	50	100	150	175	50	100	150	200	250
Class A Non-corrosive Lubricating Service	2	85	97	105	113	121	113	121	129	137	145
	2.5	113	113	121	137	145	129	145	169	193	217
	3	145	153	169	185	193	169	201	234	266	298
	4	161	185	217	250	282	217	266	322	395	467
	5	232	258	290	330	370	322	419	515	604	693
	6	346	395	443	487	522	483	604	725	846	966
	8	564	644	789	934	1031	950	1152	1345	1538	1732
	10	926	1168	1369	1570	1691	1554	1901	2247	2609	2988
	12	1409	1546	1868	2191	2376	2078	2650	3221	3785	4349
	14	2174	2859	3479	4107		3592	4309	5058	5807	6554
	16	2899	3946	4897	5919		5017	6008	7023	8021	9028
	18	3624	5211	6628	7913	N/A	6757	8005	9302	10615	11935
	20	4550	6531	8255	9906		8802	10510	12233	13989	15761
	24	6862	10381	13723	16977		15100	18523	21946	25449	28993
Class B General Service	2	93	106	115	124	133	124	133	142	150	159
	2.5	124	124	133	150	159	142	159	186	212	239
	3	159	168	186	204	212	186	221	257	292	327
	4	177	204	239	274	310	239	292	354	434	513
	5	255	283	319	363	407	354	460	566	664	761
	6	381	434	487	531	566	531	664	797	929	1062
	8	620	708	867	1027	1133	1044	1266	1478	1690	1903
	10	1018	1283	1505	1726	1859	1708	2089	2469	2867	3283
	12	1549	1699	2053	2407	2611	2283	2912	3540	4160	4779
	14	2390	3142	3823	4514		3947	4735	5558	6381	7202
	16	3186	4337	5381	6505		5514	6602	7717	8815	9921
	18	3983	5726	7284	8695	N/A	7425	8797	10222	11664	13116
	20	5000	7177	9071	10886		9673	11549	13443	15372	17319
	24	7540	11408	15080	18656		16594	20355	24116	27966	31860
Class C Severe Service	2	116	133	144	155	166	155	166	177	188	199
	2.5	155	155	166	188	199	177	199	232	266	299
	3	199	210	232	254	266	232	277	321	365	409
	4	221	254	299	343	387	299	365	443	542	642
	5	319	354	398	454	509	443	575	708	830	951
	6	476	542	608	664	708	664	830	996	1162	1328
	8	774	885	1084	1283	1416	1305	1582	1847	2113	2378
	10	1272	1604	1881	2157	2323	2135	2611	3086	3584	4104
	12	1936	2124	2567	3009	3263	2854	3640	4425	5199	5974
	14	2987	3927	4779	5642		4934	5918	6947	7976	9003
	16	3983	5421	6726	8131		6892	8253	9647	11018	12401
	18	4978	7157	9104	10869	N/A	9281	10996	12777	14580	16395
	20	6250	8972	11339	13607		12091	14437	16804	19216	21649
	24	9425	14260	18851	23320		20742	25444	30145	34958	39825

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TORQUE VALUES (N m)

		Valve Differential Pressure (bar)									
		Low Pressure Disc	Standard Disc				High Pressure Disc				
	DN	3.4	3.4	7	10.3	12	3.4	7	10.3	14	17.2
Class A Non-corrosive Lubricating Service	50	10	11	12	13	14	13	14	15	15	16
	65	13	13	14	15	16	15	16	19	22	25
	80	16	17	19	21	22	19	23	26	30	34
	100	18	21	25	28	32	25	30	36	45	53
	125	26	29	33	37	42	36	47	58	68	78
	150	39	45	50	55	59	55	68	82	96	109
	200	64	73	89	106	116	107	130	152	174	196
	250	105	132	155	177	191	176	215	254	295	338
	300	159	175	211	248	268	235	299	364	428	491
	350	246	323	393	464		406	487	571	656	741
	400	328	446	553	669		567	679	794	906	1020
	450	410	589	749	894	N/A	763	905	1051	1199	1349
	500	514	738	933	1119		995	1188	1382	1581	1781
	600	775	1173	1551	1918		1706	2093	2480	2876	3276
Class B General Service	50	11	12	13	14	15	14	15	16	17	18
	65	14	14	15	17	18	16	18	21	24	27
	80	18	19	21	23	24	21	25	29	33	37
	100	20	23	27	31	35	27	33	40	49	58
	125	29	32	36	41	46	40	52	64	75	86
	150	43	49	55	60	64	60	75	90	105	120
	200	70	80	98	116	128	118	143	167	191	215
	250	115	145	170	195	210	193	236	279	324	371
	300	175	192	232	272	295	258	329	400	470	540
	350	270	355	432	510		446	535	628	721	814
	400	360	490	608	735		623	746	872	996	1121
	450	450	647	823	983	N/A	839	994	1155	1318	1482
	500	565	811	1025	1230		1093	1305	1519	1737	1957
	600	852	1289	1704	2108		1875	2300	2725	3160	3600
Class C Severe Service	50	13	15	16	18	19	18	19	20	21	23
	65	18	18	19	21	23	20	23	26	30	34
	80	23	24	26	29	30	26	31	36	41	46
	100	25	29	34	39	44	34	41	50	61	73
	125	36	40	45	51	58	50	65	80	94	108
	150	54	61	69	75	80	75	94	113	131	150
	200	88	100	123	145	160	148	179	209	239	269
	250	144	181	213	244	263	241	295	349	405	464
	300	219	240	290	340	369	323	411	500	588	675
	350	338	444	540	638		558	669	785	901	1017
	400	450	613	760	919		779	933	1090	1245	1401
	450	563	809	1029	1228	N/A	1049	1243	1444	1648	1853
	500	706	1014	1281	1538		1366	1631	1899	2171	2446
	600	1065	1611	2130	2635		2344	2875	3406	3950	4500

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MAXIMUM ALLOWABLE STEM TORQUE VALUES

Valve Size		416 Stainless Steel		Stainless Steel (EN 1.4057)	
NPS	DN	lb-in	N m	lb-in	N m
2	50	1005	114	1020	115
2 1/2	65	1005	114	1020	115
3	80	1005	114	1020	115
4	100	1639	185	1664	188
5	125	2484	281	2522	285
6	150	2484	281	2522	285
8	200	4229	478	4293	485
10	250	12525	1415	12716	1437
12	300	12525	1415	12716	1437
14	350	17960	2029	18234	2060
16	400	25708	2905	26101	2949
18	450	49062	5543	49811	5628
20	500	49062	5543	49811	5628
24	600	158365	17893	160782	18166

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FIGURE 1 - PRESSURE DISTRIBUTION

In most applications for butterfly valves, especially NPS 20 (DN 500) or smaller, the maximum torque required to operate the valve will be seating/unseating torque. However, dynamic torque should be considered particularly in:

- Control applications using larger valves (NPS 24 [DN 600] and above) where the disc is maintained in the open position
- Applications using larger valves (NPS 24 [DN 600] and above) where the velocity is high (16 ft./sec [4.9m/sec]).

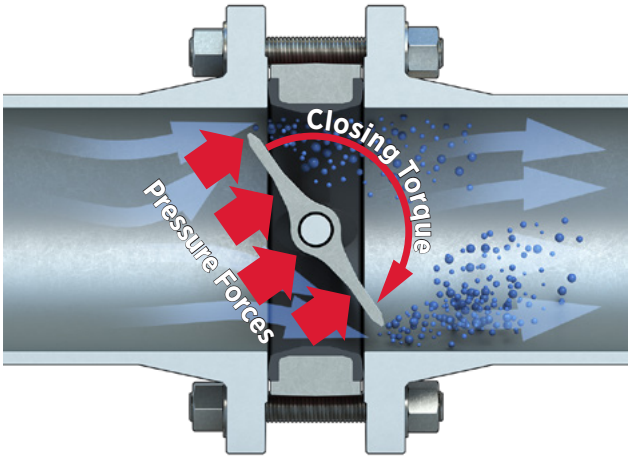
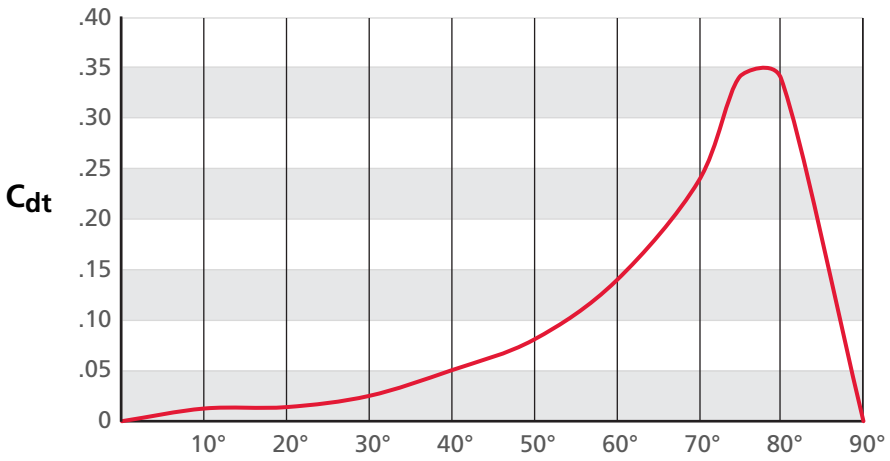


FIGURE 2 - ANGLE OF OPENING

The C_{dt} value for Bray symmetrical disc valves are approximately:

Angle of Opening	0°	10°	20°	30°	40°	50°	60°	70°	75°	80°	90°
C_{dt}	0	0.0126	0.0140	0.0251	0.0505	0.0809	0.1394	0.2384	0.3419	0.3400	0



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To use the Dynamic Torque Chart, note the following:

1. Dynamic torque values include all bearing friction and stem-seal friction torques.
2. Dynamic torque values are per 1 psi ΔP (1 bar ΔP). To determine dynamic torque (lb-in) (N m) at a desired angle of opening, multiply the pressure drop ΔP at this angle by the appropriate dynamic torque factor in the charts below.
3. Bray recommends sizing control valves between 20° and 70°, with 60° the preferred angle.
4. Dynamic torque will tend to close all Bray valves whose disc are symmetrical to the stem.

DYNAMIC TORQUE FACTORS (lb-in/psi)

	Angle of Opening									
NPS	10°	20°	30°	40°	50°	60°	70°	75°	80°	90°
2	0.11	0.13	0.23	0.45	0.73	1.25	2.14	3.07	3.05	0.00
2.5	0.22	0.24	0.43	0.87	1.39	2.39	4.09	5.86	5.83	0.00
3	0.37	0.41	0.73	1.47	2.36	4.07	6.95	9.97	9.92	0.00
4	0.86	0.95	1.70	3.43	5.49	9.45	16.17	23.19	23.07	0.00
5	1.65	1.83	3.29	6.61	10.59	18.25	31.22	44.77	44.53	0.00
6	2.49	2.77	4.97	10.00	16.01	27.59	47.19	67.68	67.32	0.00
8	6.60	6.74	12.08	24.30	38.93	67.07	114.71	164.51	163.64	0.00
10	11.99	13.32	23.89	48.06	76.99	132.65	226.86	325.35	323.64	0.00
12	20.89	23.21	41.62	83.74	134.14	231.14	395.30	566.91	563.93	0.00
14	30.04	33.38	59.84	120.40	192.87	332.34	568.37	815.12	810.83	0.00
16	45.65	50.72	90.94	182.97	293.12	505.07	863.76	1238.76	1232.24	0.00
18	65.91	73.23	131.30	264.16	423.18	729.18	1247.04	1788.44	1779.02	0.00
20	91.42	101.57	182.11	366.39	586.95	1011.37	1729.64	2480.55	2467.50	0.00
24	158.36	175.95	315.46	634.69	1016.76	1751.99	2996.23	4297.03	4274.40	0.00

Example: NPS 4 Valve; 60° Open with a 10 psi pressure drop: [Td = (9.45)(10) = 94.50 lb-in]

DYNAMIC TORQUE FACTORS (N m/bar)

	Angle of Opening									
DN	10°	20°	30°	40°	50°	60°	70°	75°	80°	90°
50	0.19	0.21	0.37	0.74	1.19	2.05	3.51	5.03	5.00	0.00
65	0.35	0.39	0.70	1.42	2.27	3.91	6.69	9.60	9.55	0.00
80	0.60	0.67	1.20	2.41	3.87	6.66	11.39	16.34	16.25	0.00
100	1.40	1.56	2.79	5.61	8.99	15.49	26.49	38.00	37.80	0.00
125	2.70	3.00	5.39	10.84	17.36	29.91	51.16	73.36	72.98	0.00
150	4.09	4.54	8.14	16.38	26.24	45.22	77.33	110.91	110.32	0.00
200	10.82	11.04	19.79	39.82	63.79	109.91	187.97	269.58	268.16	0.00
250	19.65	21.83	39.14	78.75	126.16	217.38	371.76	533.16	530.35	0.00
300	34.24	38.04	68.20	137.22	219.82	378.77	647.77	929.00	924.11	0.00
350	49.23	54.70	98.06	197.29	316.06	544.61	931.38	1335.74	1328.71	0.00
400	74.81	83.12	149.03	299.83	480.33	827.66	1415.46	2029.97	2019.28	0.00
450	108.01	120.01	215.15	432.88	693.46	1194.92	2043.53	2930.72	2915.29	0.00
500	149.80	166.45	298.42	600.40	961.83	1657.34	2834.37	4064.89	4043.50	0.00
600	259.50	288.34	516.94	1040.07	1666.17	2871.00	4909.94	7041.56	7004.49	0.00

Example: DN 100 Valve; 60° Open with a 2 bar pressure drop: [Td = (15.49)(2) = 30.98 N m]

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Cv stands for **Valve Sizing Coefficient**, sometimes called the **Flow Rate Coefficient**. **Cv** varies with the valve size, angle of opening and the manufacturer's valve style.

> Cv is defined as the volume of water in USGPM that will flow through a given restriction or valve opening with a pressure drop of one (1) psi at room temperature.

Cv VALUES

	Disc Position (Degrees)								
NPS	**10°**	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**
2	1	4	15	29	46	66	73	86	87
2.5	1	8	26	44	66	98	141	177	185
3	2	22	43	71	112	171	256	338	360
4	8	37	78	118	192	310	505	689	740
5	9	53	98	170	288	470	759	1131	1218
6	13	86	175	297	479	757	1190	1715	1900
8	19	121	254	429	754	1247	2096	3376	3765
10	37	178	365	728	1215	2005	3342	5814	6661
12	69	240	492	1008	1696	2868	4961	8455	10066
14	110	287	609	1141	1975	3328	5571	9269	11598
16	147	421	844	1547	2651	4440	7412	12214	15395
18	190	470	968	1807	3238	5509	9382	18231	20120
20	230	675	1341	2455	4210	7056	11803	19637	25329
24	317	952	1957	3592	6128	10267	17226	29061	39396

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Kv stands for **Valve Sizing Coefficient**, sometimes called the **Flow Rate Coefficient**. **Kv** varies with the valve size, angle of opening and the manufacturer's valve style.

> Kv is defined as the volume of water in cubic meters/hour (m^3/hr) that will flow through a given restriction or valve opening with a pressure drop of one (1) bar at room temperature.

Kv VALUES

	Disc Position (Degrees)								
DN	**10°**	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**
50	1	3	13	25	40	57	63	74	75
65	1	7	22	38	57	85	122	153	160
80	2	19	37	61	97	148	221	292	311
100	7	32	67	102	166	268	437	596	640
125	8	46	85	147	249	407	657	978	1054
150	11	74	151	257	414	655	1029	1483	1644
200	16	105	220	371	652	1079	1813	2920	3257
250	32	154	316	630	1051	1734	2891	5029	5762
300	60	208	426	872	1467	2481	4291	7314	8707
350	95	248	527	987	1708	2879	4819	8018	10032
400	127	364	730	1338	2293	3841	6411	10565	13317
450	164	407	837	1563	2800	4766	8115	15770	17404
500	199	584	1160	2124	3642	6103	10210	16986	21910
600	274	823	1693	3107	5301	8881	14900	25138	34078

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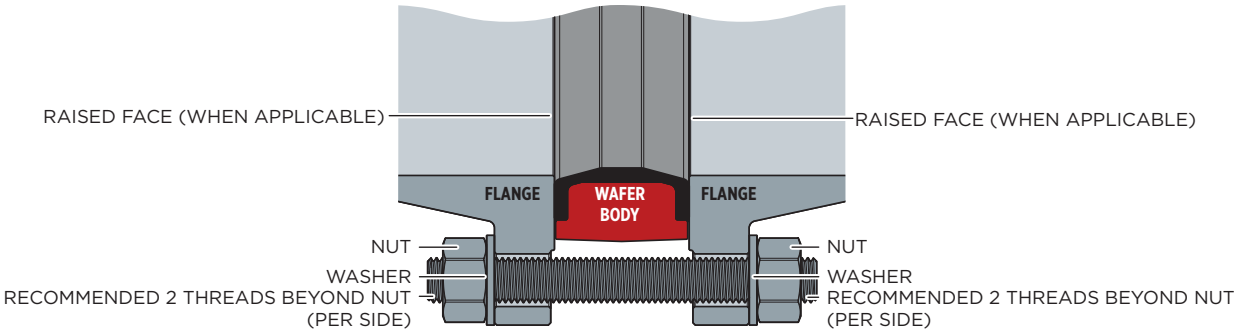
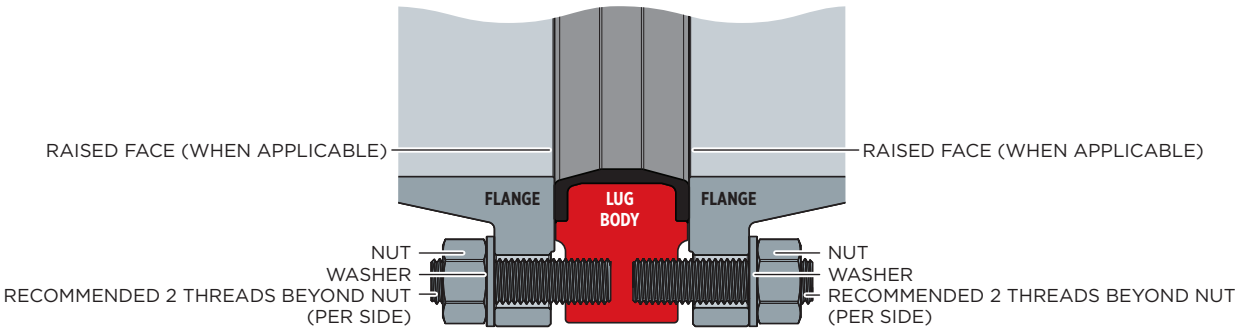
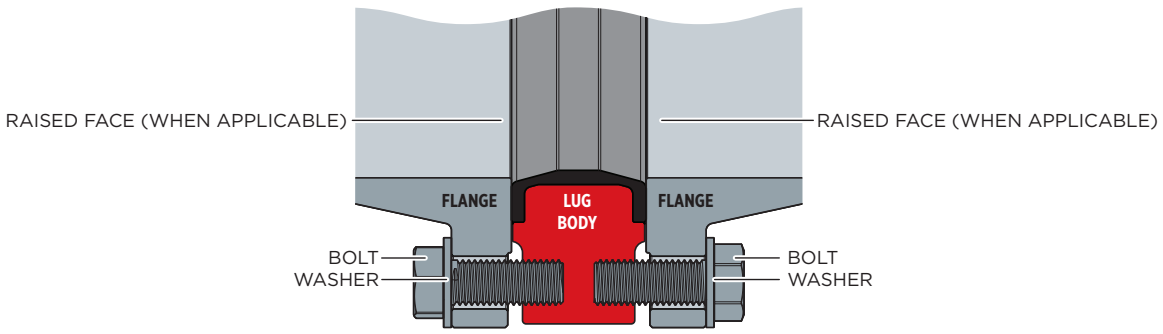
WAFER VALVE WITH THROUGH-STUDS



LUG VALVE WITH STUDS



LUG VALVE WITH HEX HEAD BOLTS



Refer to appropriate Bray dimensional drawings for specific valve drilling information.

- Pipe flange thickness may vary, therefore no stud/bolt lengths are stated.
- Lug threads may be tapped from both sides, and therefore tap may not be continuous.
- Minimum bolt engagement must be equal to the diameter of the bolt.
- When bolting the valve into the line, use standard bolting torque as recommended by applicable piping standards. Additional force from the flange bolts is not required.

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SERIES 3W | THROUGH-STUD

Valve Size		Fastener Size	Through Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
NPS	DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty
2	50	⅝-11 UNC	4	—	—	8	8
2½	65	⅝-11 UNC	4	—	—	8	8
3	80	⅝-11 UNC	4	—	—	8	8
4	100	⅝-11 UNC	8	—	—	16	16
5	125	¾-10 UNC	8	—	—	16	16
6	150	¾-10 UNC	8	—	—	16	16
8	200	¾-10 UNC	8	—	—	16	16
10	250	⅞-9 UNC	12	—	—	24	24
12	300	⅞-9 UNC	12	—	—	24	24
14	350	1-8 UN	12	—	—	24	24
16	400	1-8 UN	16	—	—	32	32
18	450	1⅛-8 UN	16	—	—	32	32
20	500	1⅛-8 UN	20	—	—	40	40
24	600	1¼-8 UN	20	—	—	40	40

SERIES 3L | STUD

Valve Size		Fastener Size	Front Side Stud	Back Side Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
NPS	DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
2	50	⅝-11 UNC	4	4	—	—	8	8
2½	65	⅝-11 UNC	4	4	—	—	8	8
3	80	⅝-11 UNC	4	4	—	—	8	8
4	100	⅝-11 UNC	8	8	—	—	16	16
5	125	¾-10 UNC	8	8	—	—	16	16
6	150	¾-10 UNC	8	8	—	—	16	16
8	200	¾-10 UNC	8	8	—	—	16	16
10	250	⅞-9 UNC	12	12	—	—	24	24
12	300	⅞-9 UNC	12	12	—	—	24	24
14	350	1-8 UN	12	12	—	—	24	24
16	400	1-8 UN	16	16	—	—	32	32
18	450	1⅛-8 UN	16	16	—	—	32	32
20	500	1⅛-8 UN	20	20	—	—	40	40
24	600	1¼-8 UN	20	20	—	—	40	40

SERIES 3L | BOLTS

Valve Size		Fastener Size	Front Side Hex Head Bolt	Back Side Hex Head Bolt	Front Blind Hex Head Bolt	Back Blind Hex Head Bolt	Washer	Nut
NPS	DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
2	50	⅝-11 UNC	4	4	—	—	8	—
2½	65	⅝-11 UNC	4	4	—	—	8	—
3	80	⅝-11 UNC	4	4	—	—	8	—
4	100	⅝-11 UNC	8	8	—	—	16	—
5	125	¾-10 UNC	8	8	—	—	16	—
6	150	¾-10 UNC	8	8	—	—	16	—
8	200	¾-10 UNC	8	8	—	—	16	—
10	250	⅞-9 UNC	12	12	—	—	24	—
12	300	⅞-9 UNC	12	12	—	—	24	—
14	350	1-8 UN	12	12	—	—	24	—
16	400	1-8 UN	16	16	—	—	32	—
18	450	1⅛-8 UN	16	16	—	—	32	—
20	500	1⅛-8 UN	20	20	—	—	40	—
24	600	1¼-8 UN	20	20	—	—	40	—

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PN10 | SERIES 3W | THROUGH-STUD

Valve Size	Fastener Size	Through Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty
50	M16	4	8	8
65	M16	4	8	8
80	M16	8	16	16
100	M16	8	16	16
125	M16	8	16	16
150	M20	8	16	16
200	M20	8	16	16
250	M20	12	24	24
300	M20	12	24	24
350	M20	16	32	32
400	M24	16	32	32
450	M24	20	40	40
500	M24	20	40	40
600	M27	20	40	40

PN10 | SERIES 3L | STUDS

Valve Size	Fastener Size	Front Side Stud	Back Side Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	8
65	M16	4	4	—	—	8	8
80	M16	8	8	—	—	16	16
100	M16	8	8	—	—	16	16
125	M16	8	8	—	—	16	16
150	M20	8	8	—	—	16	16
200	M20	8	8	—	—	16	16
250	M20	12	12	—	—	24	24
300	M20	12	12	—	—	24	24
350	M20	16	16	—	—	32	32
400	M24	16	16	—	—	32	32
450	M24	20	20	—	—	40	40
500	M24	20	20	—	—	40	40
600	M27	20	20	—	—	40	40

PN10 | SERIES 3L | BOLTS

Valve Size	Fastener Size	Front Side Hex Head Bolt	Back Side Hex Head Bolt	Front Blind Hex Head Bolt	Back Blind Hex Head Bolt	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	—
65	M16	4	4	—	—	8	—
80	M16	8	8	—	—	16	—
100	M16	8	8	—	—	16	—
125	M16	8	8	—	—	16	—
150	M20	8	8	—	—	16	—
200	M20	8	8	—	—	16	—
250	M20	12	12	—	—	24	—
300	M20	12	12	—	—	24	—
350	M20	16	16	—	—	24	—
400	M24	16	16	—	—	32	—
450	M24	20	20	—	—	32	—
500	M24	20	20	—	—	40	—
600	M27	20	20	—	—	40	—

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PN16 | SERIES 3W | THROUGH-STUD

Valve Size	Fastener Size	Through Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty
50	M16	4	8	8
65	M16	4	8	8
80	M16	8	16	16
100	M16	8	16	16
125	M16	8	16	16
150	M20	8	16	16
200	M20	12	24	24
250	M20	12	24	24
300	M20	12	24	24
350	M20	16	32	32
400	M24	16	32	32
450	M24	20	40	40
500	M24	20	40	40
600	M27	20	40	40

PN16 | SERIES 3L | STUDS

Valve Size	Fastener Size	Front Side Stud	Back Side Stud	Front Blind Stud	Back Blind Stud	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	8
65	M16	4	4	—	—	8	8
80	M16	8	8	—	—	16	16
100	M16	8	8	—	—	16	16
125	M16	8	8	—	—	16	16
150	M20	8	8	—	—	16	16
200	M20	12	12	—	—	24	24
250	M20	12	12	—	—	24	24
300	M20	12	12	—	—	24	24
350	M20	16	16	—	—	32	32
400	M24	16	16	—	—	32	32
450	M24	20	20	—	—	40	40
500	M24	20	20	—	—	40	40
600	M27	20	20	—	—	40	40

PN16 | SERIES 3L | BOLTS

Valve Size	Fastener Size	Front Side Hex Head Bolt	Back Side Hex Head Bolt	Front Blind Hex Head Bolt	Back Blind Hex Head Bolt	Washer	Nut
DN	Ø-Thread	Qty	Qty	Qty	Qty	Qty	Qty
50	M16	4	4	—	—	8	—
65	M16	4	4	—	—	8	—
80	M16	8	8	—	—	16	—
100	M16	8	8	—	—	16	—
125	M16	8	8	—	—	16	—
150	M20	8	8	—	—	16	—
200	M20	12	12	—	—	24	—
250	M20	12	12	—	—	24	—
300	M20	12	12	—	—	24	—
350	M20	16	16	—	—	32	—
400	M24	16	16	—	—	32	—
450	M24	20	20	—	—	40	—
500	M24	20	20	—	—	40	—
600	M27	20	20	—	—	40	—

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Bray Butterfly Valves with Metal Mating Flanges

A frequently asked question at Bray is "What torque do I apply to the flange bolts to insure the valve is properly installed?". Initially this seems to be a simple request until all of the factors are analyzed. The installation of a valve requires several components: the valve, mating flanges, nuts, bolts and studs. Each is supplied by different manufacturers and each has different characteristics. The proper torque for one combination may be too much or too little for a second combination. The following is a list of information which needs to be known in order to start calculating the torque requirements.

Valve
- Type
- Size
- Materials of construction (body)
- Surface finishes / surface conditions

Flange
- Type
- Size
- Finish / both sides
- Condition of flange / surface contamination

Bolt (or Stud)
- Type
- Materials of construction
- Surface conditions

Nut
- Type
- Materials of construction
- Surface conditions

Lubrication
- Type
- Coverage

General Factors
- Temperature and relative humidity at the time of installation
- Speed at which bolts are turned

Note: The elastomer valve seat manufactured by Bray also acts as the flange gasket. No additional gaskets are required or recommended. Other valve styles which do not have integral gaskets will need to have this component supplied. The characteristics of this component will also need to be considered.

Complete knowledge of all relevant conditions is almost impossible to obtain. As a result, the computation of the exact torque requirement is not practical. No reputable manufacturer can provide accurate information when so many outside factors are present.

The International Fasteners Institute covers some of the details required to "compute" a torque value. Even with this information the use of a torque wrench is only considered to be 25% accurate. Based on the difficulty and inaccuracy of using this method, Bray recommends the use of the "Turn of the Nut" method.

"Turn of the Nut" Tightening
(For Standard Iron and Steel Flanges)

**For Non-Metallic or non-standard flanges, follow the manufacturers installation procedures.

1. The valve and flange faces must be aligned parallel to each other. For rubber seated butterfly valves manufactured by Bray, it is required that the valve be fully opened prior to the tightening of the flange bolts.

2. After aligning the holes in a joint, sufficient bolts shall be placed and brought to a "snug-tight" condition to ensure that the parts of the joint are brought into full contact with each other. "Snug-tight" is the tightness attained by the full effort of a man using a wrench.

3. Following the initial snugging operation, bolts shall be placed in any remaining holes and brought to snug-tightness. Re-snugging may be necessary in large joints.

4. Tighten opposite bolts in sequence to insure even pressure around the entire flange.

5. When all bolts are snug-tight, each bolt in the joint then shall be tightened additionally by the applicable amount of nut rotation given in **Note 1**. During tightening there shall be no rotation of the valve or flange.

Note 1

For bolt lengths **not exceeding**
8 diameters or 8 inches (203.2 mm) = **1/4 turn**

For bolt lengths **exceeding**
8 diameters or 8 inches (203.2 mm) = **1/2 turn**

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Disclaimer:

Bray is issuing these recommendations only as a guide to installation. This recommendation is based on the full compliance of all materials supplied to their appropriate specifications. Since many of the components are not manufactured by Bray we can take no responsibility for any damage caused during installation.

SERIES 3W/3L - FLANGE BOLT TORQUE CHART

Valve Size		Normal Torque Range	
NPS	DN	lb-ft	N m
2	50	30	40
2.5	65	30	40
3	80	35	50
4	100	35 - 40	50 - 55
5	125	35 - 45	50 - 60
6	150	35 - 50	50 - 65
8	200	45 - 55	60 - 75
10	250	55 - 75	75 - 100
12	300	65 - 110	90 - 150
14	350	75 - 120	100 - 165
16	400	75 - 120	100 - 165
18	450	85 - 130	115 - 175
20	500	85 - 130	115 - 175
24	600	100 - 150	135 - 205

Please note that the N m and ft-lbs values are based on bolt size in respective EN and ANSI flanges, i.e. these values are not a direct conversion between N m and ft-lbs.

The values represent average torques needed to ensure full compression of the resilient valves' seats into the valves' bodies when installed in pipeline flanges. The face of both flanges must come into full contact with the valves' metal bodies.

No additional torque is required for proper functioning of the Bray resilient seated valves.

The torque values are based on using new, coarse-threaded, lubricated fasteners. Up to 25% may be added to the normal torque range values when using non-lubricated fasteners.

Torque values specified by flange manufacturers must not be exceeded.

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SINCE 1986, BRAY HAS PROVIDED FLOW CONTROL SOLUTIONS FOR A VARIETY OF INDUSTRIES AROUND THE WORLD.

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Bray®

THE HIGH PERFORMANCE COMPANY

BRAY.COM

SERIES 740

BIDIRECTIONAL KNIFE GATE VALVES

2″ to 24″ 150psi (10bar)
30″ to 36″ 100psi (7bar)

Bray®

FEATURES & BENEFITS

DESIGN FEATURES

Engineered for bidirectional on/off service and isolation of clean, dirty, corrosive, or viscous media.

1. Topworks designed for easy, quick conversion between manual and pneumatic actuation. Manual valves include a lubricant injection port for continuous, smooth operation with minimal maintenance.
2. Clevis design and horizontal bolting stabilizes gate ensuring proper alignment.
3. Standard multi-layer square packing provides exceptional gland sealing.
4. Optional energized quad seal packing for enhanced gland sealing.
5. Chest liner for sizes up to 12″ and PTFE anti-extrusion ring for sizes 14″ and up.
6. Unrestricted flow path with minimal pressure drop achieved through full port valve design.
7. Gate design ensures consistent alignment throughout the length of the stroke.
8. Mechanically retained steel reinforced elastomer seat ensures bidirectional zero leakage shutoff.
9. Cast yoke superstructure ensures robustness in valve design for different operators/orientation.

INDUSTRY APPLICATIONS

Pulp & Paper
- > Bleach Stock
- > Brown Stock Washers | Pump Isolation
- > Evaporators | Black Liquor
- > Paper Stock

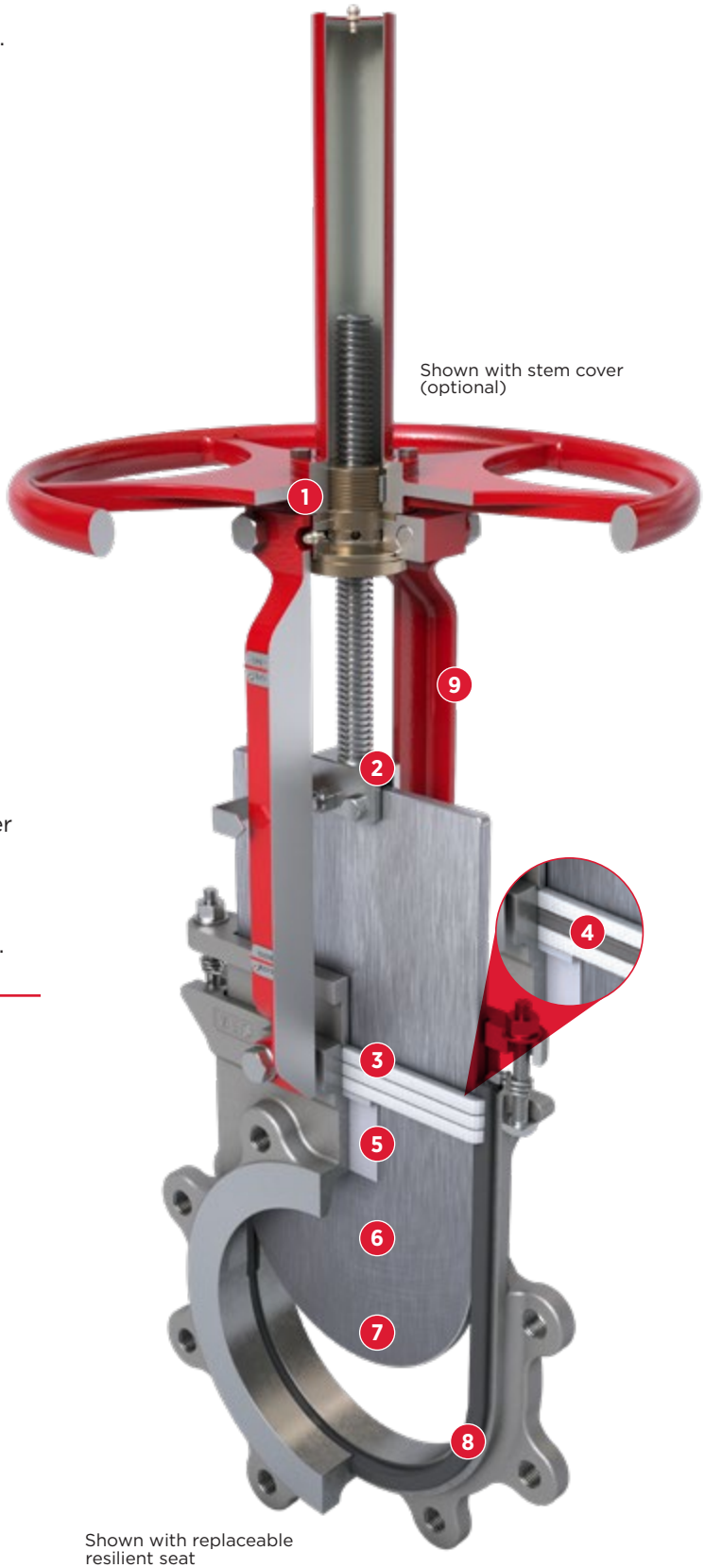
General Industrial
- > Pneumatic Conveyance
- > Raw & Treated Water
- > Water Conveyed Solids

Power
- > Fly Ash Pneumatic Conveyance Crossover Valve

Wastewater
- > RAS Return Activated Sludge
- > Pump & Equipment Isolation

Chemical
- > Process Fluids
- > Pump & tank Isolation

Ethanol
- > Syrup Lines



Series 740 Lug Style

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TECHNICAL SPECIFICATIONS

Size Range	NPS 2 to 36
	DN 50 to 900
Body Style	Single Piece Lug
Pressure Rating	2-24 150psi | 30-36 100psi
	50-600mm 10 bar | 750-900mm 7 bar
Drilling	ASME B16.5 CL150
	ASME B16.47 CL150
Face to Face	MSS SP-81
Certification	CE/PED, Canadian CRN, AWWA C520 2019
Design Standard	MSS SP-81
Testing Standard	MSS SP-151

STANDARD CONSTRUCTION

Body	CF8 (304)	CF8M (316)
Gate	304	316
Seat	Buna-N	Buna-N
Stem	304	304
Gland	304	304
Packing	PTFE Impregnated Synthetic Fiber	PTFE Impregnated Synthetic Fiber
Topworks	Steel	Steel

GATE OPTIONS

316, 317 Stainless Steel
SAF 2507 Duplex
SAF 2205 Duplex
17-4PH Stainless Steel
Hastelloy® C
Monel®

BODY OPTIONS

CF3M Stainless Steel
SAF 2205 Duplex
SAF 2507 Duplex
Ductile Iron

PACKING MAXIMUM TEMPERATURE RANGE

Pure PTFE	500°F
	260°C
PTFE Impegnated Synthetic Fiber	450°F
	232°C
PTFE w/Buna-N Quad Seal[1]	194°F
	90°C
PTFE w/Viton® Quad Seal[1]	392°F
	200°C
PTFE w/EPDM Quad Seal	248°F
	120°C

NOTE [1] Pure PTFE or PTFE Impregnated Synthetic Fiber can be used.

Pure PTFE

PTFE Impregnated Synthetic Fiber

PTFE w/Buna-N Quad Seal

PTFE w/Viton® Quad Seal

PTFE w/EPDM Quad Seal

SEAT OPTIONS

Buna-N	-34 to 194°F
	-36 to 90°C
EPDM*	-65 to 248°F
	-54 to 120°C
Viton®	-15 to 392°F
	-26 to 200°C

*When EPDM is selected as a seat material, "Pure PTFE packing with EPDM Quad Seal" shall be selected as packing material.

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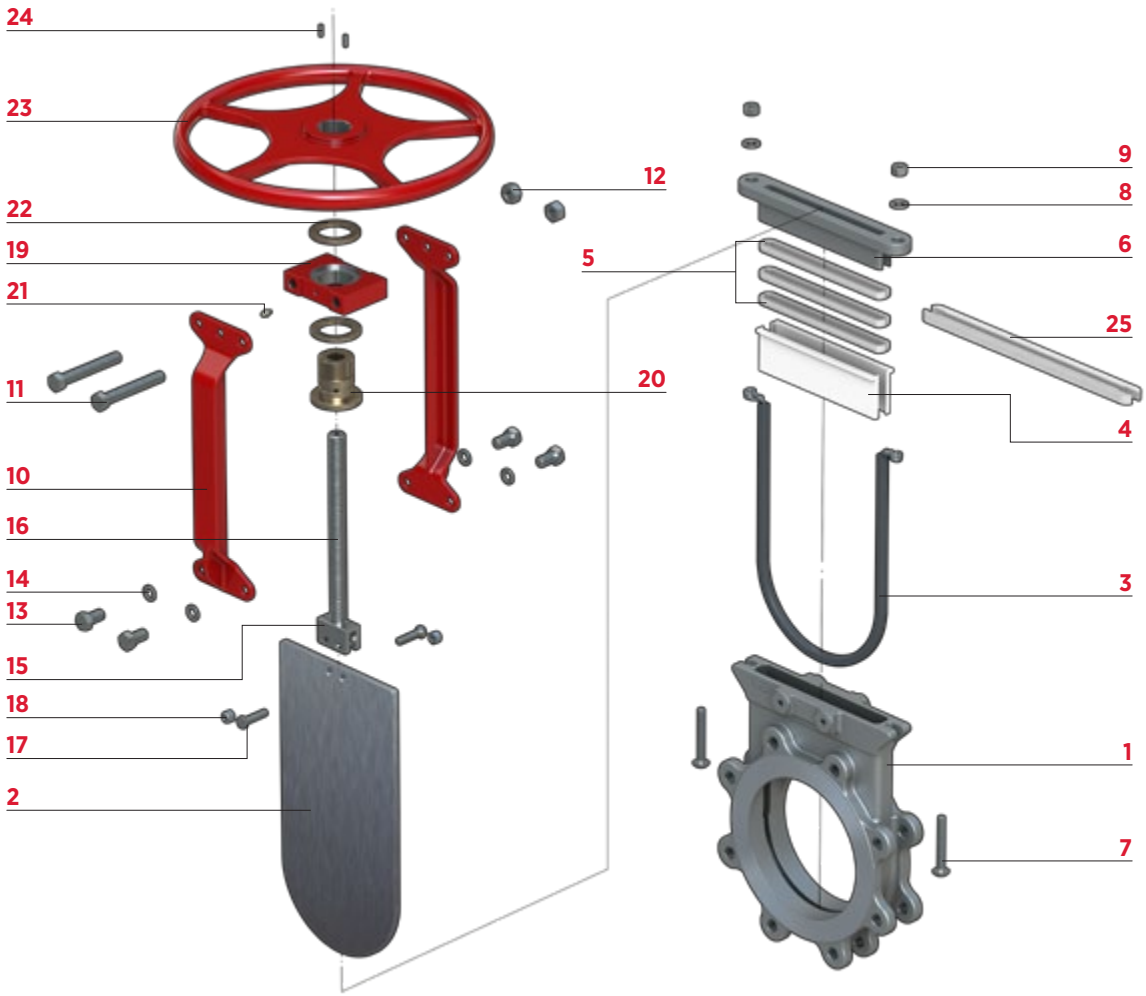
MATERIALS OF CONSTRUCTION

BILL OF MATERIALS & PARTS CALL OUT

ITEM	DESCRIPTION	MATERIAL
1	Body	304 Stainless Steel
2	Gate	304 Stainless Steel
3	Seat	Buna-N
4	Chest Liner	R-TFE
5	Packing Set	PTFE Impregnated Synthetic Fiber
6	Gland	304 Stainless Steel
7	Gland Bolt	304 Stainless Steel
8	Gland Washer	304 Stainless Steel
9	Gland Nut	316 Stainless Steel
10	Yoke	Carbon Steel
11	Mounting Bolt (Top)	304 Stainless Steel
12	Mounting Nut (Top)	316 Stainless Steel
13	Mounting Bolt (Bottom)	304 Stainless Steel

ITEM	DESCRIPTION	MATERIAL
14	Spring Washer	304 Stainless Steel
15	Clevis	304 Stainless Steel
16	Stem	304 Stainless Steel
17	Clevis Bolt	304 Stainless Steel
18	Clevis Nut	316 Stainless Steel
19	Collar	Ductile Iron
20	Yoke Sleeve	Aluminum Bronze
21	Lubricant Port	Bronze
22	Needle Bearing	Bearing Steel
23	Hand Wheel	Cast Iron
24	Soc Screw	Carbon Steel
25	Anti-Extrusion Ring[1]	R-TFE



NOTE
1 Available in valves 14" or larger.

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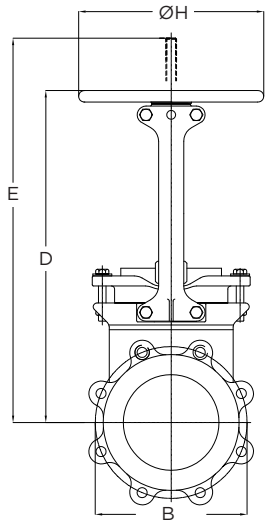
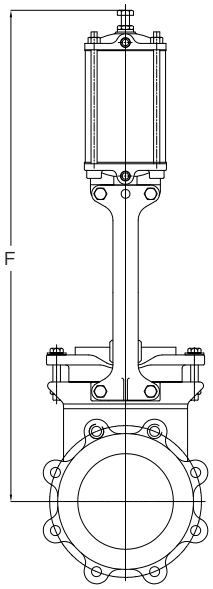
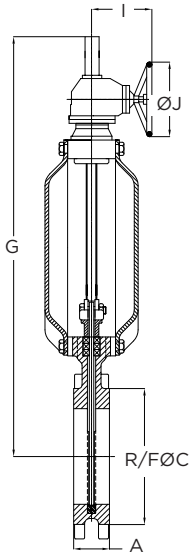
DIMENSIONS



Direct Mounted Handwheel



Pneumatic Actuator



Bevel Gear

NOTE

1 Consult factory for hydraulic and electric actuator dimensions.

2 Dimensions are approximate and subject to change. Consult factory for certified drawings.

* In conformance with ASME B16.5, Class 150 for sizes NPS 2 (DN50) through NPS 24 (DN600) and per ASME B16.47 Series A for sizes > NPS 24.

DIMENSIONS (Inches)

NPS	A	B*	R/FØC	D	E	F	G	ØH	I	ØJ
2	1.88	4.75	3.62	14.30	15.50	19.70	--	10.00	--	--
3	2.00	6.00	5.00	15.90	19.00	23.20	--	10.00	--	--
4	2.00	7.50	6.18	18.50	22.00	26.10	--	10.00	--	--
5	2.25	8.50	7.32	20.80	25.30	30.40	--	12.00	--	--
6	2.25	9.50	8.50	22.70	27.70	32.80	29.10	12.00	11.65	20.00
8	2.75	11.75	10.63	24.70	33.50	39.70	34.60	16.00	11.65	20.00
10	2.75	14.25	12.76	29.80	40.70	47.40	43.50	16.00	11.65	20.00
12	3.00	17.00	14.76	33.90	17.00	54.20	50.00	20.00	12.05	20.00
14	3.00	18.75	16.26	38.50	52.90	59.60	56.60	20.00	12.05	20.00
16	3.50	21.25	18.50	--	--	65.30	60.00	--	12.05	20.00
18	3.50	22.75	21.00	--	--	74.30	66.20	--	12.05	20.00
20	4.50	25.00	22.99	--	--	81.40	75.10	--	12.05	20.00
24	4.50	29.50	27.24	--	--	95.70	84.90	--	12.05	20.00
30	Contact factory for dimensions									
36	Contact factory for dimensions									

WEIGHT (lbs)

HAND WHEEL	PNEUMATIC ACTUATOR	GEAR OPERATOR
20	40	--
33	44	--
35	57	--
53	84	--
57	93	--
82	130	115
121	231	196
185	335	225
269	436	304
--	540	401
--	644	523
--	853	666
--	1063	1025
Contact factory		
Contact factory		

DIMENSIONS (Millimeters)

DN	A	B*	R/FØC	D	E	F	G	ØH	I	ØJ
50	48	121	92	363	394	501	--	254	--	--
80	51	153	127	405	483	590	--	254	--	--
100	51	191	157	471	558	663	--	254	--	--
125	57	216	186	529	642	773	--	305	--	--
150	57	242	216	576	703	833	740	305	296	508
200	70	299	270	627	852	1009	878	406	296	508
250	70	362	324	756	1035	1204	1104	406	296	508
300	76	432	375	862	1193	137	1271	508	306	508
350	76	476	413	978	1344	1515	1437	508	306	508
400	89	540	470	--	--	1658	1523	--	306	508
450	89	578	534	--	--	1886	1681	--	306	508
500	114	635	584	--	--	2067	1907	--	306	508
600	114	750	692	--	--	2354	2157	--	306	508
750	Contact factory for dimensions									
900	Contact factory for dimensions									

WEIGHT (kg)

9	19	--
15	20	--
16	26	--
24	38	--
26	42	--
37	59	52
55	105	89
84	152	102
122	198	138
--	245	182
--	292	237
--	387	305
--	482	465
Contact factory		
Contact factory		

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OPTIONS & ACCESSORIES

ACTUATOR OPTIONS | SHOWN IN RED

Direct Mounted Handwheel

Bevel Gear Operator

Double Acting Pneumatic Actuator

Hydraulic Actuator

Lever

Electric Actuator

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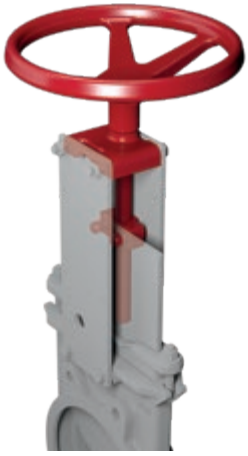
ADDITIONAL ACCESSORIES | SHOWN IN RED

Deflection Cone

Handwheel Lock Out

Pinned Lockout Open & Closed

Pneumatic Failsafe



Non-Rising Stem

Gate Guard

Manual Override

Chain Wheel

Mechanical Limit Switch

Proximity Sensor

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Bulletin 8000

VAL-MATIC®

DUAL DISC® CHECK VALVE

Dual Disc® Check Valves

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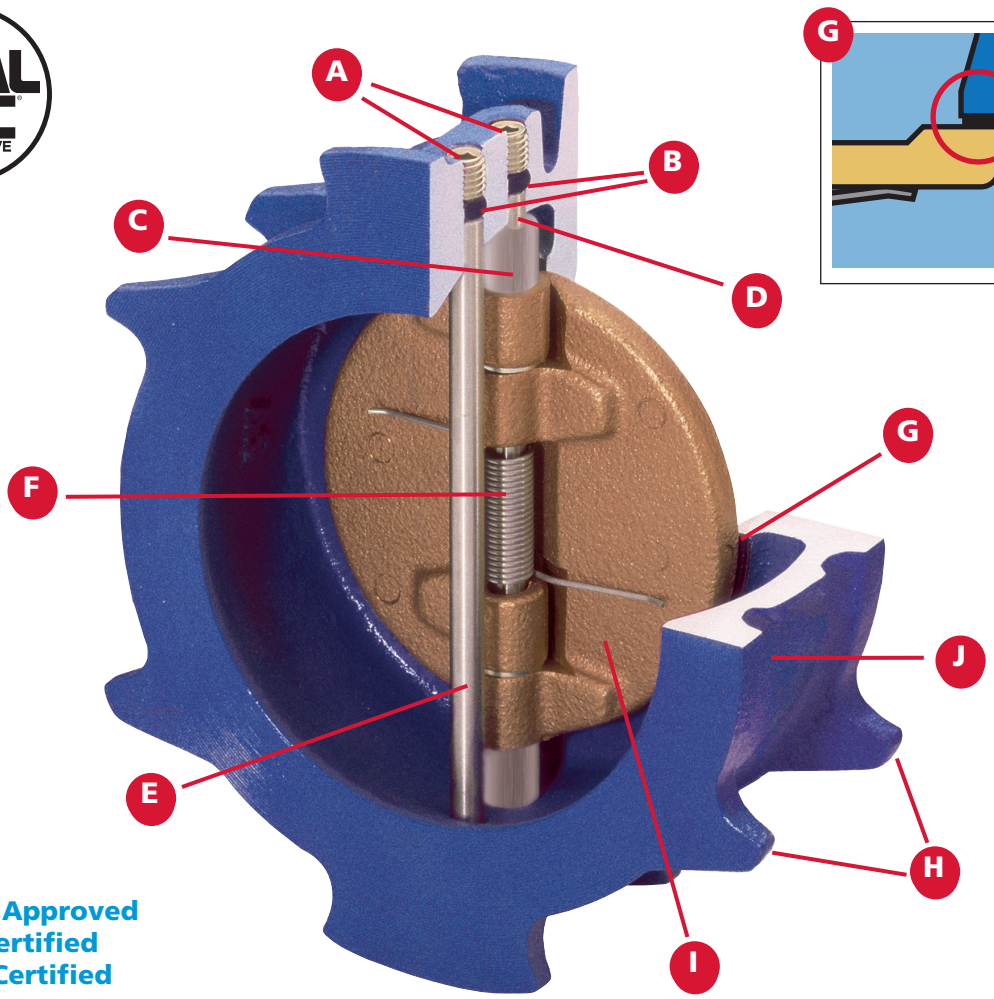
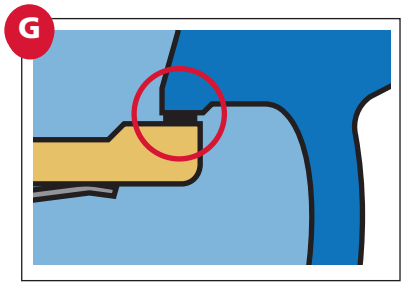
UL Listed / FM Approved
NSF/ANSI 61 Certified
NSF/ANSI 372 Certified

Feature Highlights





* **UL Listed / FM Approved**
* **NSF/ANSI 61 Certified**
* **NSF/ANSI 372 Certified**

A. Retainer Plugs
Retains hinge and stop pins while providing compression to stabilization spheres.

B. Stabilization Spheres
Stabilizes hinge and stop pins, preventing vibration and wear.

C. Thrust Bearings
Reduces friction and wear during disc action.

D. Hinge Pin
Heavy duty construction with increased bearing surface and strength.

E. Stop Pin
Positions and stabilizes discs in full open position to prevent disc flutter.

F. Spring
Specially designed torsion spring closes discs upon pump shutdown minimizing water hammer normally associated with valve shutoff. Also provides for Lift and Pivot disc action. Cycle tested 50,000 cycles to assure long, trouble free life.

G. Vulcanized Seat
Pressure sensitive seating with full disc overlap provides positive seating at high and low pressures.

H. Alignment Lugs
Provides for precise alignment in ANSI 125 and ISO PN10 and PN16 installations.

I. Disc
Dual Disc design increases valve sensitivity to flow, allowing discs to close quickly on pump shutdown.

J. Body
Choose between compact wafer design to minimize space requirements (pictured) or grooved end for ease of installation. Both provide low initial installation cost and minimal maintenance. Compact wafer style reduces installation time, minimizes space required for installation, and results in low initial unit cost. Lug style available, contact factory.

Features & Benefits

Specifiable Features

With today's demanding system requirements, engineers must specify piping components that are both cost efficient and reliable. The design of the Val-Matic Dual Disc® Check Valve answers those needs by incorporating many unique characteristics not found in similar check valves. 2" - 12" (50 -300mm) valves include ductile iron construction, with a 250 psi (17.2 BAR), cold working pressure rating. They are UL listed, FM approved and available in Wafer (ANSI 125, ISO PN10, ISO PN16) and Grooved End IPS connections. Sizes 14" (350mm) and larger are available in cast and ductile iron.

Installation Cost

Choose between compact wafer design to minimize space requirements or grooved end for ease of installation. Both provide low initial installation cost and minimal maintenance for horizontal or vertical flow up installations. The following quality features you expect from Val-Matic can be found in both the wafer and grooved end valves.

Operating Cost

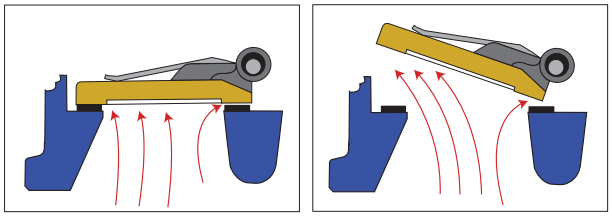
Careful attention to inlet contouring and streamlined flow design, combined with an optimal flow area, results in low pressure loss characteristics. The resulting low power consumption translates into dollar savings throughout the long life of the valve.

Product Reliability

Design features such as Lift and Pivot Disc Action, Stabilization Spheres, Pressure Sensitive Seating, Disc Stabilization, Disc Seal Overlap and Flow Sensitive Closure, combined with careful selection of materials of construction, reflect Val-Matic's efforts to build a quality valve. These efforts result in a Cost Efficient and Reliable product that will provide many years of trouble free service.

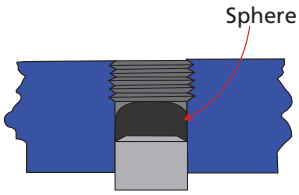
Lift and Pivot Disc Action

This feature, designed to provide longer valve life, is activated during the opening and closing cycles. It works by a combination of clearance between the pivot pin and disc bores, and the placement of the legs of the torsion spring. With this design the disc will always lift first at the pivot on opening, and not return until the disc is closed, preventing wear between disc and seat surfaces.



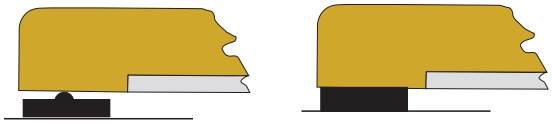
Stabilization Spheres

The resilient, synthetic spheres inserted into the hinge and stop pin holes are compressed against the pins and effectively stabilize them during flow conditions, eliminating vibration and wear.



Pressure Sensitive Seating

This design provides for minimum disc-to-seat contact at low pressures, and maximum contact at high pressures resulting in positive seating under all conditions.

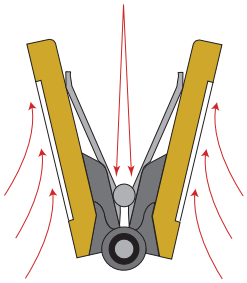


Low Pressure minimum contact

High Pressure full contact

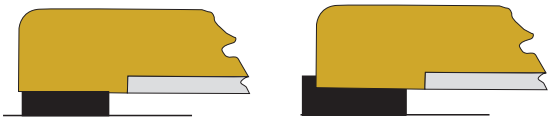
Disc Stabilization

When the valve is fully open, the discs are positioned on a slight angle, causing the flow velocity to force the discs firmly against the stop pin. The ensuing vector forces act to stabilize the disc during flow conditions thereby preventing excessive wear due to disc "flutter."



Disc Seal Overlap

Contact between the seal and the disc is uniquely designed to eliminate indentation ridges found in designs which do not allow the disc to fully overlap the seal. Indentation ridges caused by valve designs with discs smaller in diameter than the seal can result in valve leakage.



Overlap Design

Non-Overlap Design

Flow Sensitive Closure

The torsion spring closes the valve when the flow is reduced, preventing flow reversal and lessening the potential for water hammer normally associated with conventional swing check valves.

Ratings/Construction

PRESSURE RATINGS

MAXIMUM NON-SHOCK WORKING PRESSURE RATINGS, PSIG			
Temp. F	Ductile Iron	Cast Iron	
	2”-12”	14”-24”	30”-60”
150	250	150	150
200	235	135	115
250	220	125	85
Hydro Test*	500	230	230

MAXIMUM NON-SHOCK WORKING PRESSURE RATINGS, BAR			
Temp. C	Ductile Iron	Cast Iron	
	50-300 mm	350-600 mm	750-1500 mm
65	17.2	10.3	10.3
95	16.2	9.3	7.9
120	15.2	8.6	5.9
Hydro Test*	35	16	16

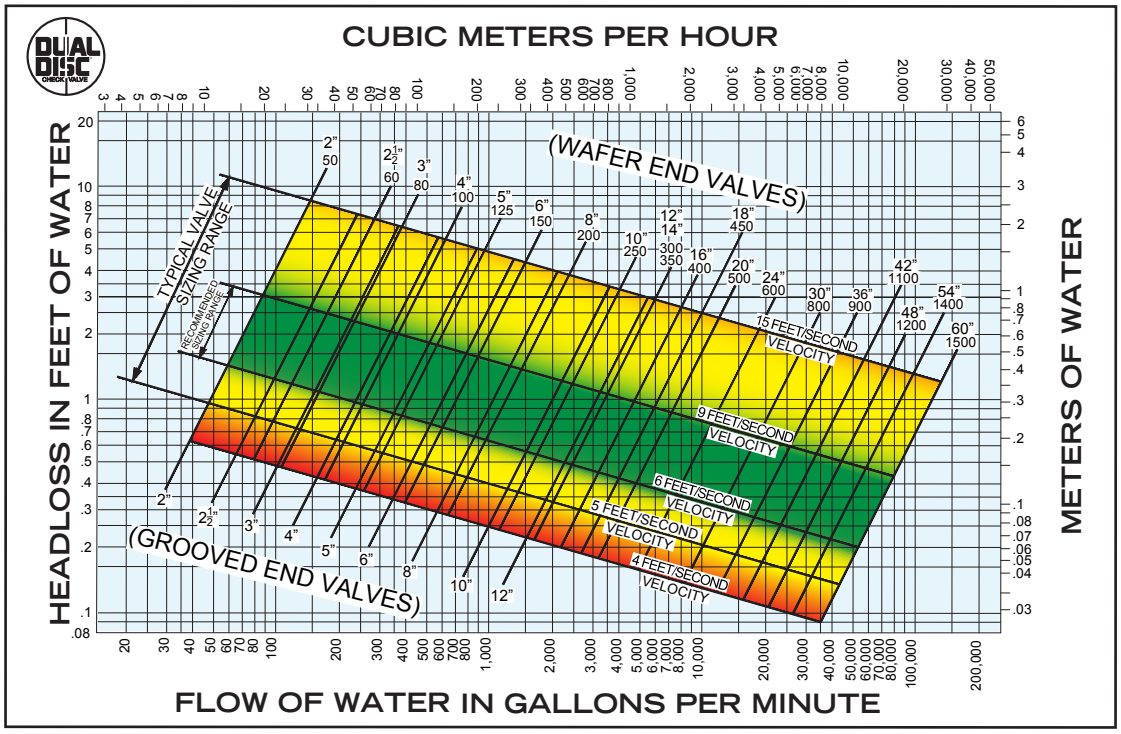
*14” & 16” valves are hydro tested to 300 psi (20 bar)

MATERIALS OF CONSTRUCTION

COMPONENT	STANDARD	OPTIONAL
Body 2”- 12” (50-300 mm)	Ductile Iron ASTM A536, Grade 65-45-12	-
Body 14”- 60” (350-1500 mm)	Cast Iron ASTM A126, Class B	Ductile Iron ASTM A536, Grade 65-45-12
Disc 2”- 12” (50-300 mm)	Bronze ASTM B584, C87600	-
Disc 14”- 60” (350-1500 mm)	Aluminum Bronze ASTM B148, C95200	Ductile Iron ASTM A536, Grade 65-45-12 Electroless Nickel Plating, Stainless Steel ASTM A351 Grade CF8M
Seat	Buna-N	Viton
Spring 2”-16” (50-400mm)	T316 Stainless Steel, ASTM A313	Inconel X750
Spring 18”-60” (450-1500mm)	17-7PH Stainless Steel, ASTM A313	Inconel X750
Coatings	Universal Primer	Fusion Bonded Epoxy

Contact Factory for other materials.

Headloss Chart

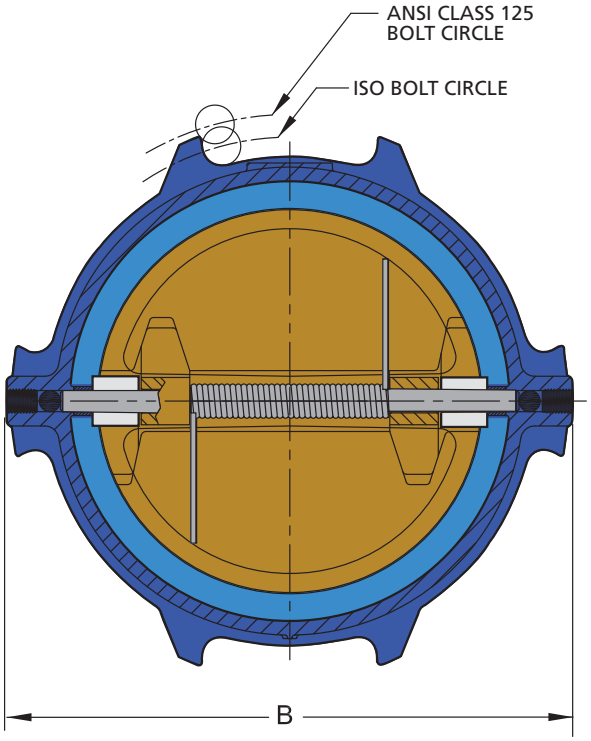


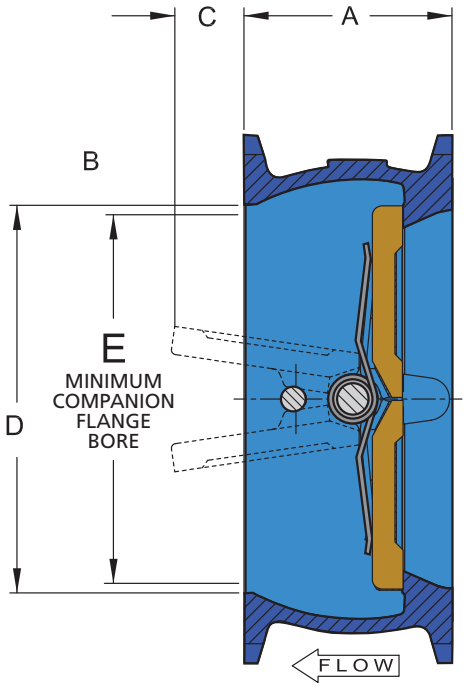
Flow Coefficients

Size	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60
Cv 8800G	77	129	209	358	573	898	1740	3180	4950	-	-	-	-	-	-	-	-	-	-	-
Cv 8800W	76	161	224	400	648	1060	1890	3340	5270	5200	7200	9400	12000	18500	33000	50000	72000	97000	130000	180000

Installation Dimensions

Wafer Style

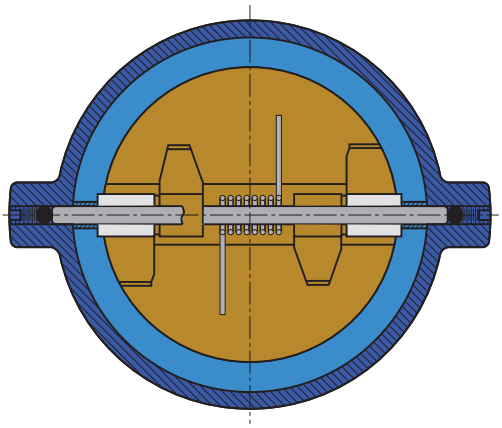




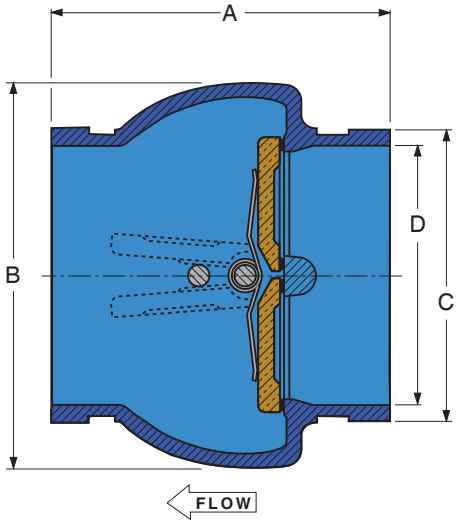
Dimensions in Inches							
Valve Size (in)	**Valve Size (mm)**	**A**	**B**	**C**	**D**	**E**	**Wafer Wt. (lb)**
2	50	2.13	5.13	-	2.88	-	4
2 1/2	60	2.38	6.00	0.13	3.50	1.31	5
3	80	2.63	5.63	0.18	3.88	1.69	7
4	100	2.63	7.75	0.63	4.75	3.06	9
5	125	3.25	7.56	0.81	5.50	3.63	13
6	150	3.75	8.63	0.81	6.25	4.25	19
8	200	5.00	12.25	1.00	8.00	5.50	41
10	250	5.50	14.75	2.06	10.25	8.50	65
12	300	7.12	17.38	1.94	12.00	9.25	94
14	350	7.25	17.75	3.25	14.38	12.50	187
16	400	7.50	20.25	4.50	16.38	15.00	270
18	450	8.00	21.63	5.38	18.38	17.00	330
20	500	8.38	23.88	6.38	20.25	19.00	424
24	600	8.75	28.25	8.50	24.25	23.00	589
30	800	12.00	34.75	9.50	30.00	28.50	1112
36	900	14.50	41.25	12.00	36.00	34.50	1864
42	1050	17.00	48.00	13.75	42.00	40.50	2889
48	1200	20.62	54.50	17.00	48.00	46.50	5525
54	1350	21.25	60.50	18.25	54.00	49.25	7000
60	1500	26.00	67.00	18.25	60.00	53.50	8500

Installation Dimensions

Grooved End Style

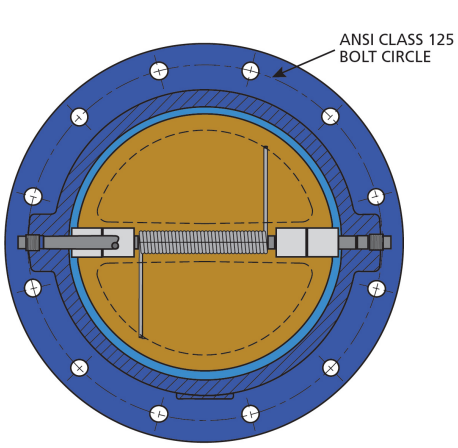


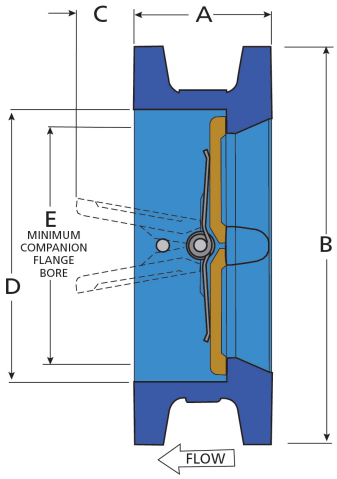
*Cut grooves per ANSI/AWWA C606



Dimensions in Inches						
Valve Size (in)	Valve Size (mm)	A	B	C	D	Grooved Wt. (lb)
2	50	4.66	4.12	2.38	2.00	4
2 1/2	60	4.90	4.88	2.88	2.41	5
3	80	5.31	5.38	3.50	2.94	8
4	100	5.38	6.00	4.50	3.91	9
5	125	5.72	7.06	5.56	4.89	13
6	150	6.00	8.12	6.62	5.92	18
8	200	6.72	10.03	8.62	7.91	30
10	250	7.78	12.38	10.75	10.00	56
12	300	8.18	14.38	12.75	11.94	87

Lug Style





Dimensions in Inches						
Valve Size (in)	Valve Size (mm)	A	B	C	D	E
14	350	7.25	21.00	3.25	14.38	12.50
16	400	7.50	23.50	4.50	16.38	15.00
18	450	8.00	25.00	5.38	18.38	17.00
20	500	8.38	27.50	6.38	20.25	19.00
24	600	8.75	32.00	8.50	24.25	23.00
30	800	8.75	38.75	9.50	30.00	28.50
36	900	8.75	46.00	12.00	36.00	34.50
42	1050	8.75	53.00	13.75	42.00	40.50
48	1200	8.75	59.50	17.00	48.00	46.50
54	1350	8.75	66.25	18.25	54.00	49.50
60	1500	8.75	73.00	18.25	60.00	53.50

Specification

SCOPE

1.1 This specification covers the design, manufacture, and testing of 2 in. (50 mm) through 60 in. (1500 mm) Dual Disc Check Valves suitable for pressures up to 500 psig (3450 kPa) water service.

1.2 The Check Valve shall be of the dual disc, wafer style, or grooved end with torsion spring induced closure.

STANDARDS AND APPROVALS

2.1 The valves shall be designed, manufactured and tested in accordance with American Water Works Association Standard ANSI/AWWA C518.

2.2 The valves for use in fire protection systems shall be Underwriters Laboratories listed in sizes 2 1/2 in. - 12 in. and Factory Mutual approved in sizes in sizes 2 1/2 in. - 16 in.

2.3 The valves shall be certified to be Lead-Free in accordance with NSF/ANSI 372.

2.4 Manufacturer shall have a quality management system that is certified to ISO 9001 by an accredited, certifying body.

CONNECTIONS

3.1 Wafer style valves shall be provided in sizes 2 in. (50 mm) through 12 in. (300 mm) for installation between ANSI B16.1Class 125 iron flanges, or between ISO 7005-2 PN10 or PN16 flanges.

3.2 Wafer style valves shall be provided in sizes 14 in. (350 mm) through 66 in. (1650 mm) for installation between ANSI B16.1 Class 125 or Class 250 iron flanges.

3.3 Grooved end valves shall be provided in 2 in. (50mm) through 12 in. (300mm) for installation on pipe with cut grooves per ANSI/AWWA C606 for steel IPS pipe.

DESIGN

4.1 The body shall be of one piece construction incorporating a vulcanized synthetic seal.

4.2 Seal design shall include a raised sealing bead for positive seating at both high and low pressures. The disc shall fully overlap the synthetic seal, preventing pressure indentations.

4.3 Opening and closing of the valve shall utilize a lift and pivot action to prevent seal wear and ensure long seal life.

4.4 Disc stabilization in the full open position shall be provided by the use of a stop pin.

4.5 The stop and hinge pins shall be stabilized by the use of synthetic spheres to prevent wear due to vibration during operating conditions. The design shall incorporate a raised seat and 1/2 in. body wall to disc clearance to ensure proper operation after long periods of inactivity and potential corrosion buildup.

4.6 Closure shall be assisted with a torsion spring to provide a cracking pressure of 0.25 psig.

MATERIALS

5.1 The valve body on sizes 2-12 in. shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. On sizes 14-66 in. the valve body shall be constructed of ASTM A126 Class B cast iron for Class 125 and Class 250 valves.

5.2 For sized 2-12 in. the disc shall be constructed of ASTM B584, Alloy C87600 (2-12 in.) cast bronze. For sizes 14 in. and up, the disc shall ve constructed of ASTM B148, Alloy C95200 cast aluminum bronze.

5.3 The hinge pins and stop pins shall be Type 316 stainless steel.

5.4 The torsion spring shall be ASTM A313 Type 316 stainless steel up to 16 in. (400 mm) and ASTM A313 Type 17-7 PH on 18 in. (450 mm) and larger sizes.

5.5 The seal shall be Buna-N per ASTM D2000-BG.

OPTIONS

6.1 Optional Disc materials for sizes 14 in. and up include ASTM A536 Grade 65-45-12 ductile iron with electroless nickel plating and ASTM A351 Grade CF8M stainless steel.

6.2 Air Service Spring (Series 8900W)

6.3 Optional Spring material includes Inconel X750.

6.4 For 14 in. and larger, end connections shall be lug with threaded flange lugs or full diameter threaded flanges when spedified for end of line service.

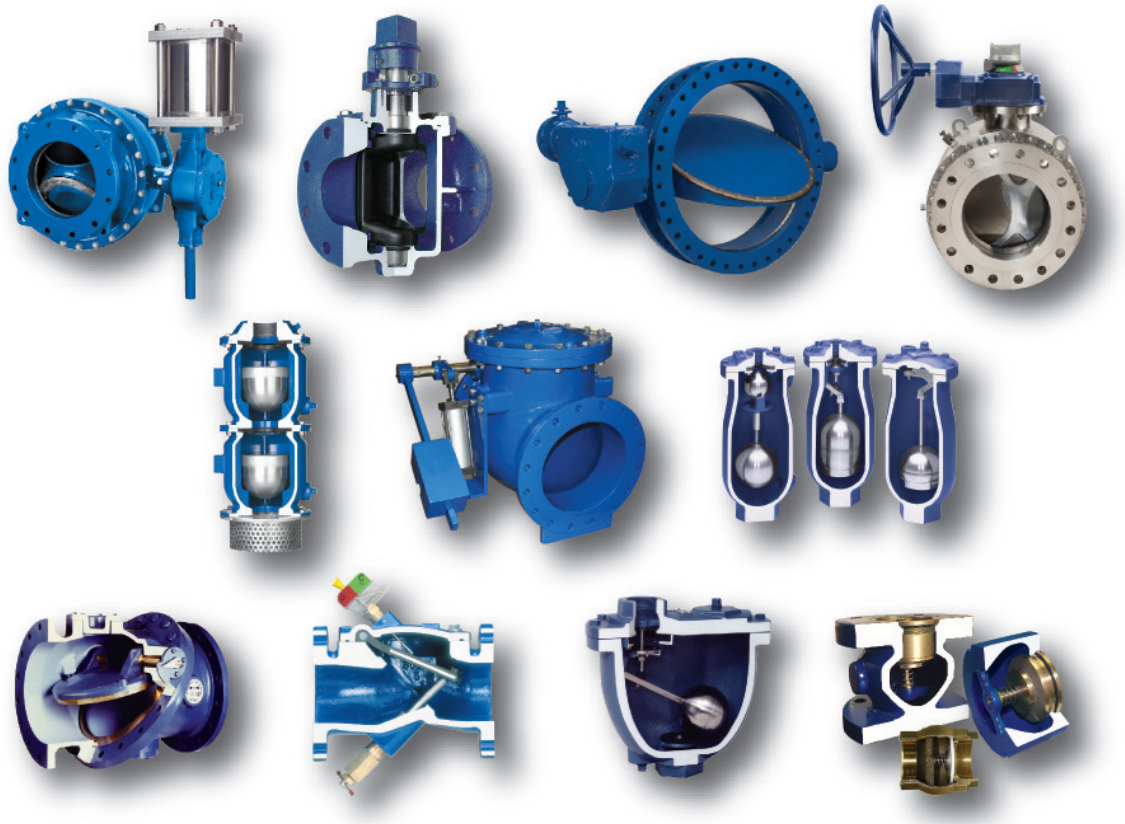
6.5 Valve interiors and exteriors shall be coated with an NSF/ANSI 61 certified fusion bonded epoxy in accordance with AWWA C550 when specified.

MANUFACTURE

7.1 The valves shall be hydrostatically tested at 1.5 or 2 times their rated cold working pressure. A seat closure test at 1.5 or 2 times the valve rating shall be conducted to demonstrate zero leakage. Additional tests shall be conducted per AWWA, ANSI, MSS or API standards when specified. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals.

7.2 The exterior of the valve shall be coated with a universal alkyd primer.

7.3 Dual Disc® Check Valves shall be Series #8800W (Wafer Style), Series #8800G (Grooved End), Series #8800 (Class 125), #8700 (Class 250), or #8800L (Lug) as manufactured by Val-Matic® Valve & Mfg. Corporation, Elmhurst, IL. USA or approved equal.



Val-Matic's quality of design and meticulous workmanship has set the standards by which all others are measured. Quality design features such as the AWWA **Ener•G® Ball Valve** with its energy efficient design, fusion bonded epoxy and adjustable resilient seating....**Cam-Centric® Plug Valves** have more requested features than any other eccentric plug valve....**American-BFV® Butterfly Valves** include a field replaceable seat without the need for special tools....**Tilted Disc® Check Valves** with high strength and wear resistant aluminum bronze trim as standard.... **Silent Check Valves** featuring combined resilient/metal-to-metal seating and are **NSF/ANSI 61 & 372 Certified**....**Sure Seal Foot Valves** provided with a heavy duty stainless steel screened inlet....**Swing-Flex® and Surgebuster® Check Valves** designed with an unrestricted full flow area....**Swing Check Valves** with field adjustable closure versatility....**Dual Disc® Check Valves** utilizing stabilized components to provide extended life.... **Air Release, Air/Vacuum and Combination Air Valves** provided standard with Type 316 stainless steel trim.... **VaultSafe®** family of products includes the **FloodSafe® Inflow Preventer**, **FrostSafe®** two-way damper and the **VentSafe®** vent pipe security cage. The **QuadroSphere® Trunnion Ball Valve** features a unique ball design with recessed surfaces creating additional flow paths to provide a self-cleaning action and reduced wear and torque.

Val-Matic is totally committed to providing the highest quality valves and outstanding service to our customers. Complete customer satisfaction is our goal. **Make the change to quality, specify Val-Matic!**

VAL-MATIC® *Your Valve Experts™*

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Phone: 630-941-7600 • Fax: 630-941-8042
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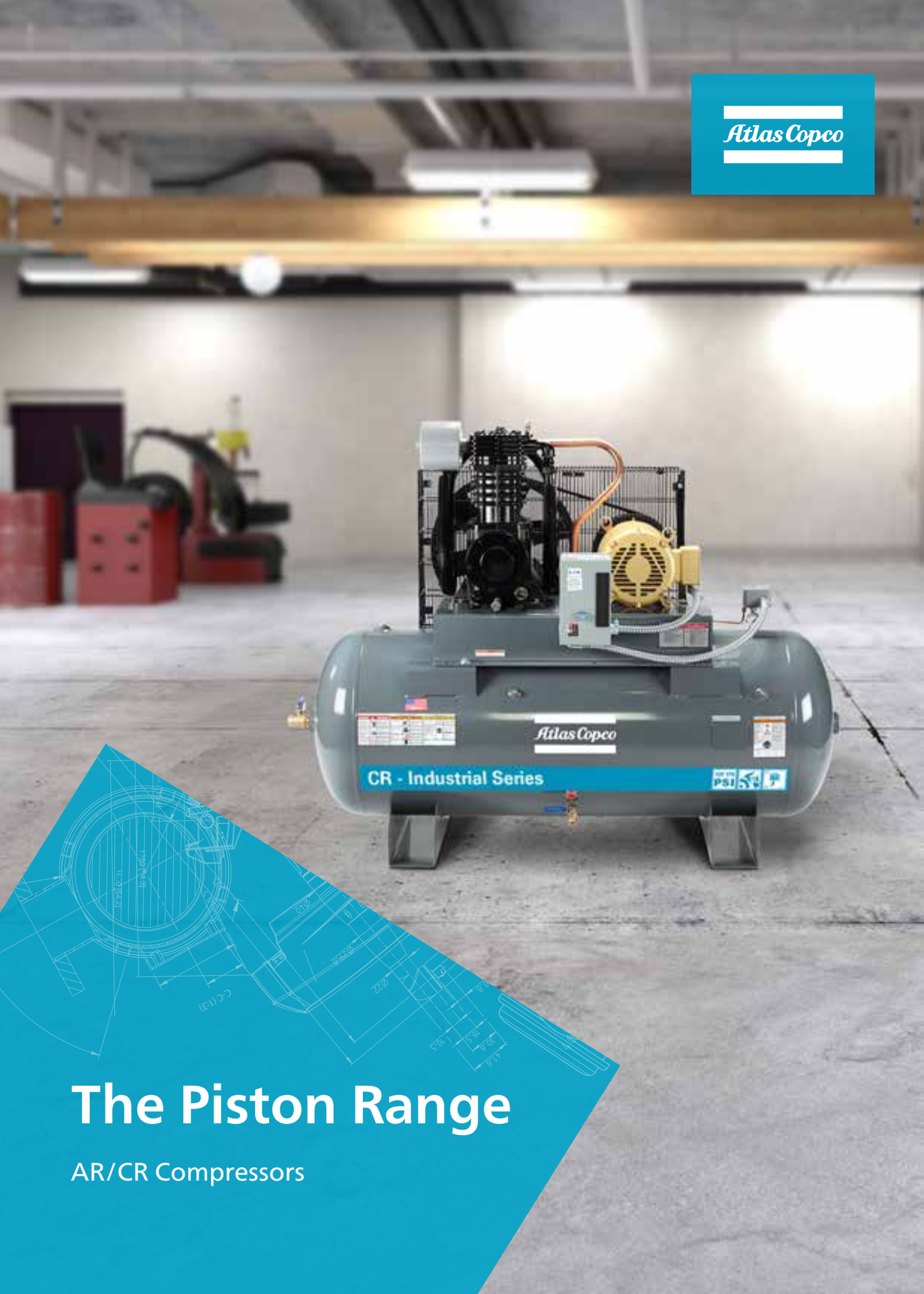
7/19



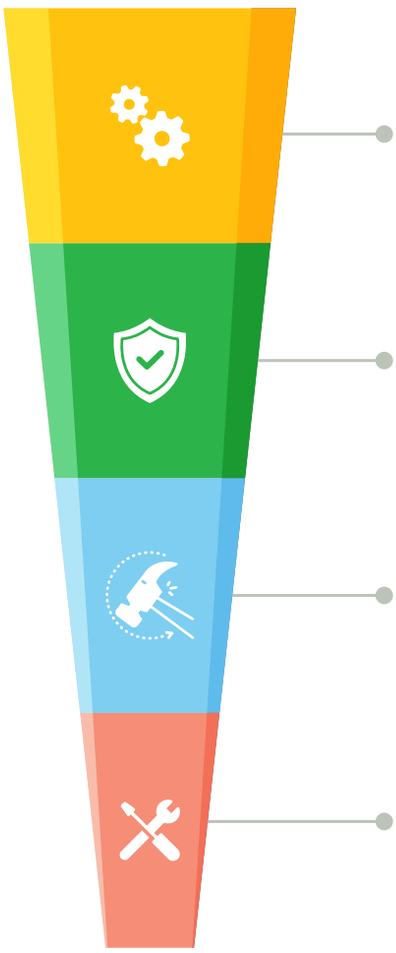
The Piston Range

AR/CR Compressors

The Atlas Copco Piston Lineup

More dependable than ever with tailored options for all applications, Atlas Copco is pleased to introduce the newly designed AR (aluminum) and CR (cast iron) piston compressor ranges. Both ranges deliver a winning combination of outstanding maximum reliability matched with robust performance, even in the most demanding conditions, for a dependable piston you can count on.

Assembled in the United States



Options Available Include:

Customize your piston to your needs. Options available include:

- Auto tank drain
- Aftercooler
- Low oil level switch
- TEFC motor
- NEMA4 control panel
- Pressure lubricated pump
- Simplex and duplex configurations
- And more...

Reliability

Engineered using the most state-of-the-art manufacturing techniques for a product of design excellence. The compressed air you need to keep your operations running efficiently with maximum uptime.

Heavy-Duty Construction

Ensures durability and reliability for the most demanding applications.

Easy Maintenance

Every component is easily accessible allowing minimum downtime and requires only limited maintenance.

AR Range

AR piston Compressors are splash lubricated, two-stage compressors with a maximum operating pressure of 175 psi. All models feature an aluminum pump. Models are equipped with a magnetic starter as standard. And include a low oil level switch, and pneumatic auto drain.

5-7.5 HP

CR Industrial Series

CR piston compressors include a cast-iron pump and are splash lubricated, two-stage compressors with a maximum operating pressure of 175 psi. All models feature a magnetic, an electronic auto drain, low oil level switch, and belt guard-mounted aftercooler.

5-15 HP

Advanced options include a NEMA4 cubicle and TEFC motor upgrade.

CR Industrial Duplex Range

The same great features as the CR Range but with a two-pump duplex design. A duplex design can be used to improve efficiency and/or to create redundancy and give you a backup option inside a single unit.

(Up to 20HP overall capacity)

These units come with an industrial control panel that allows them to be set up in a lead/lag configuration. Advanced options include a NEMA4 control panel and TEFC motor upgrade.

Gas Range

The Gas Power Range is comprised of splash lubricated two stage compressors. All models are equipped with an electric starter. They are perfect for remote job sites without access to electrical power. The CR model has a cast-iron pump and the AR model has an aluminum pump.

13-14 HP

AR Range

AR piston Compressors are splash lubricated, two-stage compressors with a maximum operating pressure of 175 psi. All models feature an aluminum pump. Models are equipped with a magnectic starter as standard. And include a low oil level switch, and pneumatic auto drain.lower duty cycle applications.

AR Professional Series

Model numbers listed for voltage options

Description	HP	230/1	230/3	460/3	Tank Gal	ACFM @100	ACFM @175	Air Outlet NPT	LxWxH (in)	Weight (lbs)
AR5-P49-TS-60GV Pressure Switch Starter	5	2021119056			60V	15.4	14.6	1/2"	23x30x69	327
AR5-P49-TS-80GV	5	2021119108			80V	15.4	14.6	3/4''	26x32x69	381
AR5-P49-TS-80GV	5		2021119110	2021119111	80V	16.1	15.2	3/4''	26x36x69	381
AR-7.5-T39-TS-80GV	7.5	2021119104	2021119105		80V	25.2	22.2	3/4''	26x37x77	457
AR-7.5-T39-TS-80GV PD LOLS	7.5	2021119106	2021119107		80V	25.2	22.2	3/4''	26x37x77	460

CR Range

CR piston compressors include a cast-iron pump and are splash lubricated, two-stage compressors with a maximum operating pressure of 175 psi. All models feature a magnetic, an electronic auto drain, low oil level switch, and belt guard-mounted aftercooler.

CR Industrial Series

Model numbers listed for voltage options

Description	HP	230/1	230/3	460/3	Tank Gal	ACFM @100	ACFM @175	Air Outlet NPT	LxWxH (in)	Weight (lbs)
CR5-CRS1-80V	5	2020041506	2020041507	2020041508	80V	18	17.4	3/4"	35x28x77	561
CR7.5-CRS1-80V	7.5	2020041516	2020041517	2020041518	80V	24.3	23.6	3/4"	35x28x77	593
CR10-CRS2-120V	10		2020041539	2020041540	120V	36.9	36	1"	49x34x78	923
CR15-CRS2-120H	15		2020041571	2020041572	120H	54	51	1"	71x30x55	997

CR Industrial Series - With TEFC Motor and NEMA4 Starter Box

Model numbers listed for voltage options

Description	HP	230/1	230/3	460/3	Tank Gal	ACFM @100	ACFM @175	Air Outlet NPT	LxWxH (in)	Weight (lbs)
CR5-CRS1-80V-IS-N4	5	2020041813	2020041814	2020041815	80V	18	17.4	3/4"	35x28x77	561
CR7.5-CRS1- 80V-IS-N4	7.5	2020041823	2020041824	2020041825	80V	24.3	23.6	3/4"	35x28x77	593
CR10-CRS2-120V-IS-N4	10		2020041846	2020041847	120V	36.9	36	1"	49x34x78	923
CR15-CRS2-120H-IS-N4	15		2020041878	2020041879	120H	54	51	1"	71x30x55	997

15 horsepower Ind Pack model comes with head unloaders as standard.

Duplex (Two-Pump) Range

The CR Piston Range also comes in a two-pump duplex design. A duplex design can be used to improve efficiency and/or to create redundancy and give you a back up option inside a single unit. These units come with an industrial control panel that allows for them to be set up in a lead/lag configuration.

CR Industrial Series - Duplex

Model numbers listed for voltage options

Description	HP	230/1	230/3	460/3	Tank Gal	ACFM @100	ACFM @175	Air Outlet NPT	LxWxH (in)	Weight (lbs)
CR5-CRS1-230/1-120HD-IS	10 (5x2)	2020041596	2020041597	2020041598	120H	36	34.8	3/4"	79x34x54	969
CR7.5-CRS1 - 230/1-120HD-IS	15 (7.5x2)	2020041606	2020041607	2020041608	120H	48.6	47.2	3/4"	79x34x54	1033
CR10-CRS2-230/3-200HD-IS	20 (10x2)		2020041615	2020041616	200H	73.8	72	1"	76x56x64	1668

CR Industrial Series - Duplex - With TEFC Motor and NEMA4 Control Panel

Model numbers listed for voltage options

Description	HP	230/1	230/3	460/3	Tank Gal	ACFM @100	ACFM @175	Air Outlet NPT	LxWxH (in)	Weight (lbs)
CR5-CRS1-230/1-120HD-IS-N4	10 (5x2)	2020041903	2020041904	2020041905	120H	36	34.8	3/4"	79x34x54	969
CR7.5-CRS1 - 230/1-120HD-IS-N4	15 (7.5x2)	2020041913	2020041914	2020041915	120H	48.6	47.2	3/4"	79x34x54	1033
CR10-CRS2-230/3-200HD-IS-N4	20 (10x2)		2020041922	2020041923	200H	73.8	72	1"	76x56x64	1668

Gas Range

The Gas Power Range is comprised of splash lubricated two stage compressors. All models are equipped with an electric starter. They are perfect for remote job sites without access to electrical power. The CR model has a cast-iron pump and the AR model has an aluminum pump.

Gas Series

Model numbers listed below

Description	HP	Engine	Part No.	Tank Gal	ACFM @100	ACFM @175	Air Outlet NPT	LxWxH (in)	Weight (lbs)
AR-P49-TS-13HP	13	Honda	8090303366	30H	13.4	12.7	3/4"	41x19x44	325
CR13-CRS1-HG-30H-PS*	13	Honda	2020041630	30H	24.6	23.6	1/2''	42x24x44	485
CR14-CRS1-KG-30H-PS*	14	Kohler	2020041631	30H	24.6	23.6	1/2''	42x24x45	492

Ed	Position	Description	Date	Intr./Appd.
01		DRAWING RELEASED	08/18	BJW

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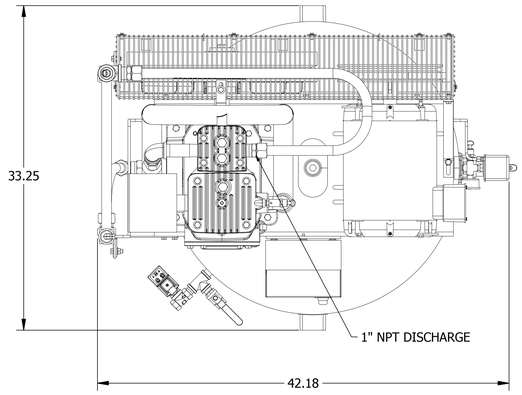

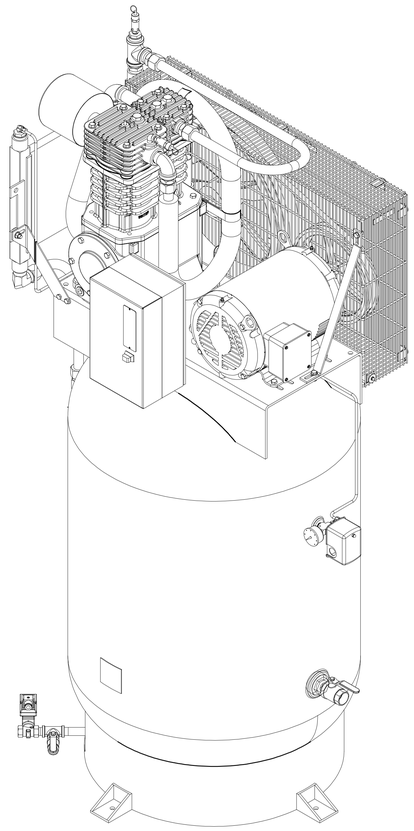

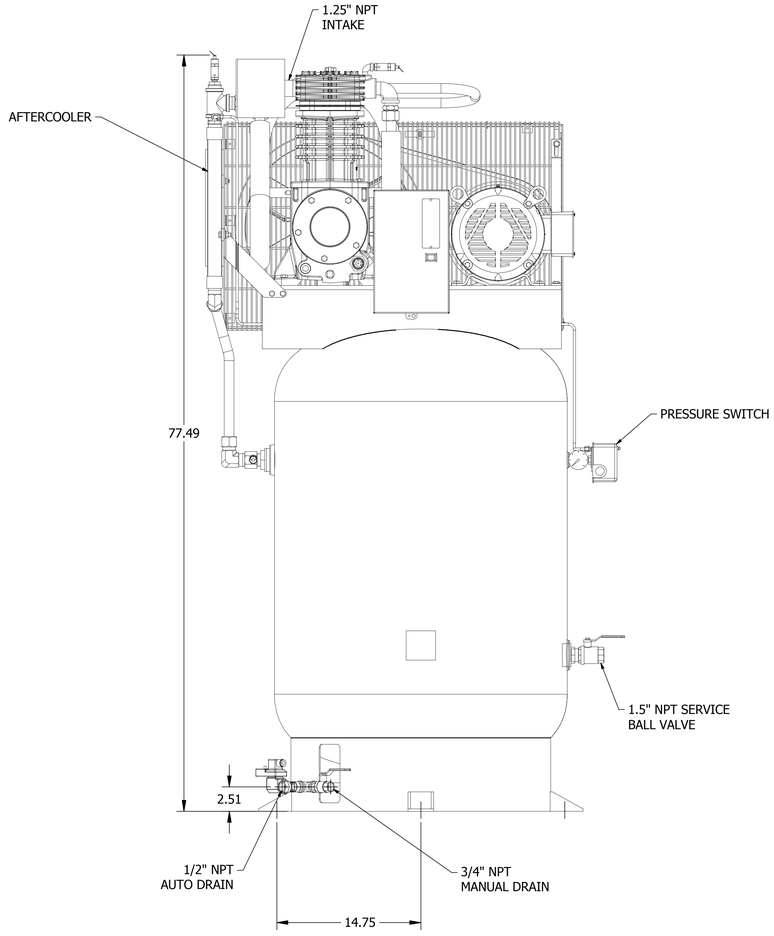

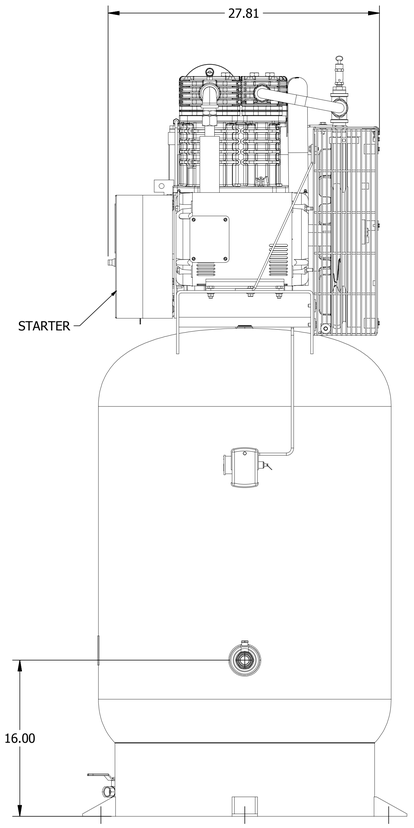

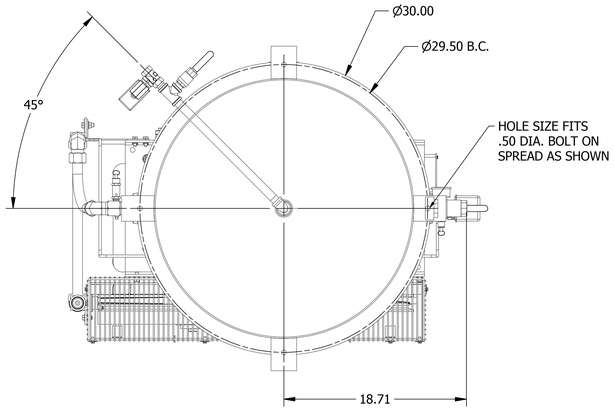

NOTES:

1) ALL DIMENSIONS GIVEN IN INCHES.
2) ALLOW A MINIMUM OF 12 INCHES ON ALL SIDES FOR SERVICE AND COOLING.
3) NEMA 4 STARTER SHIPPED LOOSE.

Dimensions and tolerances in accordance with ASME Y14.5 M-1994 Unless otherwise specified all dimensions are in inches primary.	Name	DRAWING,DIM,CR10-TS-120V-PPS			Confidentiality Class acc. to 20122203718	
TOLERANCES ON ANGLES ±	Material	Not Applicable			Internal	
TOLERANCES ON 2 PLANES DIM'S ±	Finish	Not Applicable			INV	
TOLERANCES ON 3 PLANES DIM'S ±	Ingersoll Rand	Scale 1/5	Family	E	Similar to	Drawing owner UTY
FINISH ON MACHINED SURFACES √		Drawn by utymcobar	Make From		Replaces	
2022035040	STATUS	Version Drwg	Blank wt lb	Fini wt. 0 lb	Designation	Sheet 1 / 1
Parent 3D model	Ed . Version 3D	Approved Internal	Date checked.	Prod checked.	Approved.	Date 8/14/2018

2022035041

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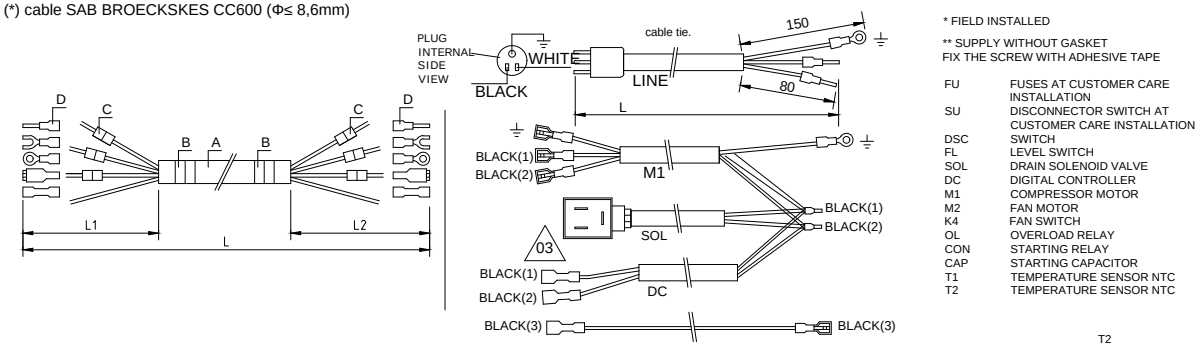
CABLE BILL OF MATERIALS			SIDE A		SIDE B		
CABLE FOR	LENGTH mm	CABLE TYPE	L1 mm	TERMINAL TYPE	L2 mm	TERMINAL TYPE	NOTES
MAIN SUPPLY	4000	AWG14 3G2,5	-	NEMA5 - 15P	80 -150GND	2xBF-P10 + S2,5-M6	LISTED SJ, SJT, SJTO,SJOOW,SJTOW
MOTOR M1 (*)	1120	AWG14 3G2,5	100	2xBF-F608+160831-3(GND)	80 -150GND	2xGF-P10+ S2,5-M6	style 2587 or 2550 or 21098 or 21216 or equivalent
FAN M2	-	-	-	-	-	-	
DIGITAL CONTROLLER DC	450	AWG18 2x1	100	2xRF-F 608P 03	80	-	
SOLENOID VALVE SOL	850	AWG18 2x1	-	43650/B **	80	-	
OUTPUT RELAY FOR FAN	1400	AWG18 1mm2 black	-	RF-F 608P	-	RF-F 608	style 1015 90°

(*) cable SAB BROECKSKES CC600 (Φ≤ 8,6mm)

BILL OF MATERIALS

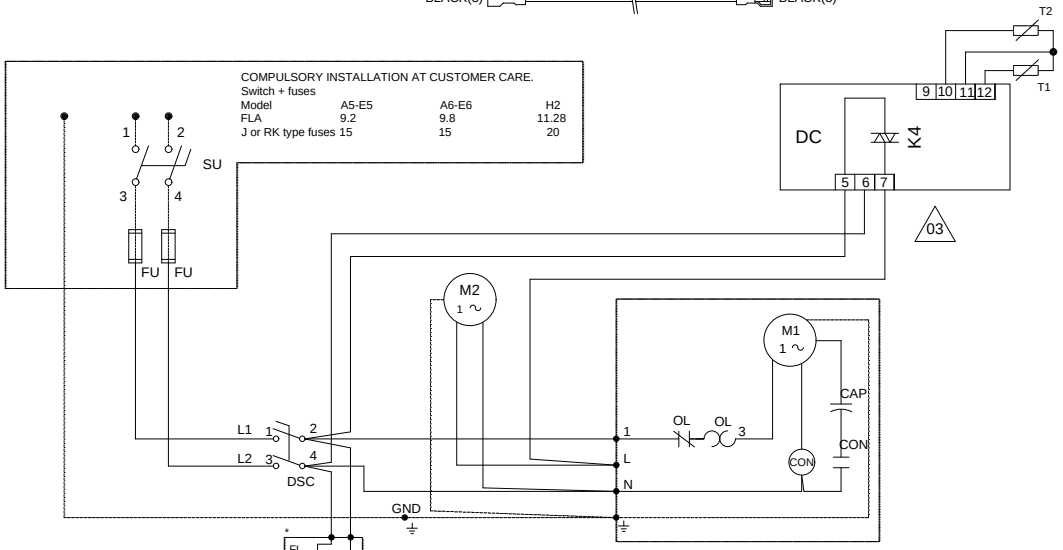
ID	DESCRIPTION	TYPE	MANUFACTOR	CODE	QUANT.	POSITION
DSC	SWITCH	OT25FT3	ABB	1089949849	1	
	HANDLE	OHBS3RH	ABB	1089949850	1	
	Plastic cable tie	5203	ITW			
		320-30	LEGRAND			
	CABLE GLAND	M25X1,5	(7-13mm)	0698514122	1	
	NUT	M25x1,5		0697980954	1	



* FIELD INSTALLED

** SUPPLY WITHOUT GASKET
FIX THE SCREW WITH ADHESIVE TAPE

FU	FUSES AT CUSTOMER CARE INSTALLATION
SU	DISCONNECTOR SWITCH AT CUSTOMER CARE INSTALLATION
DSC	SWITCH
FL	LEVEL SWITCH
SOL	DRAIN SOLENOID VALVE
DC	DIGITAL CONTROLLER
M1	COMPRESSOR MOTOR
M2	FAN MOTOR
K4	FAN SWITCH
OL	OVERLOAD RELAY
CON	STARTING RELAY
CAP	STARTING CAPACITOR
T1	TEMPERATURE SENSOR NTC
T2	TEMPERATURE SENSOR NTC



WIRE HARNESS 9828443171
SERVICE DIAGRAM EQUIVALENT TO 9828443179

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Note	Position	Modified from	Date	Intr./Appd.
03		Update Controller and Wirings. DN:20054176 CID:27700	21/09/2020	

Parent 3D Model	Ed.Version 3D

Tolerances,if not indicated,according to: General tolerances
ATLAS COPCO STANDARD CLASS 1350K - V

Name: SERVICE DIAGRAM — A5-6 / E5-6 115/60 UL EL CONTROL
Material: See Drawing
Treatment: Not Applicable
Confidentiality class acc. to 1102 K: Internal
ACDE

Scale: -:-
Drawn by: Administrator
Drawing format: A2
Blank wt. Kg
Fini wt. Kg
Family
Blank nr.
Compare
Replaces
Drawing owner: CAI
Transferred from
Designation
Sheet ( ) 01 01
Approved Internal
Dws checked.
Prod checked.
Approved.
Date 04/08/2015 11:03:34

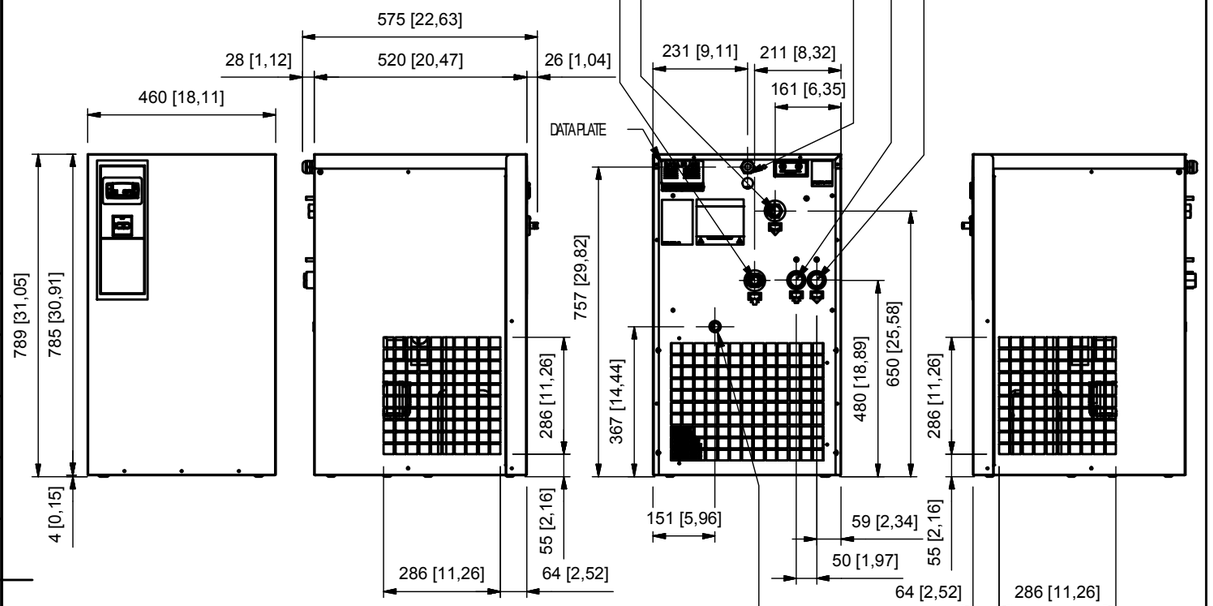
9828443170

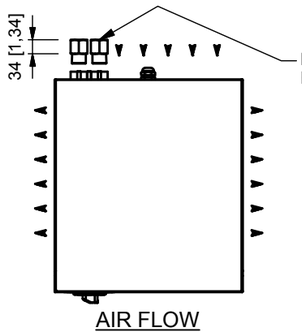
H 2-3

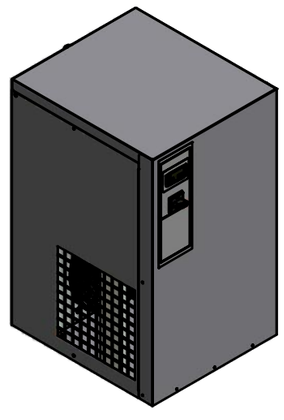
H 3 - ONLY
AIR OUTLET
NPT 3/4 FEMALE
AIR INLET
NPT 3/4 FEMALE

H 2 - ONLY
AIR INLET
NPT 1 FEMALE
(WITH ADAPTORS)
AIR OUTLET
NPT 1 FEMALE

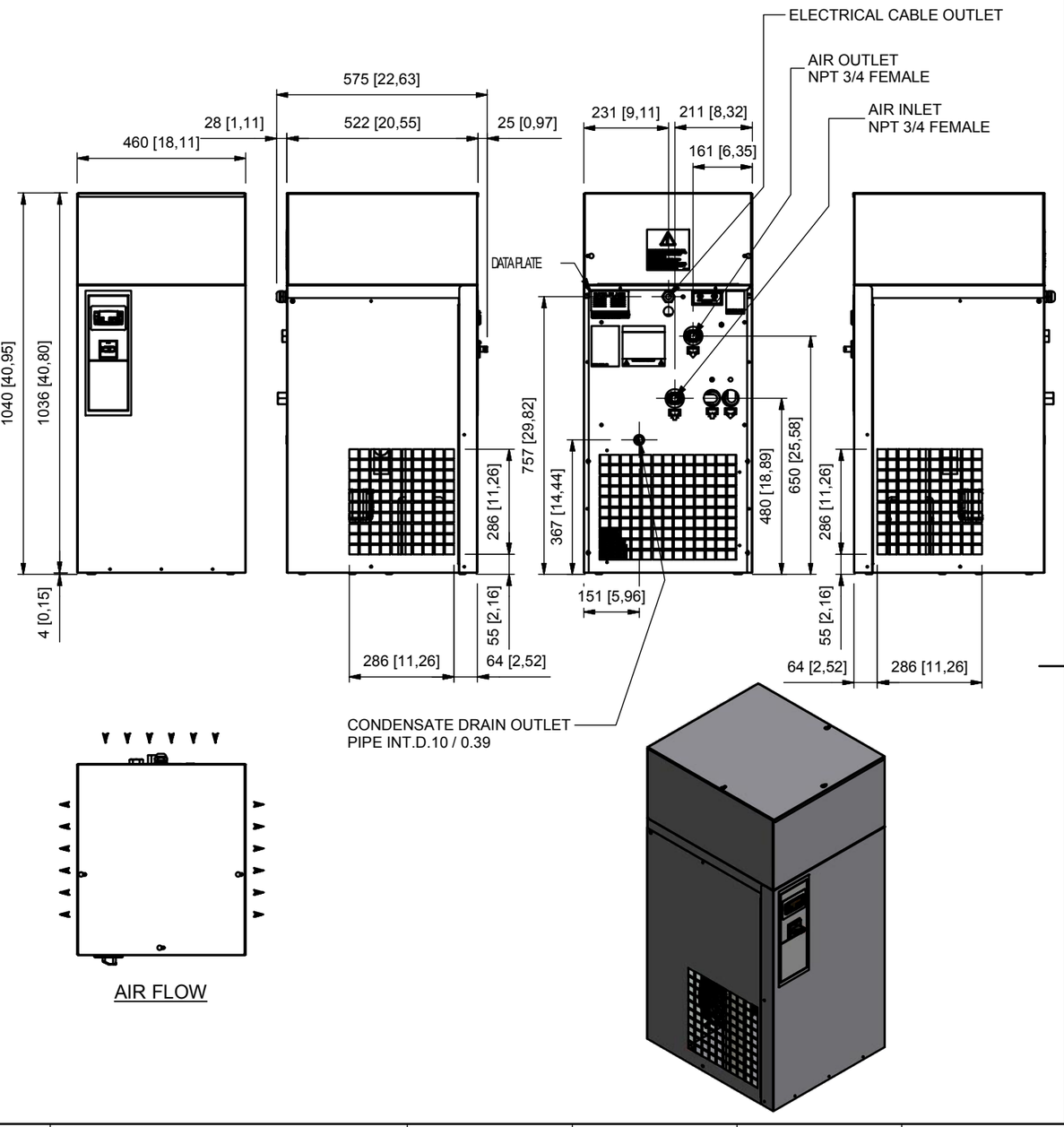
ELECTRICAL CABLE OUTLET







H 4-5



ALL DIMENSIONS: mm [inch]

Toleranties, indien niet aangegeven, zijn volgens: Tolerances, if not indicated, according to:				

01		DIG.CONTROLLER ADDED. CID25679/19-11-14. DN14 0611 49.	2014-11-25	asavio ,	9828499964	01.00
Ed	Posi-tion	Gewijzigd van Modified from	Datum Date	Ingev./Goedg Intr./Appd.	Parent 3D model	Ed . Version 3D

Benaming Name	DIMENS. DRWG	DRYERS HT(H2-5)MB		Geheimh.klasse Secrecy Class	
Materiaal Material	NOT APPLICABLE			1102K/ Confidential	
Behandeling Treatment	Not Applicable			INV	
	Schaal Scale 1:15	Familie Family DRYERS	A3	Vergelijk Compare	Eigenaar Drawing owner
	Getekend Drawn by sgraser	Ruw nr. Blank nr.		Vervangt Replaces	CAI
STATUS	Version Dwg 01.00	Ruw gew. Blank wt 0 Kg	Afg gew. Fini wt. 109.94 Kg	Identificatie/Designation	Blad/Sheet 1 / 1
Approved	Des gez./chd.	Prod gez/chd.	Goedg./Appd.	Datum/Date 2011-11-07	9828499964

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TU5 SERIES TURBIDIMETERS

Applications

- Drinking Water
- Power
- Beverage
- Pharmaceutical

The next standard in the evolution of turbidity

Only the new TU5 Series Lab & Process Turbidimeters with 360° x 90° Detection™ deliver unprecedented confidence that a change in your reading is a change in your water.

Groundbreaking 360° x 90° Detection™ Technology

The TU5 Series employs a patented optical design that sees more of your sample than any other turbidimeter, delivering the best low level precision and sensitivity while minimizing variability from test to test.

Matching lab and online results

For the first time you will be able to remove the uncertainty of which measurement to trust, thanks to identical 360° x 90° Detection™ Technology in both instruments.

Everything about turbidity – faster

The TU5 Series dramatically reduces the time needed to get a turbidity measurement you can rely on, with 98% less online sample surface area to clean, sealed vials for calibration, and the elimination of the need for indexing and silicone oil in the lab. Not to mention, a smaller online sample volume means you will detect events almost immediately.

No surprises

Prognosys™ monitors your TU5 Series online instrument, proactively alerting you to maintenance needs before your measurement becomes questionable. And a Hach Service Agreement protects your investment and helps ensure that you stay in compliance and on budget.

HACH®
Be Right™

Technical Data*

TU5200

Light Source	Class 2 laser product, with embedded 650 nm (EPA) or 850 nm (ISO), max. 1.0 mW Class 2 laser source (complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50)
Range	EPA: 0 to 700 NTU / FNU / TE/F / FTU 0 to 100 mg/L 0 to 175 EBC ISO: 0 to 1000 NTU / FNU / TE/F / FTU 0 to 100 mg/L 0 to 250 EBC
Accuracy	±2 % of reading plus 0.01 NTU from 0 to 40 NTU; ±10 % of reading from 40 to 1000 NTU based on Formazin primary standard (at 25 °C)
Resolution	0.0001 NTU / FNU / TE/F / FTU / EBC / mg/L
Repeatability	<40 NTU: Better than 1% of reading or ±0.002 NTU on Formazin at 25 °C (77 °F), whichever is greater >40 NTU: Better than 3.5% of reading on Formazin at 25 °C (77 °F)
Stray Light	<10 mNTU
Units	NTU, FNU, TE/F, FTU, EBC; mg/L if calibrated with Degrees calibration curve
Operating Temperature Range	10 to 40 °C (50 to 104 °F)
Operating Humidity	80% at 30 °C (non condensing)
Sample Temperature	4 to 70 °C (39 to 158 °F)
Storage Conditions	-30 to 60 °C (-22 to 140 °F)
Power Requirements (Voltage)	100 - 240 VAC
Power Requirements (Hz)	50/60 Hz
Certifications	CE compliant US FDA accession number: 1420493-000 EPA version, 1420492-000 ISO version Complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50) Australian RCM Marking
Dimensions (H x W x D)	195 mm x 409 mm x 278 mm
Weight	5.29 lbs. (2.4 kg)
Warranty	1 year

TU5300 sc / TU5400 sc

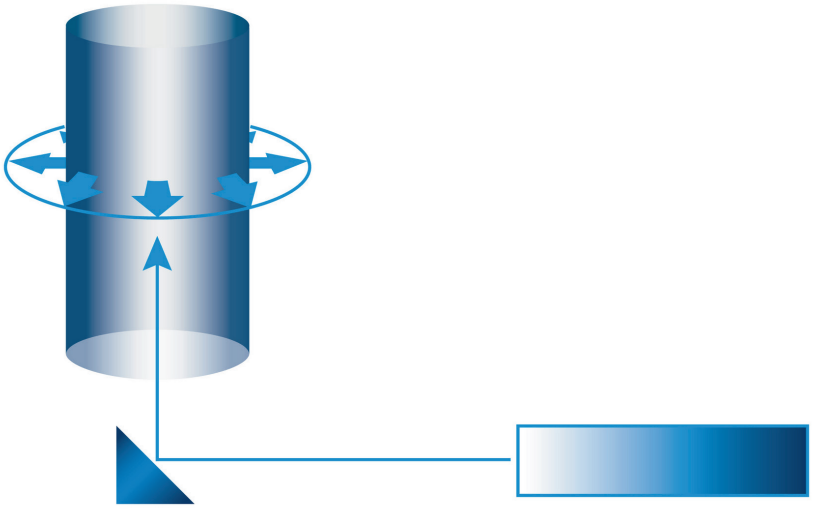
Light Source	Class 2 laser product, with embedded 650 nm (EPA) or 850 nm (ISO), max. 1.0 mW Class 2 laser source (complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50)
Range	EPA: 0 to 700 NTU / FNU / TE/F / FTU 0 to 175 EBC ISO: 0 to 1000 NTU / FNU / TE/F / FTU 0 to 250 EBC
Accuracy	±2% of reading plus 0.01 NTU from 0 to 40 NTU ±10% of reading from 40 to 1000 NTU based on Formazin primary standard
Resolution	0.0001 NTU / FNU / TE/F / FTU / EBC
Repeatability	TU5300 sc: Better than 1% of reading or ±0.002 NTU on Formazin at 25 °C (77 °F), whichever is greater TU5400 sc: Better than 1% of reading or ±0.0006 NTU on Formazin at 25 °C (77 °F), whichever is greater
Stray Light	<10 mNTU
Units	NTU, FNU, TE/F, FTU, EBC
Signal Average Time	5 to 90 seconds (default: 30 seconds)
Response Time	T90<30 seconds at 100 mL/min
Sample Temperature	2 to 60 °C (35 to 140 °F)
Sample Pressure	6 bar (87 psi) maximum, compared to air at sample temperature range from 2 to 40 °C (35.6 to 104 °F)
Sample Flow Rate	100 to 1000 mL/min; optimal flow rate: 200 to 500 mL/min
Operating Temperature Range	0 to 50 °C (32 to 122 °F)
Operating Humidity	Relative humidity: 5 to 95% at different temperatures, non-condensing
Storage Conditions	-40 to 60 °C (-40 to 140 °F)
Certifications	CE compliant US FDA accession number: 1420493-000 EPA version, 1420492-000 ISO version Complies with IEC/EN 60825-1 and to 21 CFR 1040.10 in accordance with Laser Notice No. 50) Australian RCM Marking
Dimensions (H x W x D)	249 mm x 268 mm x 190 mm
Weight	5.95 lbs. (2.7 kg) (11 lbs. (5.0 kg) with all accessories)
Warranty	1 year

**Subject to change without notice.*

Principle of Operation

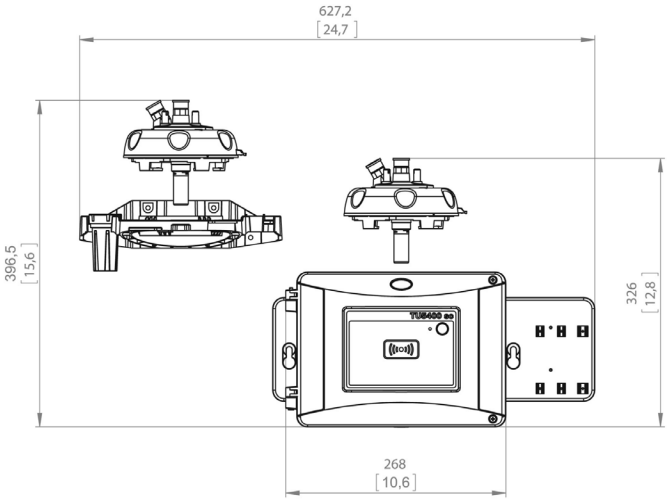
The TU5 Series turbidimeters measure turbidity by directing a laser into a sample to scatter off suspended particles. The light that is scattered at a 90° angle from the incident beam is reflected through a conical mirror in a 360° ring around the sample before it is captured by a detector.

The amount of light scattered is proportional to the turbidity of the sample. If the turbidity of the sample is negligible, little light will be scattered and detected by the photocell and the turbidity reading will be low. High turbidity, on the other hand, will cause a high level of light scattering and result in a high reading.

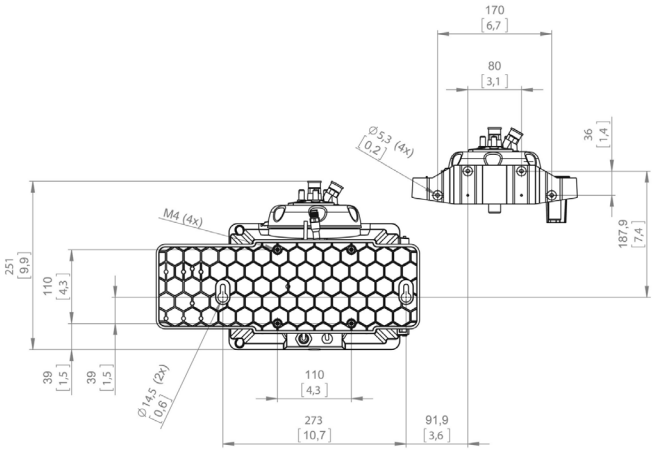


Dimensions

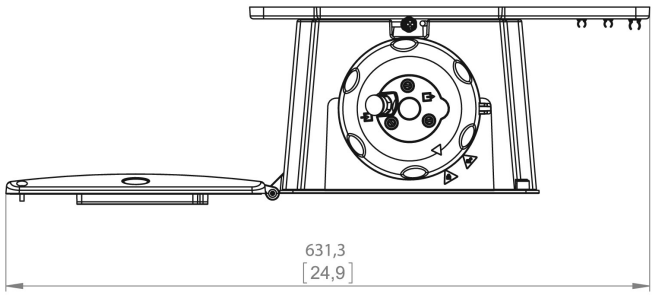
TU5300 sc and TU5400 sc front view



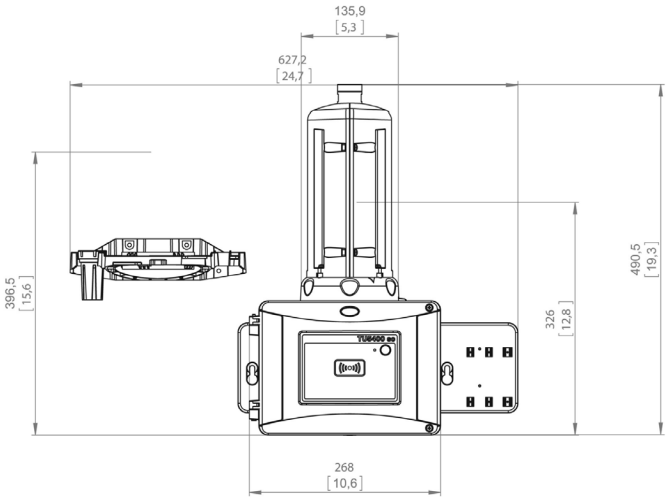
TU5300 sc and TU5400 sc rear view



TU5300 sc and TU5400 sc top view



TU5300 sc and TU5400 sc with automatic cleaning module



Order Information

TU5200 Benchtop Laser Turbidimeters

LPV442.99.01012	TU5200 Benchtop Laser Turbidimeter with System Check, EPA Version
LPV442.99.03012	TU5200 Benchtop Laser Turbidimeter with System Check and RFID, EPA Version

TU5300 sc/TU5400 sc Online Laser Turbidimeters

LXV445.99.10112	TU5300 sc Low Range Laser Turbidimeter, EPA Version
LXV445.99.10212	TU5400 sc Ultra-High Precision Low Range Laser Turbidimeter, EPA Version
LXV445.99.53112	TU5300sc with Flow Sensor, Automatic Cleaning, RFID, and System Check, EPA Version
LXV445.99.53212	TU5400 sc with Flow Sensor, Automatic Cleaning, RFID, and System Check, EPA Version

Please note: Other turbidimeter configurations are available and RFID may not be available in all areas. Please contact your local Hach representative.

Calibration and Verification

LZY835	Stablcal® Calibration Set with RFID
LZY898	Stablcal® Calibration Set without RFID
LZY901	Glass Rod Secondary Turbidity Standard <0.1 NTU/FNU
LZY834	Replacement Vial for TU5300 sc and TU5400 sc
LZV946	Sample Vials for TU5200

TU5 Series Accessories

LQV159.99.00002	Automatic Cleaning Module for TU5300 sc and TU5400 sc
LQV160.99.00002	Flow Sensor for TU5300 sc and TU5400 sc
LZY876	Desiccant Cartridge for TU5300 sc and TU5400 sc
LZY907.97.00002	Maintenance Kit for TU5300 sc and TU5400 sc
LQV157.99.40002	SIP10 Sipper Unit for TU5200
LZY903	Manual Vial Wiper for TU5200, TU5300 sc, and TU5400 sc

Service Options

Start-Up:

Instrument start-up, Basic instrument training to help you learn how to use your instrument from the first day you use it.

Service Agreement:

Hach offers a wide range of agreements for bench or field service to help you maximize your measurement reliability and instrument uptime.

Contact us to learn about what Hach Service option is right for you.

DOC050.53.10053.Jul16

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In the interest of improving and updating its equipment, Hach Company reserves the right to alter specifications to equipment at any time.

HACH®
Be Right™

HACH®
Be Right™

The NEW SC4500 Controller

Ready for Now. Ready for the Future.

Hach® Controllers: Features and Functionality Options		SC200	SC4500	Claros Enabled SC4500 + MSM
Basic Functionality				
Compatible with Hach's Full SC Sensor Portfolio		✓	✓	✓
Analog mA Output to PLC/SCADA		✓	✓	✓
Digital Outputs				
Modbus TCP/IP		✗	✓	✓
Profibus DP		✓	✓	✓
EtherNet/IP		✗	✓	✓
Profinet IO		✗	✓	✓
Sensor Options				
Hach Controller Networking		✗	✓	✓
Embedded Health and Maintenance Alerts		✗	✓	✓
Connected Solutions				
Mobile Sensor Management (MSM)	Remote Visibility & Menu Access	✗	✗	✓
	Maintenance Workflow for Sensors/Analyzers	✗	✗	✓
Remote Service	Compatible w/Instrument Monitoring Partnerships	✗	✗	✓
	Compatible w/ The Plus Program™	✗	✗	✓

Pricing

Item(s)	Part Number	Standard List Price	Limited Time Offer*
Controller only	LXV525.99A1B551	**$3,040**	**$3,040**
Controller + LAN Accessory + MSM	LXV525.99KTO053	**$3,565**	**$3,199**
Controller + Wi-Fi Accessory + MSM	LXV525.99KTO049	**$3,100**	**$2,899**
Controller + Cellular Accessory + Dataplan + MSM	LXV525.99KTO052	**$4,120**	**$2,799** BEST DEAL

*Limited Time Offer valid through 31 December 2021. Included MSM and Dataplan subscriptions are for one year. Included MSM subscriptions are for one sensor.

DOC063.53.30720.Oct21

TI01046D/06/EN/10.21
71535814
2021-09-01

Technical Information
Proline Promag W 400

Electromagnetic flowmeter

Versatile standard flowmeter for the water and wastewater industry

Application

- The bidirectional measuring principle is virtually independent of pressure, density, temperature and viscosity
- Ideal for water measurement, e.g. drinking water, utility water and industrial/municipal wastewater

Device properties
- International drinking water approvals
- Degree of protection IP68 (Type 6P enclosure)
- Approved for custody transfer to MI-001/OIML R49
- Transmitter housing made of durable polycarbonate or aluminum
- WLAN access
- Integrated data logger: measured values monitoring

Your benefits

- Reliable measurement at constant accuracy with 0 x DN run without pressure loss
- Flexible engineering – sensors with fixed flanges or lap joint flanges
- Application suitability – corrosion protection according to EN ISO 12944 for buried or underwater installations
- Improved plant availability – sensor compliant with industry-specific requirements
- Safe operation – no need to open device
- Time-saving local operation without additional software and hardware – integrated web server
- Built-in verification and build-up detection – Heartbeat Technology

Endress+Hauser
People for Process Automation

Endress+Hauser
People for Process Automation

11	6 PC	Promag W 400, 5W4C5H, DN500 20"	
		~~5W4C5H-NFR4/0~~	
		(5W4C5H-C6KLHA0DUA1KGA)	
		EDI-Orderref.:	2002711405-0011
		Electromagnetic flowmeter Inline version. Application: Ideal for water measurement e.g. drinking water, utility water and industrial/municipal wastewater. International drinking water approvals. Installation length: DVGW/ISO conform. Corrosion-resistant transmitter version. Same housing for compact/remote version. :: Versatile standard flowmeter for the water and wastewater industry :: Constant accuracy with 0 x DN inlet	

Endress+Hauser
People for Process Automation

Order code description

C6	Approval: CSA C/US NI Cl.I Div.2 Gr. ABCD
K	Design: Fixed flange, long face-to-face length, 0 x DN inlet/outlet runs
L	Power Supply: 100-240VAC/24VAC/DC
H	Output; Input: 4-20mA HART, pulse/freq., switch output
A	Housing: Compact, alu, coated
0	Cable, Remote Version: Not used
D	Electrical Connection: Thread NPT1/2
U	Liner: Polyurethane
A1K	Process Connection: Cl.150, carbon steel, flange ASME B16.5
G	Electrodes: 1.4435/316L, bullet nose
A	Calibration Flow: 0.5%

Details

Format display	1 value, max. size	
Value 1 display	Volume flow	
Value 2 display	None	
Value 3 display	None	
Value 4 display	None	
Display damping	0.00000	s
Totalizer 1		
Unit		USgal
Operating mode totalizer	Net flow total	
Failure mode	Stop	
Totalizer 2		
Unit		USgal
Operating mode totalizer	Net flow total	
Failure mode	Stop	
Totalizer 3		
Unit		USgal
Operating mode totalizer	Net flow total	
Failure mode	Stop	
Curr. output 1	Volume flow	
Current span	4...20 mA US	
Value 0/4 mA	0.00000	USgal/min
Value 20 mA	7,500.00000	USgal/min
Failsafe mode current output	Max.	
Damping output 1	1.00000	s
Operating mode	Pulse	
Assign pulse output	Volume flow	
Pulse value (per pulse)	75.00000	USgal
Pulse width	100.000	ms
Failsafe mode pulse	No pulses	

-

21	1 PC	Promag W 400, 5W4C4H, DN400 16" 5W4C4H-N0H0/0 (5W4C4H-C6ILHA0DHA1KGA) EDI-Orderref.: 2002711405-0021 Electromagnetic flowmeter Inline version. Application: Ideal for water measurement	

Item	Qty	Product
		e.g. drinking water, utility water and industrial/municipal wastewater. International drinking water approvals. Installation length: DVGW/ISO conform. Corrosion-resistant transmitter version. Same housing for compact/remote version. :: Versatile standard flowmeter for the water and wastewater industry :: Constant accuracy with 0 x DN inlet run and no pressure loss (optional).

Delivery time 8 week(s)

Order code description

C6	Approval: CSA C/US NI Cl.I Div.2 Gr. ABCD
I	Design: Fixed flange, 0 x DN inlet/ outlet runs
L	Power Supply: 100-240VAC/24VAC/DC
H	Output; Input: 4-20mA HART, pulse/freq., switch output
A	Housing: Compact, alu, coated
0	Cable, Remote Version: Not used
D	Electrical Connection: Thread NPT1/2
H	Liner: Hard rubber
A1K	Process Connection: Cl.150, carbon steel, flange ASME B16.5
G	Electrodes: 1.4435/316L, bullet nose
A	Calibration Flow: 0.5%

Details

Format display	1 value, max. size
Value 1 display	Volume flow
Value 2 display	None
Value 3 display	None
Value 4 display	None
Display damping	0.00000 s
Totalizer 1	
Unit	USgal
Operating mode totalizer	Net flow total
Failure mode	Stop
Totalizer 2	
Unit	USgal
Operating mode totalizer	Net flow total
Failure mode	Stop
Totalizer 3	
Unit	USgal
Operating mode totalizer	Net flow total
Failure mode	Stop
Curr. output 1	Volume flow
Current span	4...20 mA US
Value 0/4 mA	0.00000 USgal/min
Value 20 mA	4,800.00000 USgal/min

Item	Qty	Product

Failsafe mode current output	Max.
Damping output 1	1.00000 s
Operating mode	Pulse
Assign pulse output	Volume flow
Pulse value (per pulse)	50.00000 USgal
Pulse width	100.000 ms
Failsafe mode pulse output	No pulses

Net weight: 338.161 pound

Country of origin	Country of dispatch	HS-Code
FR	FR	9026100010

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About this document

Symbols

Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective Earth (PE) A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: ▪ Inner ground terminal: Connects the protectiv earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.

Communication symbols

Symbol	Meaning
	Wireless Local Area Network (WLAN) Communication via a wireless, local network.
	Bluetooth Wireless data transmission between devices over a short distance.
	LED Light emitting diode is off.
	LED Light emitting diode is on.
	LED Light emitting diode is flashing.

Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Preferred Procedures, processes or actions that are preferred.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

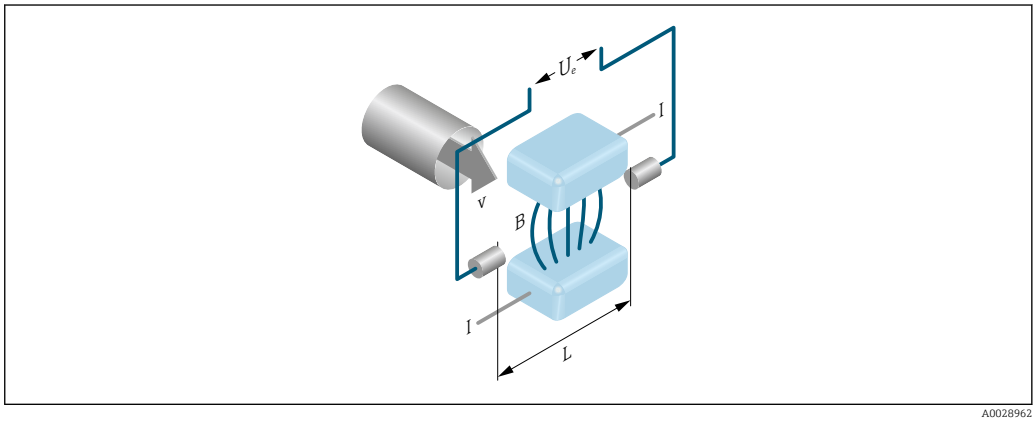
Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
1., 2., 3., ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.



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Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
I *Current*
v *Flow velocity*

In the electromagnetic measuring principle, the flowing medium is the moving conductor. The voltage induced (U_e) is proportional to the flow velocity (v) and is supplied to the amplifier by means of two measuring electrodes. The flow volume (Q) is calculated via the pipe cross-section (A). The DC magnetic field is created through a switched direct current of alternating polarity.

Formulae for calculation

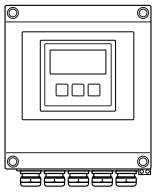
- Induced voltage $U_e = B \cdot L \cdot v$
- Volume flow $Q = A \cdot v$

Measuring system

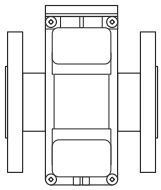
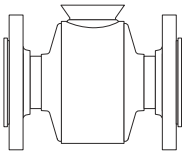
The device consists of a transmitter and a sensor.

Two device versions are available:
- Compact version - transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

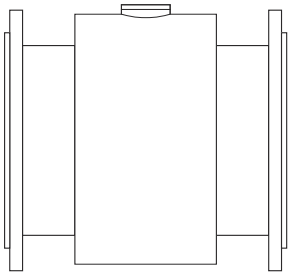
Transmitter

Proline 400
 
A0045222
	Device versions and materials:
	▪ Compact version: compact housing
	  ▪ Polycarbonate plastic
	  ▪ Aluminum, AlSi10Mg, coated
	▪ Remote version: wall-mount housing
	  ▪ Polycarbonate plastic
	  ▪ Aluminum, AlSi10Mg, coated
	
	Configuration:
	▪ External operation via four-line, illuminated local display with touch control and guided menus ("Make-it-run" wizards) for applications
	▪ Via operating tools (e.g. FieldCare)
	▪ Via Web browser (e.g. Microsoft Internet Explorer)
	▪ Also for device version with EtherNet/IP output:
	  ▪ Via Add-on Profile Level 3 for automation system from Rockwell Automation
	  ▪ Via Electronic Data Sheet (EDS)
	▪ Also for device version with PROFIBUS DP output:
	Via PDM driver for Siemens automation system

Sensor

Promag W *Lap joint flange, lap joint flange, stamped plate or fixed flange with aluminum half-shell housing: DN 25 to 300 mm (1 to 12 in)*  A0017040	▪ Nominal diameter range: DN 25 to 3 000 mm (1 to 120 in) ▪ Materials → 🖹 91
Fixed flange with fully welded housing made of carbon steel: DN 25 to 300 mm (1 to 12 in)  A0022673	

Fixed flange with fully welded housing made of carbon steel: DN 350 to 3 000 mm (14 to 120 in)



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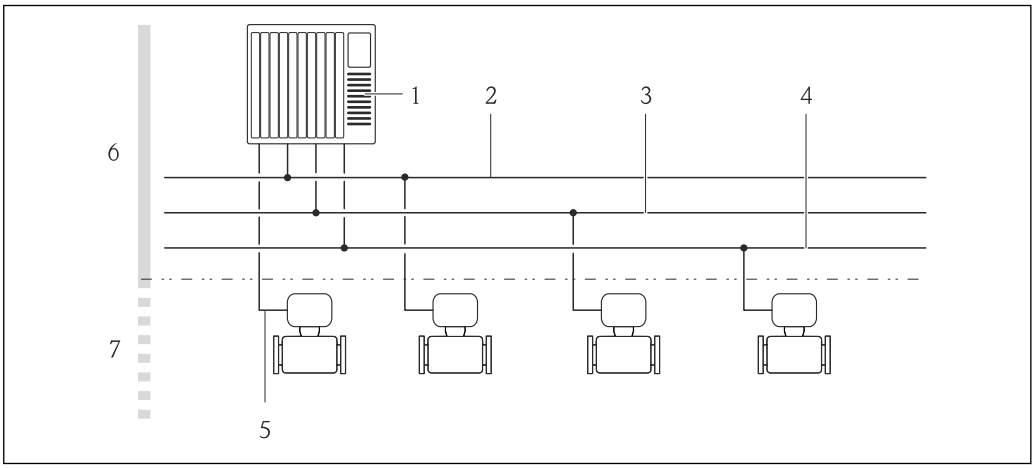
Equipment architecture



A0037833

1 *Possibilities for integrating measuring devices into a system*

1 *Control system (e.g. PLC)*
2 *EtherNet/IP*
3 *PROFIBUS DP*
4 *Modbus RS485*
5 *4 to 20 mA HART, pulse/frequency/switch output*
6 *Non-hazardous area*
7 *Non-hazardous area and Zone 2/Div. 2*

Safety

IT security

Our warranty is valid only if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the device and associated data transfer, must be implemented by the operators themselves in line with their security standards.

Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section.

Protecting access via a password

Different passwords are available to protect write access to the device parameters or access to the device via the WLAN interface.

- User-specific access code
  Protect write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.
- WLAN passphrase
  The network key protects a connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option.

User-specific access code

Write access to the device parameters via the local display or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code.

WLAN passphrase: Operation as WLAN access point

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface, which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter.

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.

Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server. The connection is via the service interface (CDI-RJ45) or the WLAN interface. For device versions with the EtherNet/IP and PROFINET communication protocols, the connection can also be established via the terminal connection for signal transmission with EtherNet/IP or PROFINET (RJ45 plug).

The Web server is enabled when the device is delivered. The Web server can be disabled if necessary (e.g. after commissioning) via the **Web server functionality** parameter.

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.

For detailed information on device parameters, see:
The "Description of Device Parameters" document → 106

Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Electrical conductivity

In custody transfer: only volume flow

Calculated measured variables

Mass flow

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Electrical conductivity: ≥ 5 µS/cm for liquids in general

Flow characteristic values in SI units: DN 25 to 125 mm (1 to 4 in)

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3...10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
25	1	9 to 300	75	0.5	1
32	–	15 to 500	125	1	2

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3...10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
40	1 ½	25 to 700	200	1.5	3
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1 200	10	20
125	–	220 to 7 500	1 850	15	30

Flow characteristic values in SI units: DN 150 to 3 000 mm (6 to 120 in)

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3...10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
150	6	20 to 600	150	0.025	2.5
200	8	35 to 1 100	300	0.05	5
250	10	55 to 1 700	500	0.05	7.5
300	12	80 to 2 400	750	0.1	10
350	14	110 to 3 300	1 000	0.1	15
375	15	140 to 4 200	1 200	0.15	20
400	16	140 to 4 200	1 200	0.15	20
450	18	180 to 5 400	1 500	0.25	25
500	20	220 to 6 600	2 000	0.25	30
600	24	310 to 9 600	2 500	0.3	40
700	28	420 to 13 500	3 500	0.5	50
750	30	480 to 15 000	4 000	0.5	60
800	32	550 to 18 000	4 500	0.75	75
900	36	690 to 22 500	6 000	0.75	100
1000	40	850 to 28 000	7 000	1	125
–	42	950 to 30 000	8 000	1	125
1200	48	1 250 to 40 000	10 000	1.5	150
–	54	1 550 to 50 000	13 000	1.5	200
1400	–	1 700 to 55 000	14 000	2	225
–	60	1 950 to 60 000	16 000	2	250
1600	–	2 200 to 70 000	18 000	2.5	300
–	66	2 500 to 80 000	20 500	2.5	325
1800	72	2 800 to 90 000	23 000	3	350
–	78	3 300 to 100 000	28 500	3.5	450
2000	–	3 400 to 110 000	28 500	3.5	450

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3...10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
–	84	3700 to 125000	31000	4.5	500
2200	–	4100 to 136000	34000	4.5	540
–	90	4300 to 143000	36000	5	570
2400	–	4800 to 162000	40000	5.5	650
–	96	5000 to 168000	42000	6	675
–	102	5700 to 190000	47500	7	750
2600	–	5700 to 191000	48000	7	775
–	108	6500 to 210000	55000	7	850
2800	–	6700 to 222000	55500	8	875
–	114	7100 to 237000	59500	8	950
3000	–	7600 to 254000	63500	9	1025
–	120	7900 to 263000	65500	9	1050

Flow characteristic values in SI units: DN 50 to 200 mm (2 to 8 in) for order code for "Design", option C "Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs"

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.12...5 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 4 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.01 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
50	2	15 to 600	300	1.25	1.25
65	–	25 to 1000	500	2	2
80	3	35 to 1500	750	3	3.25
100	4	60 to 2400	1200	5	4.75
125	–	90 to 3700	1850	8	7.5
150	6	145 to 5400	2500	10	11
200	8	220 to 9400	5000	20	19

Flow characteristic values in SI units: DN 250 to 300 mm (10 to 12 in) for order code for "Design", option C "Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs"

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.12...5 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 4 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.01 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
250	10	20 to 850	500	0.03	1.75
300	12	35 to 1300	750	0.05	2.75

Flow characteristic values in US units: DN 1 to 48 in (25 to 1200 mm)

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3...10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
1	25	2.5 to 80	18	0.2	0.25
–	32	4 to 130	30	0.2	0.5
1 ½	40	7 to 185	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
–	65	16 to 500	130	1	2
3	80	24 to 800	200	2	2.5
4	100	40 to 1250	300	2	4
–	125	60 to 1950	450	5	7
6	150	90 to 2650	600	5	12
8	200	155 to 4850	1200	10	15
10	250	250 to 7500	1500	15	30
12	300	350 to 10600	2400	25	45
14	350	500 to 15000	3600	30	60
15	375	600 to 19000	4800	50	60
16	400	600 to 19000	4800	50	60
18	450	800 to 24000	6000	50	90
20	500	1000 to 30000	7500	75	120
24	600	1400 to 44000	10500	100	180
28	700	1900 to 60000	13500	125	210
30	750	2150 to 67000	16500	150	270
32	800	2450 to 80000	19500	200	300
36	900	3100 to 100000	24000	225	360
40	1000	3800 to 125000	30000	250	480
42	–	4200 to 135000	33000	250	600
48	1200	5500 to 175000	42000	400	600

Flow characteristic values in US units: DN 54 to 120 in (1400 to 3000 mm)

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3...10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[Mgal/d]	[Mgal/d]	[Mgal]	[Mgal/d]
54	–	9 to 300	75	0.0005	1.3
–	1400	10 to 340	85	0.0005	1.3
60	–	12 to 380	95	0.0005	1.3
–	1600	13 to 450	110	0.0008	1.7
66	–	14 to 500	120	0.0008	2.2
72	1800	16 to 570	140	0.0008	2.6

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3...10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[Mgal/d]	[Mgal/d]	[Mgal]	[Mgal/d]
78	–	18 to 650	175	0.0010	3.0
–	2000	20 to 700	175	0.0010	2.9
84	–	24 to 800	190	0.0011	3.2
–	2200	26 to 870	210	0.0012	3.4
90	–	27 to 910	220	0.0013	3.6
–	2400	31 to 1 030	245	0.0014	4.0
96	–	32 to 1 066	265	0.0015	4.0
102	–	34 to 1 203	300	0.0017	5.0
–	2600	34 to 1 212	305	0.0018	5.0
108	–	35 to 1 300	340	0.0020	5.0
–	2800	42 to 1 405	350	0.0020	6.0
114	–	45 to 1 503	375	0.0022	6.0
–	3000	48 to 1 613	405	0.0023	6.0
120	–	50 to 1 665	415	0.0024	7.0

Flow characteristic values in US units: DN 2 to 12 in (50 to 300 mm) for order code for "Design", option C "Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs"

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.12...5 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 4 Pulse/s at v ~ 2.5 m/s)	Low flow cut off (v ~ 0.01 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
2	50	4 to 160	75	0.3	0.35
–	65	7 to 260	130	0.5	0.6
3	80	10 to 400	200	0.8	0.8
4	100	16 to 650	300	1.2	1.25
–	125	24 to 1 000	450	1.8	2
6	150	40 to 1 400	600	2.5	3
8	200	60 to 2 500	1 200	5	5
10	250	90 to 3 700	1 500	6	8
12	300	155 to 5 700	2 400	9	12

Recommended measuring range

Flow limit → 52

For custody transfer, the applicable approval determines the permitted measuring range, the pulse value and the low flow cut off.

Operable flow range

Over 1000 : 1

For custody transfer, the operable flow range is 100 : 1 to 630 : 1, depending on the nominal diameter. Further details are specified by the applicable approval.

Input signal

External measured values

Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section → 105

It is recommended to read in external measured values to calculate the following measured variables: Mass flow

HART protocol

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:
- HART protocol
- Burst mode

Digital communication

The measured values can be written from the automation system to the measuring via:
- PROFIBUS DP
- Modbus RS485
- EtherNet/IP

Status input

Maximum input values	▪ DC 30 V ▪ 6 mA
Response time	Configurable: 5 to 200 ms
Input signal level	▪ Low signal (low): DC −3 to +5 V ▪ High signal (high): DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset totalizers 1-3 separately ▪ Reset all totalizers ▪ Flow override

Output

Output signal

Current output

Current output	Can be set as: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA HART ▪ 0 to 20 mA
Maximum output values	▪ DC 24 V (no flow) ▪ 22.5 mA
Load	0 to 700 Ω
Resolution	0.5 µA

Damping	Configurable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity [1] ▪ Corrected conductivity [1] ▪ Temperature [1] ▪ Electronics temperature ▪ Reference electrode potential [1] ▪ Coil current rise time [1] ▪ Noise [1] ▪ Build-up measured value [1] ▪ Test points 1-3

1) Visible depending on order options or device settings

Pulse/frequency/switch output

Function	▪ With the order code for "Output; Input", option **H**: output 2 can be set as a pulse or frequency output ▪ With the order code for "Output; Input", option **I**: output 2 and 3 can be set as a pulse, frequency or switch output ▪ With the order code for "Output; Input", option **J**: output 2 firmly assigned as certified pulse output
Version	Passive, open collector
Maximum input values	▪ DC 30 V ▪ 250 mA
Voltage drop	At 25 mA: ≤ DC 2 V
Pulse output	
Pulse width	Configurable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Configurable
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow
Frequency output	
Output frequency	Configurable: 0 to 12 500 Hz
Damping	Configurable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity [1] ▪ Corrected conductivity [1] ▪ Temperature [1] ▪ Electronics temperature ▪ Noise [1] ▪ Coil current rise time [1] ▪ Reference electrode potential [1] ▪ Build-up measured value [1] ▪ Test points 1-3
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s

Number of switching cycles	Unlimited

Assignable functions	▪ Off
	▪ On
	▪ Diagnostic behavior
	▪ Limit value:
	  ▪ Off
	  ▪ Volume flow
	  ▪ Corrected volume flow
	  ▪ Mass flow
	  ▪ Flow velocity
	  ▪ Conductivity [1)]
	  ▪ Corrected conductivity [1)]
	  ▪ Totalizer 1-3
	  ▪ Temperature [1)]
	  ▪ Electronics temperature
	▪ Flow direction monitoring
	▪ Status:
	  ▪ Empty pipe detection
	  ▪ Low flow cut off
	  ▪ Build-up limit value [1)]

1) Visible depending on order options or device settings

PROFIBUS DP

Signal encoding	NRZ code
Data transmission	9.6 kBaud...12 MBaud

Modbus RS485

Physical interface	In accordance with EIA/TIA-485-A standard
Terminating resistor	Integrated, can be activated via DIP switch on the transmitter electronics module

EtherNet/IP

Standards	In accordance with IEEE 802.3

Signal on alarm

Depending on the interface, failure information is displayed as follows:

Current output 4 to 20 mA

4 to 20 mA

Failure mode	Choose from: ▪ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ▪ 4 to 20 mA in accordance with US ▪ Min. value: 3.59 mA ▪ Max. value: 22.5 mA ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 22.5 mA

HART current output

Device diagnostics	Device condition can be read out via HART Command 48

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value: 0 to 12 500 Hz
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02

Modbus RS485

Failure mode	Choose from: ▪ NaN value instead of current value ▪ Last valid value

EtherNet/IP

Device diagnostics	Device condition can be read out in Input Assembly

Local display

Plain text display	With information on cause and remedial measures
Backlight	Red backlighting indicates a device error.

Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
  - HART protocol
  - PROFIBUS DP
  - Modbus RS485
  - EtherNet/IP
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation → 95

Web browser

Plain text display	With information on cause and remedial measures

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred ▪ EtherNet/IP network available ▪ EtherNet/IP connection established

Low flow cut off

The switch points for low flow cut off are user-selectable.

Galvanic isolation

The following connections are galvanically isolated from each other:
- Inputs
- Outputs
- Power supply

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x1169
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω
Dynamic variables PV, SV, TV, QV	▪ Read out the dynamic variables via HART command 3 ▪ The measured variables can be freely assigned to the dynamic variables
Device variables	▪ Read out the device variables via HART command 9 ▪ The measured variables can be freely assigned ▪ A maximum of 8 device variables can be transmitted
System integration	Operating Instructions for the device → 106

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x1562
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.profibus.org
Output values	Output values (from the measuring device to the automation system) ▪ 4 Analog input ▪ 2 Digital input ▪ 3 Totalizer

Input values	Input values (from the automation system to the measuring device) ▪ 2 Analog output (fixed assignment) ▪ 2 Digital output (fixed assignment) ▪ 3 Totalizer
Device address configuration options	Configuration of the device address ▪ Hardware: DIP switches on the I/O electronics module ▪ Software: Via operating tools (e.g. FieldCare)
Supported functions	▪ Identification & Maintenance: Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download: Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status: Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
System integration	Operating Instructions for the device → 🖹 106

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 1200 BAUD ▪ 2400 BAUD ▪ 4800 BAUD ▪ 9600 BAUD ▪ 19200 BAUD ▪ 38400 BAUD ▪ 57600 BAUD ▪ 115200 BAUD
Modus data transmission	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For detailed information on the "Modbus RS485 register information", see the Description of Device Parameters → 🖹 106
System integration	Operating Instructions for the device → 🖹 106

EtherNet/IP

Protocol	▪ The CIP Networks Library Volume 1: Common Industrial Protocol ▪ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP
Communication type	▪ 10Base-T ▪ 100Base-TX
Device profile	Generic device (product type: 0x2B)
Manufacturer ID	0x49E

Device type ID	0x1069
Baud rates	Automatic 10/100 Mbit with half-duplex and full-duplex detection
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Supported CIP connections	Max. 3 connections
Explicit connections	Max. 5 connections
I/O connections	Max. 6 connections (scanner)
Configuration options for measuring device	Configuration options for measuring device ▪ DIP switches on the electronics module for IP addressing ▪ Manufacturer-specific software (FieldCare) ▪ Custom Add-on Profile for Rockwell Automation control systems ▪ Web browser ▪ Electronic Data Sheet (EDS) integrated in the measuring device
EtherNet interface configuration options	Configuration of the EtherNet interface ▪ Speed: 10 MBit, 100 MBit, auto (factory setting) ▪ Duplex: half-duplex, full-duplex, auto (factory setting)
Device address configuration options	Configuration of the device address ▪ DIP switches on the electronics module for IP addressing (last octet) ▪ DHCP ▪ Manufacturer-specific software (FieldCare) ▪ Custom Add-on Profile for Rockwell Automation control systems ▪ Web browser ▪ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation)
Device Level Ring (DLR)	No
Assembly	▪ Legacy Input Assembly Fix (Assem 100) ▪ Legacy Input Assembly Configurable (Assem 101) ▪ Legacy Output Assembly Fix (Assem 102) ▪ Legacy Configuration Assembly (Assem 104) ▪ Input Assembly Fix (Assem 120) ▪ Input Assembly Configurable (Assem 121) ▪ Output Assembly Fix (Assem 122) ▪ Configuration Assembly (Assem 124) ▪ Volume Flow Extended Fix Input (Assem 126) ▪ Volume Flow Universal Fix Input (Assem 127) ▪ Dummy Output Assembly Fix (Assem 199)
Requested Packet Interval (RPI)	5 ms to 10 s (factory setting: 20 ms)
System integration	Operating Instructions for the device → 🖹 106

Power supply

Terminal assignment

Transmitter: 0 to 20 mA/4 to 20 mA HART

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	**Power supply**	
Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option **L** (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	−15 to +10%	50/60 Hz, ±4 Hz

Signal transmission with current output 0 to 20 mA/4 to 20 mA HART and other outputs and inputs

Order code for "Output" and "Input"	Terminal numbers							
	Output 1		Output 2		Output 3		Input	
	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)
Option **H**	Current output ▪ 4 to 20 mA HART (active) ▪ 0 to 20 mA (active)		Pulse/frequency output (passive)		Switch output (passive)		-	
Option **I**	Current output ▪ 4 to 20 mA HART (active) ▪ 0 to 20 mA (active)		Pulse/frequency/ switch output (passive)		Pulse/frequency/ switch output (passive)		Status input	
Option **J**	Current output ▪ 4 to 20 mA HART (active) ▪ 0 to 20 mA (active)		Fixed assignment: Certified pulse output (passive)		Switch output		Status input	

Transmitter: PROFIBUS DP

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option **L** (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	−15 to +10%	50/60 Hz, ±4 Hz

PROFIBUS DP signal transmission

Order code for "Output" and "Input"	Terminal numbers	
	26 (RxD/TxD-P)	27 (RxD/TxD-N)
Option **L**	B	A
Order code for "Output": Option L: PROFIBUS DP, for use in non-hazardous areas and Zone 2/Div. 2		

Transmitter: Modbus RS485

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	**Power supply**	
Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option **L** (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	−15 to +10%	50/60 Hz, ±4 Hz

Signal transmission with Modbus RS485 and other outputs

Order code for "Output" and "Input"	Terminal numbers							
	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)
Option **M**	Modbus		-		-		-	
	B	A						
Option **O**	Current output 4 to 20 mA (active)		Pulse/frequency/ switch output (passive)		Pulse/frequency/ switch output (passive)		Modbus	
							B	A
Option **P**	Current output 4 to 20 mA (active)		Pulse output certified (passive)		Pulse/frequency/ switch output (passive)		Modbus	
							B	A

Transmitter: EtherNet/IP

The transmitter can be ordered with terminals or a device plug.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	**Power supply**	
EtherNet/IP (RJ45 plug)	Terminals	Option **D**: thread NPT ½"
Device plug → 🖹 22	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20

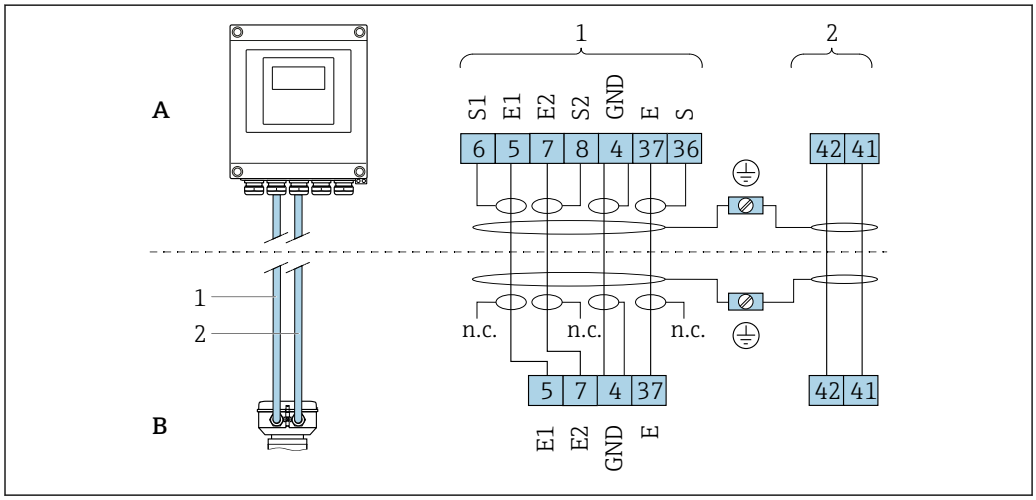
Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option **L** (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	−15 to +10%	50/60 Hz, ±4 Hz

EtherNet/IP signal transmission

Order code for "Output"	Connection via
Option **N**	EtherNet/IP: RJ45 or M12 plug

Remote version



2 *Remote version terminal assignment*

A Transmitter wall-mount housing
B Sensor connection housing
1 Electrode cable
2 Coil current cable
n.c. Not connected, insulated cable shields

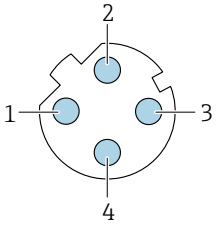
Terminal No. and cable colors: 6/5 = brown; 7/8 = white; 4 = green; 36/37 = yellow

Pin assignment, device plug

Order codes for the M12x1 plugs, see the "Order code for electrical connection" column: EtherNet/IP → 21

EtherNet/IP

Device plug for signal transmission (device side)



Pin		Assignment	Coding	Plug/socket
1	+	Tx	D	Socket
2	+	Rx		
3	-	Tx		
4	-	Rx		

Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q
- The device plug is not permitted in the hazardous area, Class I Division 2. The device plug may only be used in the non-hazardous area (General Purpose).

Supply voltage

Transmitter

Order code for "Power supply"	terminal voltage		Frequency range
Option **L**	DC 24 V	±25%	–
	AC 24 V	±25%	50/60 Hz, ±4 Hz
	AC 100 to 240 V	−15 to +10%	50/60 Hz, ±4 Hz

Power consumption

Order code for "Output"	Maximum power consumption
Option **H**: 4-20mA HART, pulse/frequency output, switch output	30 VA/8 W
Option **I**: 4-20mA HART, 2 x pulse/frequency/switch output, status input	30 VA/8 W
Option **J**: 4-20mA HART, certified pulse output, switch output, status input	30 VA/8 W
Option **L**: PROFIBUS DP	30 VA/8 W
Option **M**: Modbus RS485	30 VA/8 W
Option **O**: Modbus RS485, 4-20mA, 2 x pulse/ frequency/switch output	30 VA/8 W
Option **P**: Modbus RS485, 4-20mA, certified pulse output, pulse/frequency/switch output	30 VA/8 W
Option **N**: EtherNet/IP	30 VA/8 W

Current consumption

Transmitter

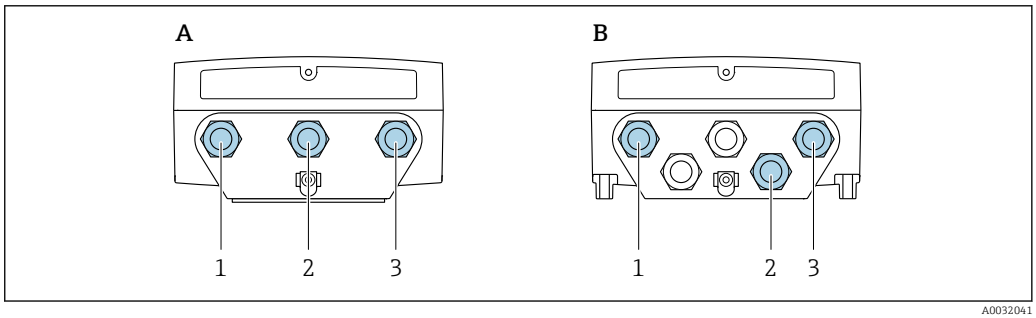
Order code for "Power supply"	Maximum Current consumption	Maximum switch-on current
Option **L**: AC 100 to 240 V	145 mA	25 A (< 5 ms)
Option **L**: AC/DC 24 V	350 mA	27 A (< 5 ms)

Power supply failure

- Totalizers stop at the last value measured.
- Depending on the device version, the configuration is retained in the device memoryor in the pluggable data memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Connecting the transmitter

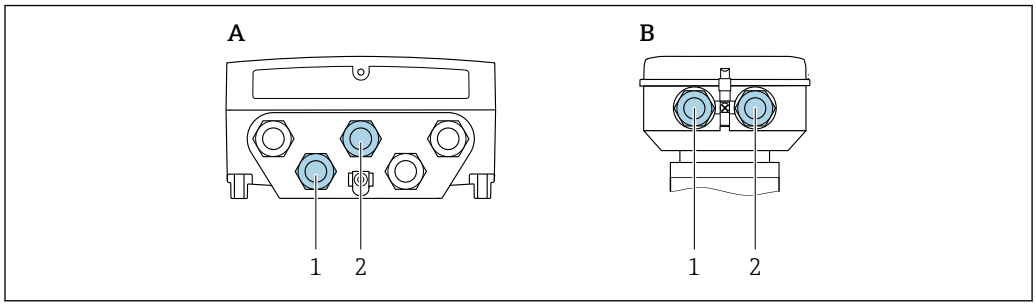


3 Supply voltage and signal transmission connection

A Compact version
B Remote version wall-mount housing
1 Cable entry for supply voltage
2 Cable entry for signal transmission
3 Cable entry for signal transmission

Remote version connection

Connecting cable



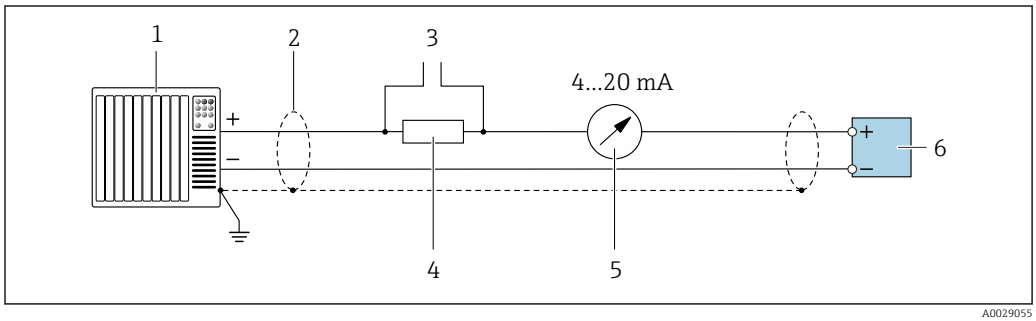
4 Connecting cable connection: electrode and coil current cable

A Transmitter wall-mount housing
B Sensor connection housing
1 Electrode cable
2 Coil current cable

- Fix the cable run or route it in an armored conduit.
  Cable movements can influence the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between the sensor and transmitter → 27.

Connection examples

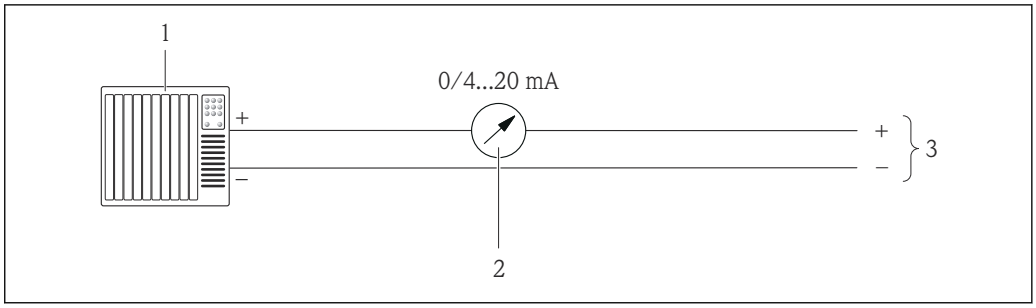
Current output 4 to 20 mA HART



5 Connection example for 4 to 20 mA HART current output (active)

1 Automation system with current input (e.g. PLC)
2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 31
3 Connection for HART operating devices → 95
4 Resistor for HART communication (≥ 250 Ω): observe maximum load → 13
5 Analog display unit: observe maximum load → 13
6 Transmitter

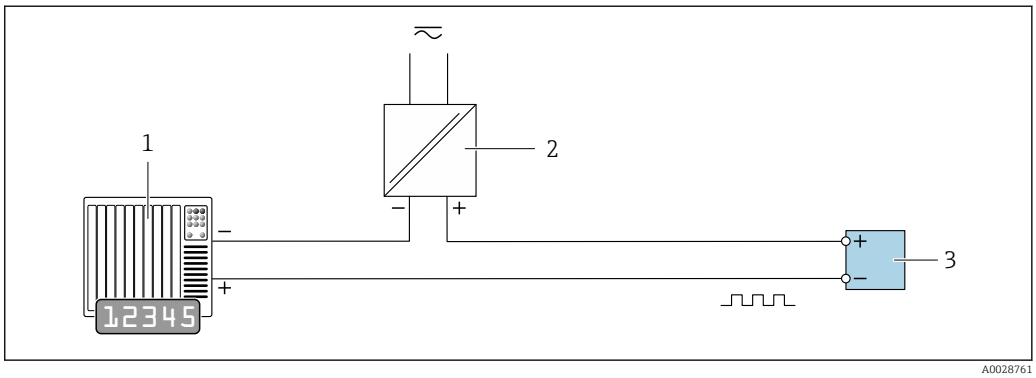
Current output 4 to 20 mA



6 Connection example for 0 to 20 mA (active) and 4 to 20 mA (active) current output

1 Automation system with current input (e.g. PLC)
2 Analog display unit: observe maximum load
3 Transmitter

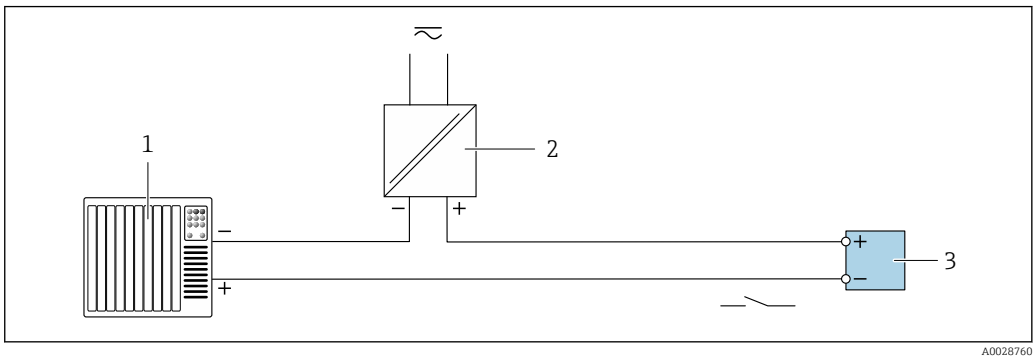
Pulse/frequency output



7 Connection example for pulse/frequency output (passive)

1 Automation system with pulse/frequency input (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values → 14

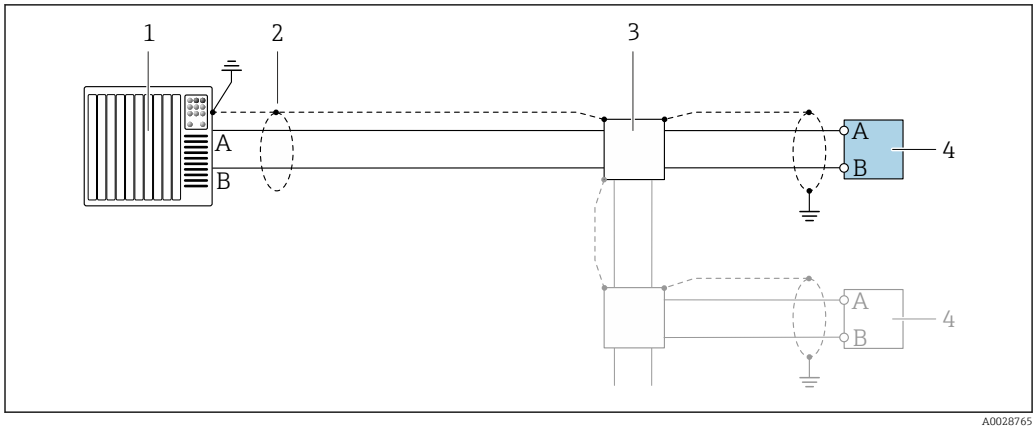
Switch output



8 Connection example for switch output (passive)

1 Automation system with switch input (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values → 14

PROFIBUS DP

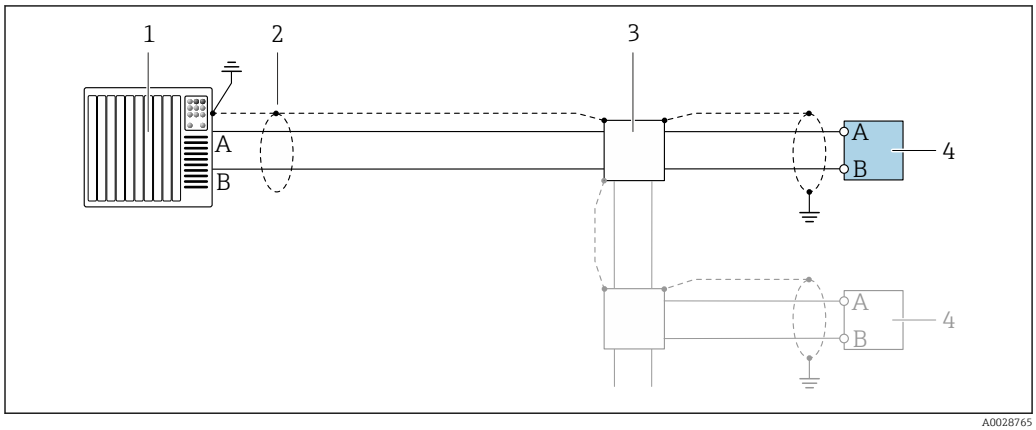


9 Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2

1 Control system (e.g. PLC)
2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
3 Distribution box
4 Transmitter

If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

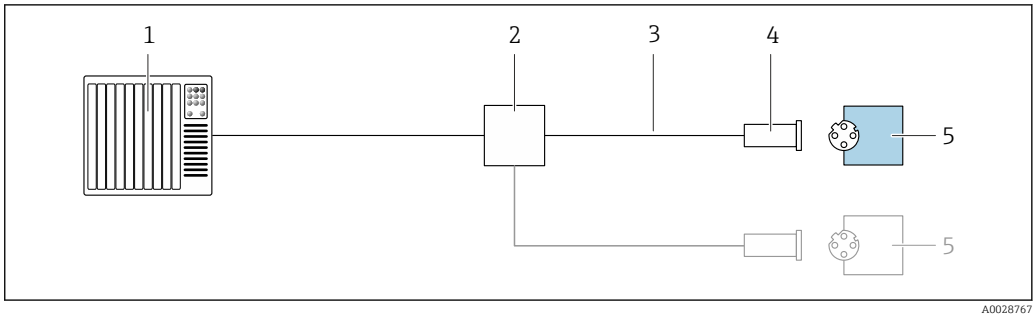
Modbus RS485



10 Connection example for Modbus RS485, non-hazardous area and Zone 2/Div. 2

1 Control system (e.g. PLC)
2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
3 Distribution box
4 Transmitter

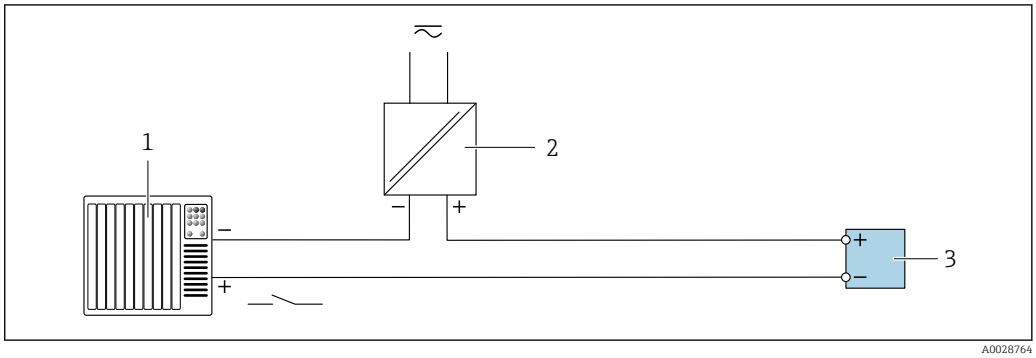
EtherNet/IP



11 Connection example for EtherNet/IP

1 Control system (e.g. PLC)
2 Ethernet switch
3 Observe cable specifications
4 Device plug
5 Transmitter

Status input



12 Connection example for status input

1 Automation system with status output (e.g. PLC)
2 Power supply
3 Transmitter

Potential equalization

Introduction

Correct potential equalization (equipotential bonding) is a prerequisite for stable and reliable flow measurement. Inadequate or incorrect potential equalization can result in device failure and present a safety hazard.

The following requirements must be observed to ensure correct, trouble-free measurement:
- The principle that the medium, the sensor and the transmitter must be at the same electrical potential applies.
- Take in-company grounding guidelines, materials and the grounding conditions and potential conditions of the pipe into consideration.
- Any necessary potential equalization connections must be established by ground cables with a minimum cross-section of 6 mm^2 (0.0093 in^2).
- For remote device versions, the ground terminal in the example always refers to the sensor and not to the transmitter.

You can order accessories like ground cables and ground disks from Endress+Hauser → 103

For devices intended for use in hazardous locations, observe the instructions in the Ex documentation (XA).

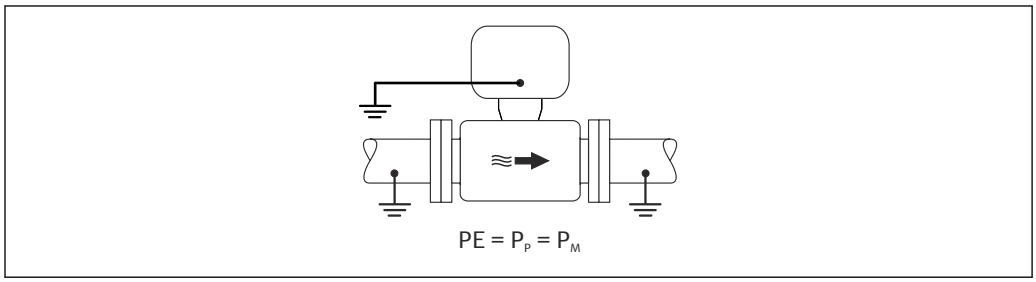
Abbreviations used
- PE (Protective Earth): potential at the protective earth terminals of the device
- P_P (Potential Pipe): potential of the pipe, measured at the flanges
- P_M (Potential Medium): potential of the medium

Connection examples for standard situations

Unlined and grounded metal pipe

- Potential equalization is via the measuring pipe.
- The medium is set to ground potential.

Starting conditions:
- Pipes are correctly grounded on both sides.
- Pipes are conductive and at the same electrical potential as the medium



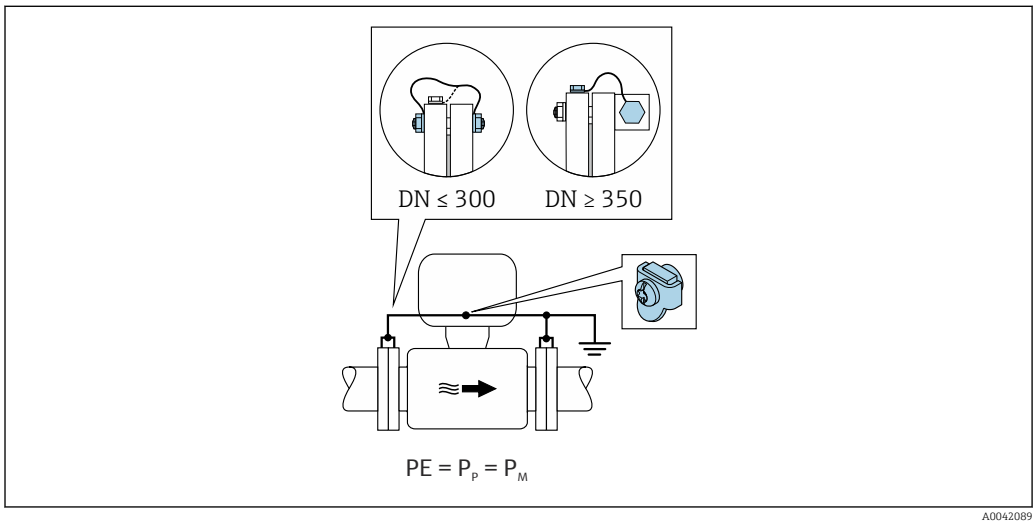
A0044854

▶ Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

Unlined metal pipe

- Potential equalization is via the ground terminal and pipe flanges.
- The medium is set to ground potential.

Starting conditions:
- Pipes are not sufficiently grounded.
- Pipes are conductive and at the same electrical potential as the medium



A0042089

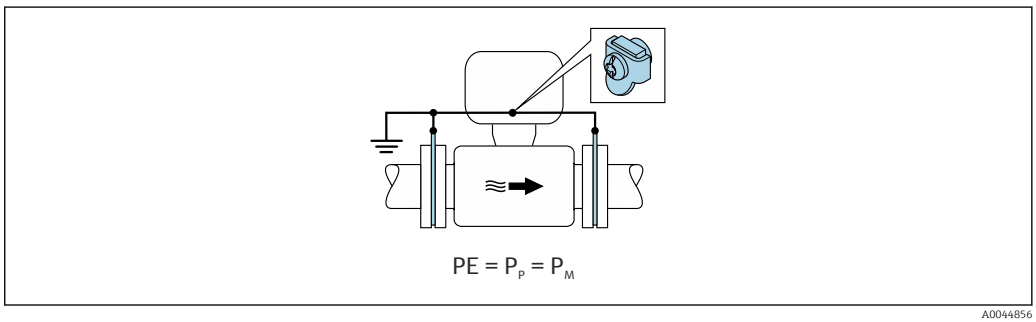
1. Connect both sensor flanges to the pipe flange via a ground cable and ground them.
2. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

- For DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
- For DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket. Observe screw tightening torques: see the Brief Operating Instructions for the sensor.

Plastic pipe or pipe with insulating liner

- Potential equalization is via the ground terminal and ground disks.
- The medium is set to ground potential.

Starting conditions:
- The pipe has an insulating effect.
- Low-impedance medium grounding close to the sensor is not guaranteed.
- Equalizing currents through the medium cannot be ruled out.



A0044856

1. Connect the ground disks to the ground terminal of the connection housing of the transmitter or sensor via the ground cable.
2. Connect the connection to ground potential.

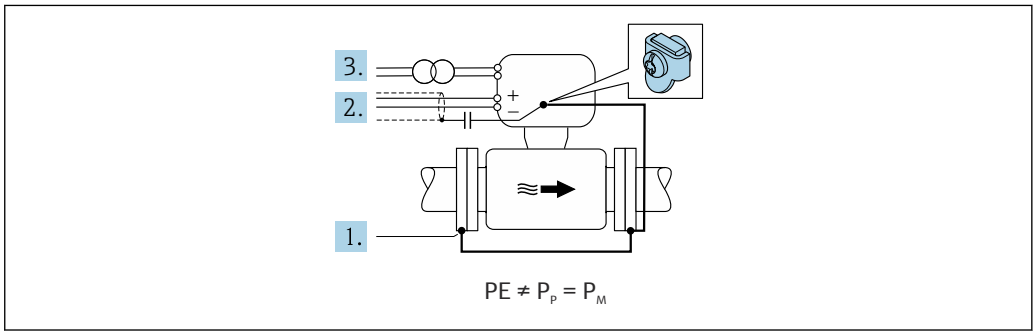
Connection example with the potential of the medium not equal to the protective ground

In these cases, the medium potential can differ from the potential of the device.

Metal, ungrounded pipe

The sensor and transmitter are installed in a way that provides electrical insulation from PE, e.g. applications for electrolytic processes or systems with cathodic protection.

Starting conditions:
- Unlined metal pipe
- Pipes with an electrically conductive liner



A0042253

1. Connect the pipe flanges and transmitter via the ground cable.
2. Route the shielding of the signal lines via a capacitor (recommended value 1.5µF/50V).
3. Device connected to power supply such that it is floating in relation to the protective earth (isolation transformer). This measure is not required in the case of 24V DC supply voltage without PE (= SELV power unit).

Connection examples with the potential of medium not equal to protective earth with the "Measurement isolated from ground" option

In these cases, the medium potential can differ from the potential of the device.

Introduction

The "Measurement isolated from ground" option enables the galvanic isolation of the measuring system from the device potential. This minimizes harmful equalizing currents caused by differences

in potential between the medium and the device. The "Measurement isolated from ground" option is optionally available: order code for "Sensor option", option CV

Operating conditions for the use of the "Measurement isolated from ground" option

Device version	Compact version and remote version (length of connecting cable ≤ 10 m)
Differences in voltage between medium potential and device potential	As small as possible, usually in the mV range
Alternating voltage frequencies in the medium or at ground potential (PE)	Below typical power line frequency in the country

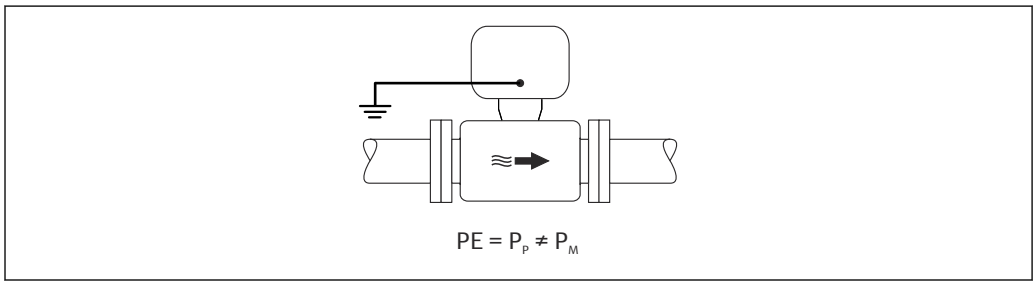
To achieve the specified conductivity measuring accuracy, a conductivity calibration is recommended when the device is installed.

A full pipe adjustment is recommended when the device is installed.

Plastic pipe

Sensor and transmitter are correctly grounded. A difference in potential can occur between the medium and protective earth. Potential equalization between P_M and PE via the reference electrode is minimized with the "Measurement isolated from ground" option.

Starting conditions:
- The pipe has an insulating effect.
- Equalizing currents through the medium cannot be ruled out.



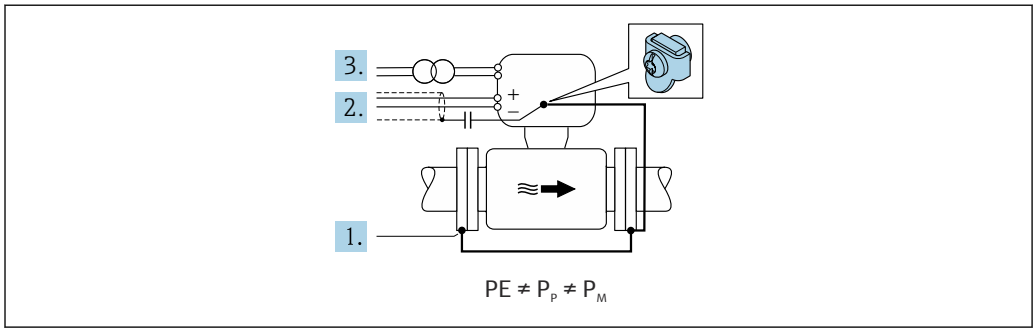
A0044855

1. Use the "Measurement isolated from ground" option, while observing the operating conditions for measurement isolated from ground.
2. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for this purpose.

Metal, ungrounded pipe with insulating liner

The sensor and transmitter are installed in a way that provides electrical insulation from PE. The medium and pipe have different potentials. The "Measurement isolated from ground" option minimizes harmful equalizing currents between P_M and P_P via the reference electrode.

Starting conditions:
- Metal pipe with insulating liner
- Equalizing currents through the medium cannot be ruled out.



A0044857

1. Connect the pipe flanges and transmitter via the ground cable.
2. Route the shielding of the signal cables via a capacitor (recommended value 1.5µF/50V).
3. Device connected to power supply such that it is floating in relation to the protective earth (isolation transformer). This measure is not required in the case of 24V DC supply voltage without PE (= SELV power unit).
4. Use the "Measurement isolated from ground" option, while observing the operating conditions for measurement isolated from ground.

Terminals

Transmitter
- Supply voltage cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Signal cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Electrode cable: spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Coil current cable: spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Sensor connection housing
Spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entries

Cable entry thread
- M20 x 1.5
- Via adapter:
  - NPT ½"
  - G ½"

Cable gland
- For standard cable: M20 × 1.5 with cable Φ 6 to 12 mm (0.24 to 0.47 in)
- For armored cable: M20 × 1.5 with cable Φ 9.5 to 16 mm (0.37 to 0.63 in)

If metal cable entries are used, use a grounding plate.

Cable specification

Permitted temperature range
- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Power supply cable (incl. conductor for the inner ground terminal)

Standard installation cable is sufficient.

Signal cable

Current output 0/4 to 20 mA

Standard installation cable is sufficient.

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

PROFIBUS DP

The IEC 61158 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm² (22 AWG)

Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

For further information on planning and installing PROFIBUS networks see:
Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S)

Modbus RS485

The EIA/TIA-485 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm² (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤110 Ω/km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

EtherNet/IP

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.

For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of ODVA Organization

Connecting cable for remote version

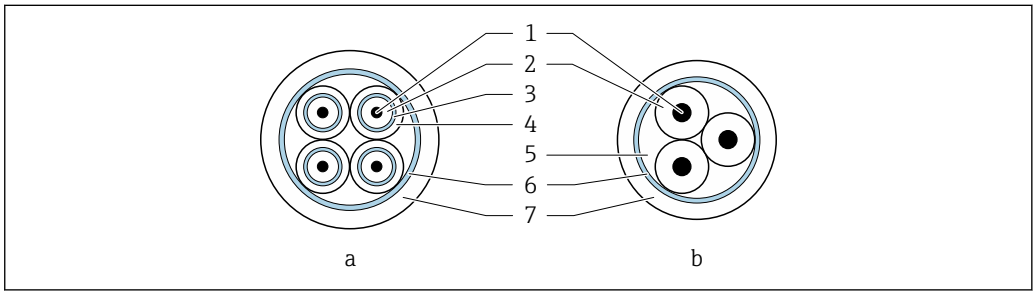
Electrode cable

Standard cable	3 ×0.38 mm² (20 AWG) with common, braided copper shield (ϕ ~9.5 mm (0.37 in)) and individual shielded cores
Cable for empty pipe detection (EPD)	4 ×0.38 mm² (20 AWG) with common, braided copper shield (ϕ ~9.5 mm (0.37 in)) and individual shielded cores
Conductor resistance	≤50 Ω/km (0.015 Ω/ft)
Capacitance: core/shield	≤420 pF/m (128 pF/ft)
Operating temperature	–20 to +80 °C (–4 to +176 °F)

Coil current cable

Standard cable	3 ×0.75 mm² (18 AWG) with common, braided copper shield (ϕ ~9 mm (0.35 in))
Conductor resistance	≤37 Ω/km (0.011 Ω/ft)
Capacitance: core/core, shield grounded	≤120 pF/m (37 pF/ft)

Operating temperature	–20 to +80 °C (–4 to +176 °F)
Test voltage for cable insulation	≤ AC 1433 V rms 50/60 Hz or ≥ DC 2026 V



13 *Cable cross-section*

a Electrode cable
b Coil current cable
1 Core
2 Core insulation
3 Core shield
4 Core jacket
5 Core reinforcement
6 Cable shield
7 Outer jacket

A connecting cable can be ordered from Endress+Hauser for IP68:
- Pre-terminated cables that are already connected to the sensor
- Pre-terminated cables, where the cables are connected by the customer onsite (incl. tools for sealing the connection compartment)

Armored connecting cable

Armored connecting cables with an additional, reinforcing metal braid should be used:
- When laying the cable directly in the ground
- Where there is a risk of damage from rodents
- Use as per IP68 degree of protection

Armored connecting cables with an additional, reinforcing metal braid can be ordered from Endress+Hauser → 103.

Operation in environments with strong electrical interference

The measuring system meets the general safety requirements → 102 and EMC specifications → 48.

Grounding is by means of the ground terminal provided for the purpose inside the connection housing. The stripped and twisted lengths of cable shield to the ground terminal must be as short as possible.

Performance characteristics

Reference operating conditions

- Error limits following DIN EN 29104, in future ISO 20456
- Water, typically +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi)
- Data as indicated in the calibration protocol
- Accuracy based on accredited calibration rigs according to ISO 17025

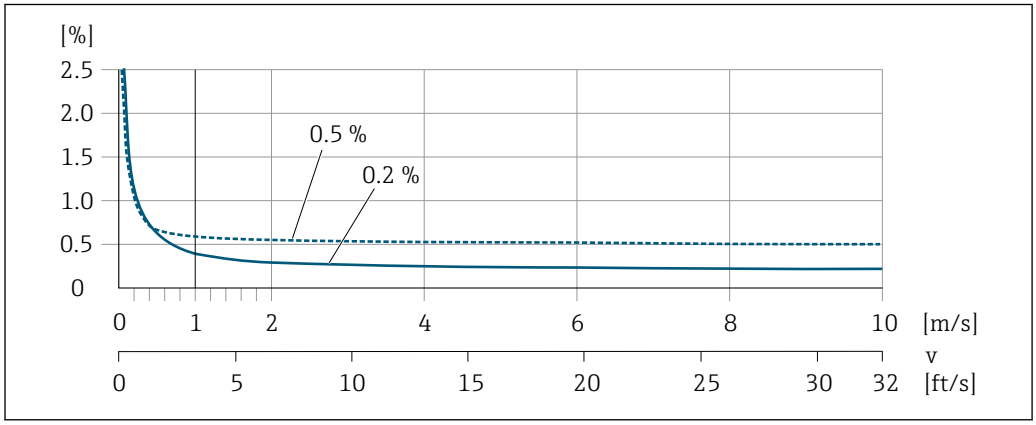
Maximum measured error

Error limits under reference operating conditions

Volume flow

- ±0.5 % o.r. ± 1 mm/s (0.04 in/s)
- Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s)

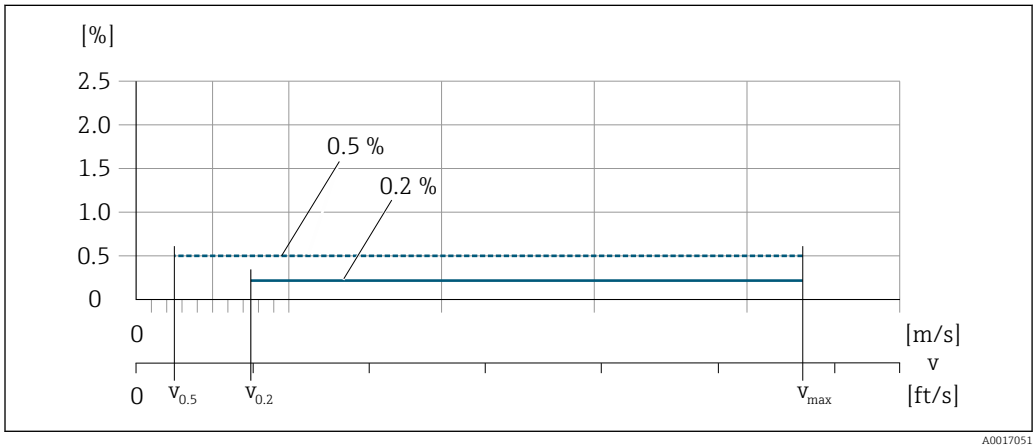
Fluctuations in the supply voltage do not have any effect within the specified range.



14 *Maximum measured error in % o.r.*

Flat Spec

For Flat Spec in the range $v_{0.5}$ ($v_{0.2}$) up to v_{max} the measured error is constant.



15 *Flat Spec in % o.r.*

Flat Spec flow values 0.5 %

Nominal diameter		$v_{0.5}$		v_{max}	
[mm]	[in]	[m/s]	[ft/s]	[m/s]	[ft/s]
25 to 600	1 to 24	0.5	1.64	10	32
50 to 300 [1)]	2 to 12	0.25	0.82	5	16

1) Order code for "Design", option C

Flat Spec flow values 0.2 %

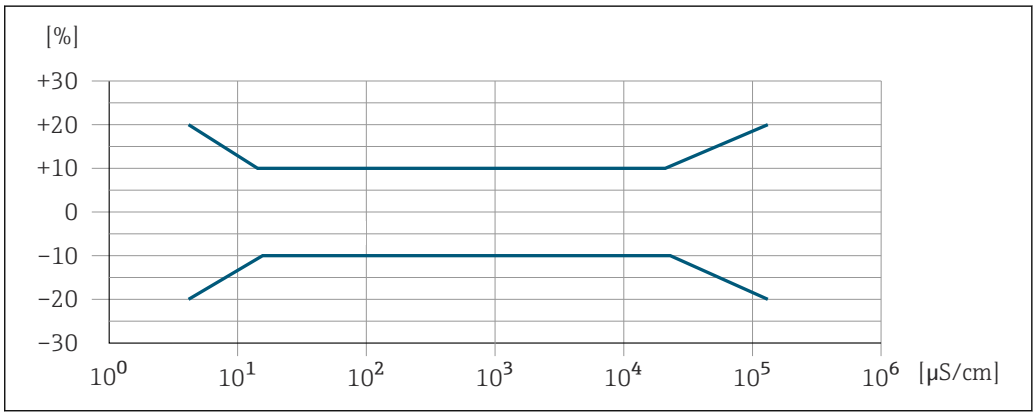
Nominal diameter		$v_{0.2}$		v_{max}	
[mm]	[in]	[m/s]	[ft/s]	[m/s]	[ft/s]
25 to 600	1 to 24	1.5	4.92	10	32
50 to 300 [1)]	2 to 12	0.6	1.97	4	13

1) Order code for "Design", option C

Electrical conductivity

The values apply for:
- Measurements at a reference temperature of 25 °C (77 °F)
  At different temperatures, attention must be paid to the temperature coefficient of the medium (typically 2.1 %/K)
- Device version: compact version - transmitter and sensor form a mechanical unit
- Devices installed in a metal pipe or in a non-metal pipe with ground disks
- Devices whose potential equalization was performed according to the instructions in the associated Operating Instructions

Conductivity [µS/cm]	Measured error [%] o. r.
5 to 20	± 20%
20 to 20 000	± 10%
20 000 to 100 000	± 20%



16 *Measured error*

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	Max. ±5 µA

Pulse/frequency output

o.r. = of reading

Accuracy	Max. ±50 ppm o.r. (over the entire ambient temperature range)

Repeatability

o.r. = of reading

Volume flow
max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Electrical conductivity
Max. ±5 % o.r.

Influence of ambient temperature

Current output

o.r. = of reading

Temperature coefficient	Max. ±0.005 % o.r./°C

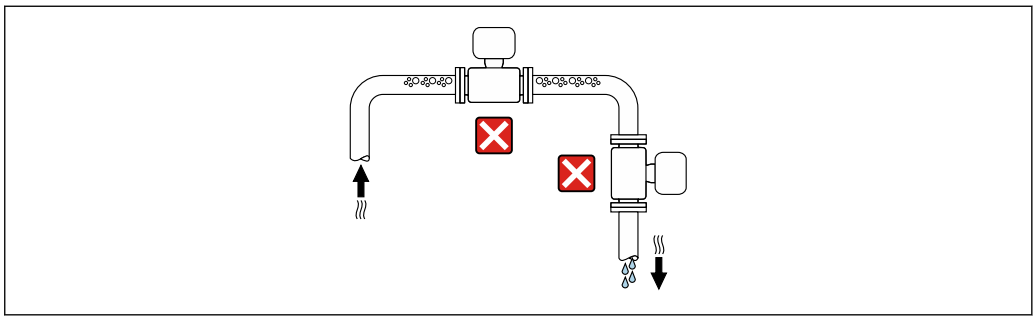
Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

Installation

Mounting location

- Do not install the device at the highest point of the pipe.
- Do not install the device upstream from a free pipe outlet in a down pipe.



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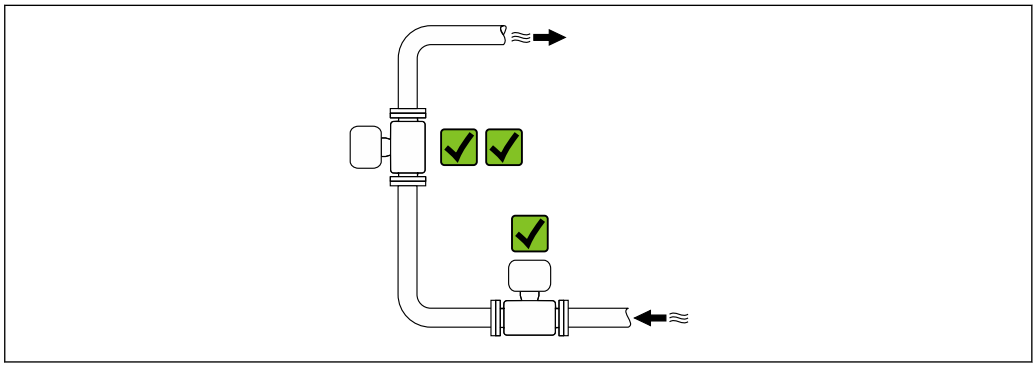
The device should ideally be installed in an ascending pipe.



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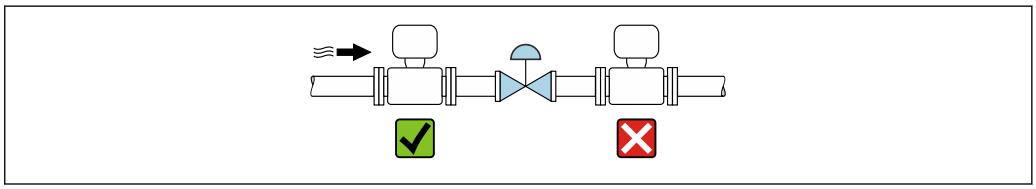
Installation near valves

Install the device in the direction of flow upstream from the valve.



A0041091

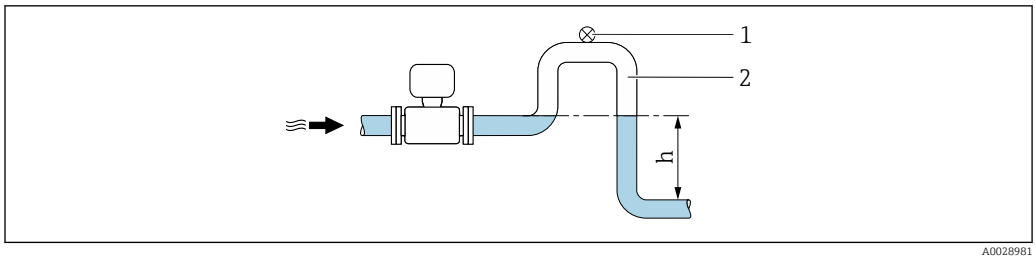
Installation upstream from a down pipe

NOTICE

Negative pressure in the measuring pipe can damage the liner!

▶ If installing upstream from down pipes with a length h ≥ 5 m (16.4 ft), install a siphon with a vent valve downstream from the device.

This arrangement prevents the stoppage of liquid flow and the formation of air pockets.

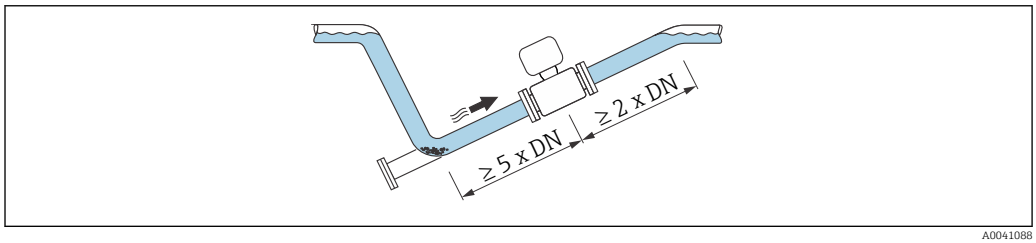


A0028981

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation with partially filled pipes

- Partially filled pipes with a gradient require a drain-type configuration.
- The installation of a cleaning valve is recommended.



A0041088

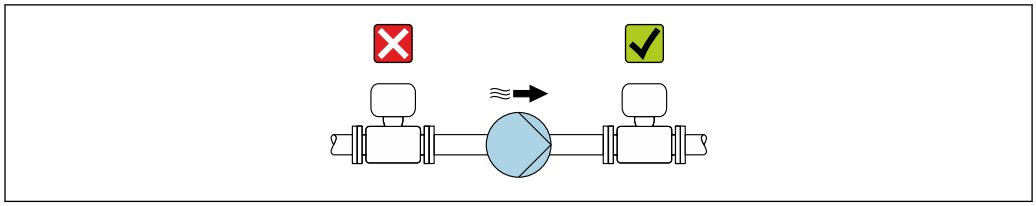
No inlet and outlet runs for devices with the order code for "Design": Option C, H, I, J or K.

Installation near pumps

NOTICE

Negative pressure in the measuring pipe can damage the liner!

- ▶ In order to maintain the system pressure, install the device in the flow direction downstream from the pump.
- ▶ Install pulsation dampers if reciprocating, diaphragm or peristaltic pumps are used.



A0041083

- Information on the liner's resistance to partial vacuum → 51
- Information on the measuring system's resistance to vibration and shock → 47

Installation of very heavy devices

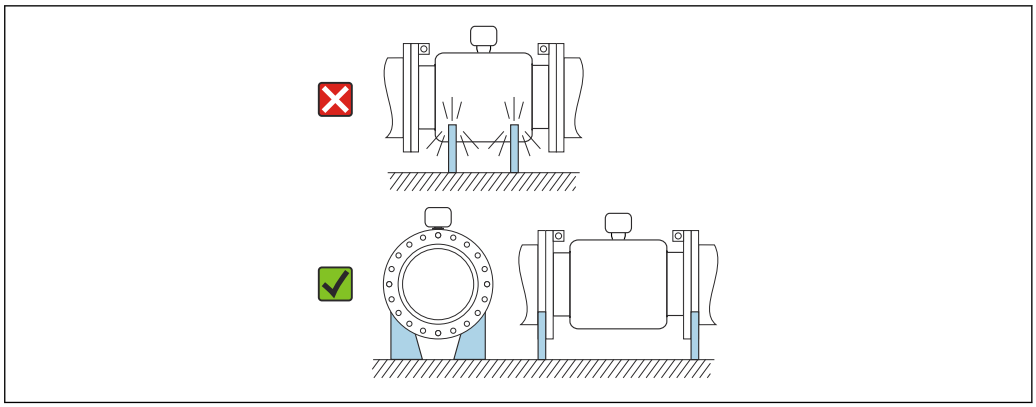
Support required for nominal diameters of DN ≥ 350 mm (14 in).

NOTICE

Damage to the device!

If incorrect support is provided, the sensor housing could buckle and the internal magnetic coils could be damaged.

- ▶ Only provide supports at the pipe flanges.



A0041087

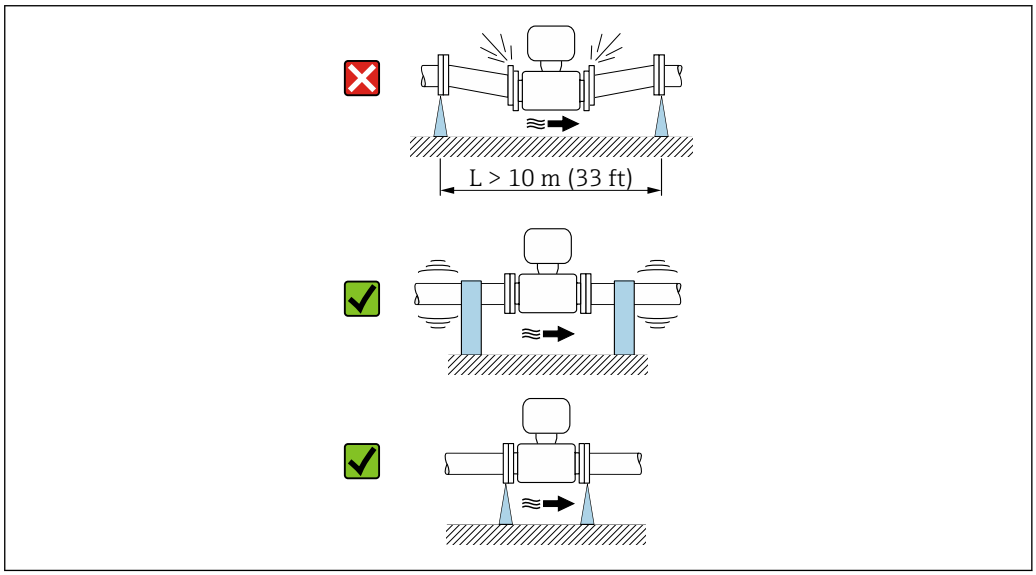
Installation in event of pipe vibrations

A remote version is recommended in the event of strong pipe vibrations.

NOTICE

Pipe vibrations can damage the device!

- Do not expose the device to strong vibrations.
- Support the pipe and fix it in place.
- Support the device and fix it in place.
- Mount the sensor and transmitter separately.

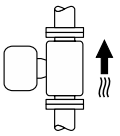
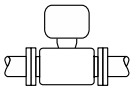
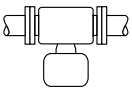
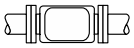


A0041092

Information on the measuring system's resistance to vibration and shock → 47

Orientation

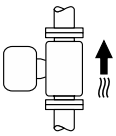
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

Orientation		Recommendation
Vertical orientation	 A0015591	✓✓
Horizontal orientation, transmitter at top	 A0015589	✓✓ 1)
Horizontal orientation, transmitter at bottom	 A0015590	✓✓ 2) 3) ✗ 4)
Horizontal orientation, transmitter at side	 A0015592	✗

1) Applications with low process temperatures may decrease the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.
3) To prevent the electronics module from overheating in the case of a sharp rise in temperature (e.g. CIP or SIP processes), install the device with the transmitter component pointing downwards.
4) With the empty pipe detection function switched on: empty pipe detection only works if the transmitter housing is pointing upwards.

Vertical

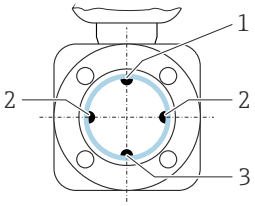
Optimum for self-emptying pipe systems and for use in conjunction with empty pipe detection.



A0015591

Horizontal

- Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the measuring electrodes by entrained air bubbles.
- Empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.



A0029344

1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

Inlet and outlet runs

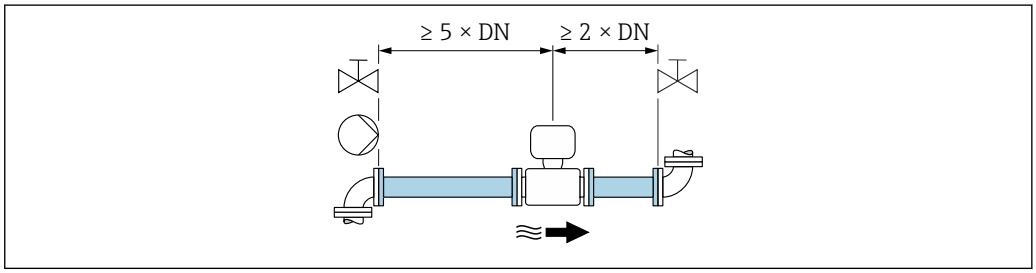
Installation with inlet and outlet runs

Installation requires inlet and outlet runs: devices with the order code for "Design", option D, E, F and G.

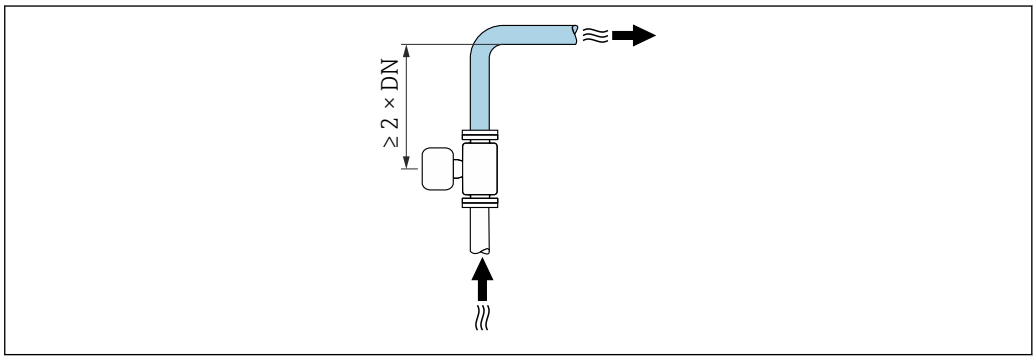
Installation with elbows, pumps or valves

To avoid a vacuum and to maintain the specified level of accuracy, install the device upstream from assemblies that produce turbulence (e.g. valves, T-sections) and downstream from pumps, wherever possible.

Maintain straight, unimpeded inlet and outlet runs.



A0028997



A0042132

Installation without inlet and outlet runs

Depending on the device design and installation location, the inlet and outlet runs can be reduced or omitted entirely.

Maximum measured error
When the device is installed with the inlet and outlet runs described, a maximum measured error of ±0.5 % of the reading ±1 mm/s (0.04 in/s) can be guaranteed.

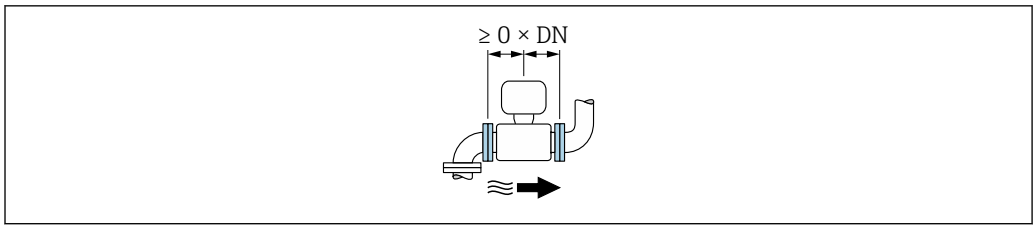
Devices and possible order options

Order code for "Design"		
Option	**Description**	**Design**
C	Fixed flange, constricted measuring tube, 0 x DN inlet/outlet runs	Constricted measuring tube [1]
H	Lap joint flange, 0 x DN inlet/outlet runs	Full Bore [2]
I	Fixed flange, 0 x DN inlet/outlet runs	
J	Fixed flange, short installed length, 0 x DN inlet/ outlet runs	
K	Fixed flange, long installed length, 0 x DN inlet/ outlet runs	

1) "Constricted measuring tube" stands for a reduction of the internal diameter of the measuring tube. The reduced internal diameter causes a higher flow velocity inside the measuring tube.
2) "Full Bore" stands for the full diameter of the measuring tube. There is no pressure loss with a full diameter.

Installation before or after bends

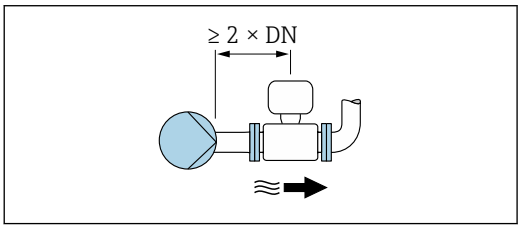
Installation without inlet and outlet runs is possible: devices with the order code for "Design", option C, H, I, J and K.



Installation downstream of pumps

Installation without inlet and outlet runs is possible: devices with the order code for "Design", option C, H and I.

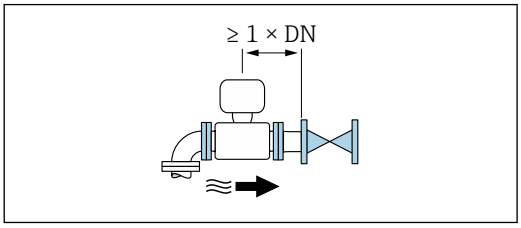
In the case of devices with the order code for "Design", option J and K, an inlet run of only ≥ 2 x DN must be taken into consideration.



Installation upstream of valves

Installation without inlet and outlet runs is possible: devices with the order code for "Design", option C, H and I.

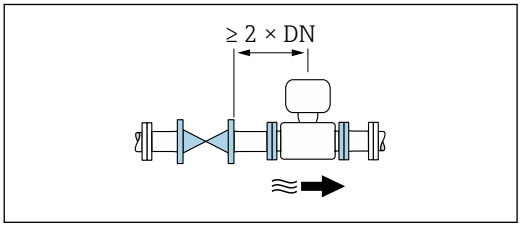
In the case of devices with the order code for "Design", option J and K, an outlet run of only ≥ 1 x DN must be taken into consideration.



Installation downstream of valves

Installation without inlet and outlet runs is possible if the valve is 100% open during operation: devices with the order code for "Design", option C, H and I.

In the case of devices with the order code for "Design", option J and K, an inlet run of only ≥ 2 x DN must be taken into consideration if the valve is 100% open during operation.



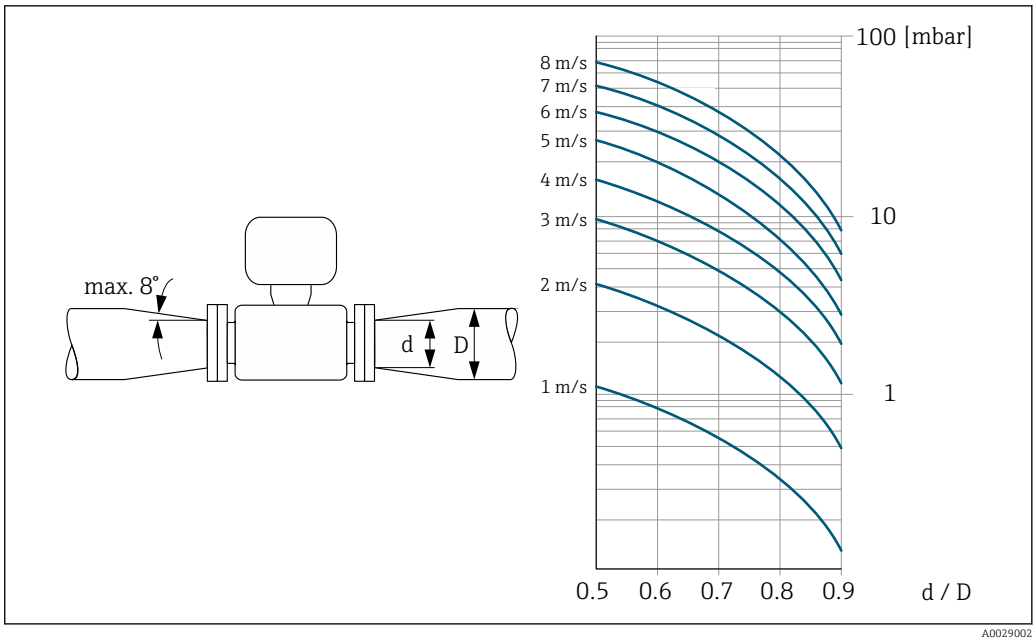
Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids.

The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders:

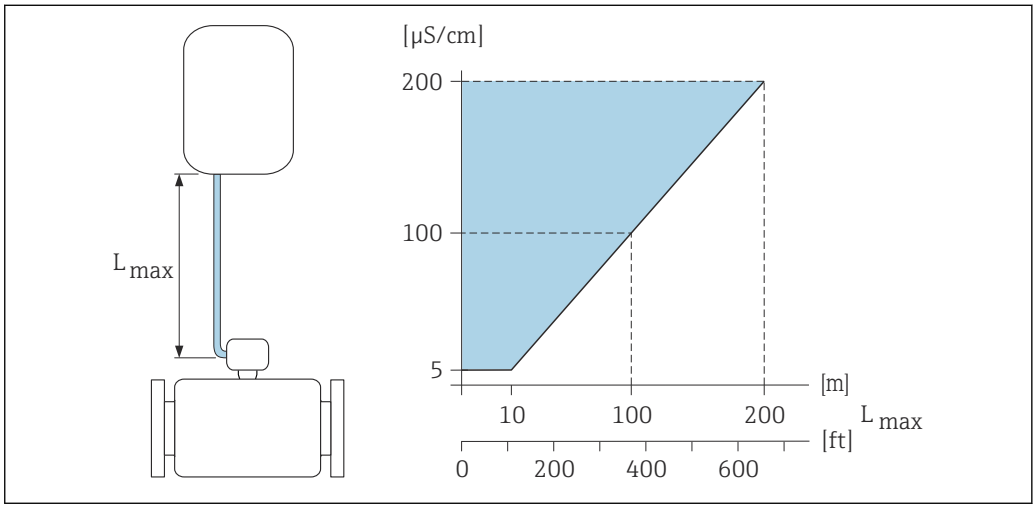
- Calculate the ratio of the diameters d/D.
- From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

The nomogram only applies to liquids with a viscosity similar to that of water.



Length of connecting cable

To obtain correct measurement results, observe the permitted connecting cable length of L_{max}. This length is determined by the conductivity of the fluid. If measuring liquids in general: 5 µS/cm



17 *Permitted length of connecting cable*

Colored area = permitted range
L_{max} = length of connecting cable in [m] ([ft])
[µS/cm] = fluid conductivity

Special mounting instructions

Display guard

To ensure that the optional display guard can be easily opened, maintain the following minimum head clearance: 350 mm (13.8 in)

Immersion in water

- Only the remote version of the device with IP68 protection, Type 6P is suitable for underwater use: order code for "Sensor option", options CB, CC, CD, CE and CQ.
- Pay attention to regional installation instructions.

NOTICE

If the maximum water depth and operating duration is exceeded, this can damage the device!

▶ Observe the maximum water depth and operating duration.

Order code for "Sensor option", options CB, CC

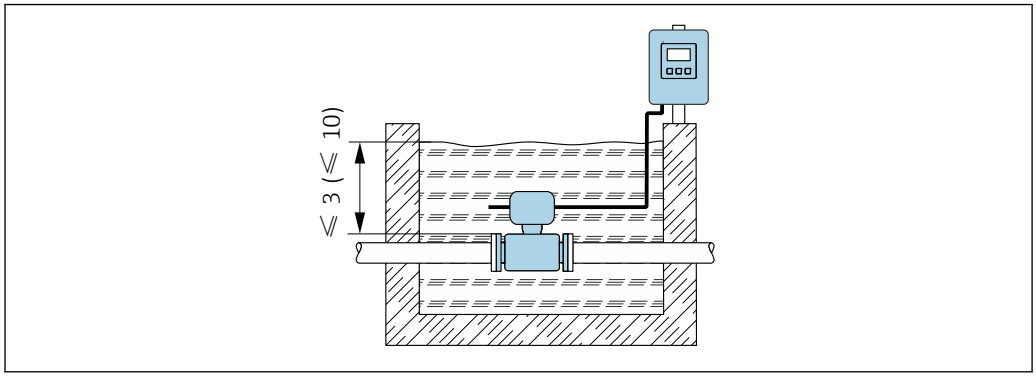
- For the operation of the device under water
- Operating duration at a maximum depth of:
  - 3 m (10 ft): permanent use
  - 10 m (30 ft): maximum 48 hours

Order code for "Sensor option", option CQ "Temporarily water-proof "

- For the temporary operation of the device under non-corrosive water
- Operating duration at a maximum depth of:
  3 m (10 ft): maximum 168 hours

Order code for "Sensor option", options CD, CE

- For the operation of the device under water and in saline water
- Operating duration at a maximum depth of:
  - 3 m (10 ft): permanent use
  - 10 m (30 ft): maximum 48 hours



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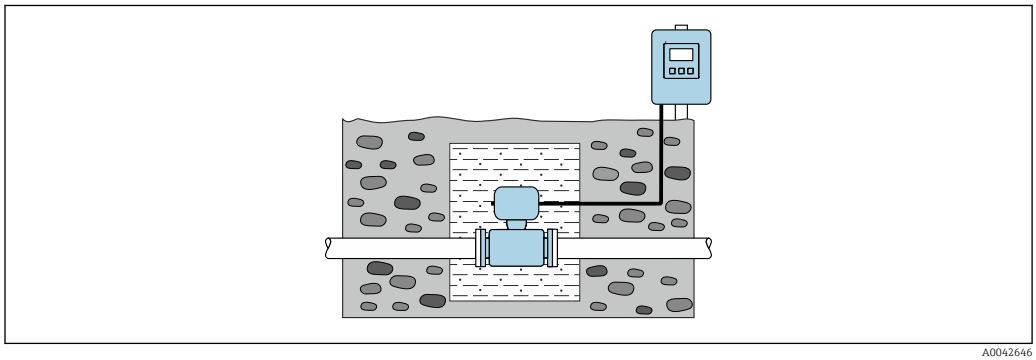
Use in buried applications

- Only the remote version of the device with IP68 protection is suitable for use in buried applications: order code for "Sensor option", options CD and CE.
- Pay attention to regional installation instructions.

Order code for "Sensor option", options CD, CE

For the use of the device in buried applications.



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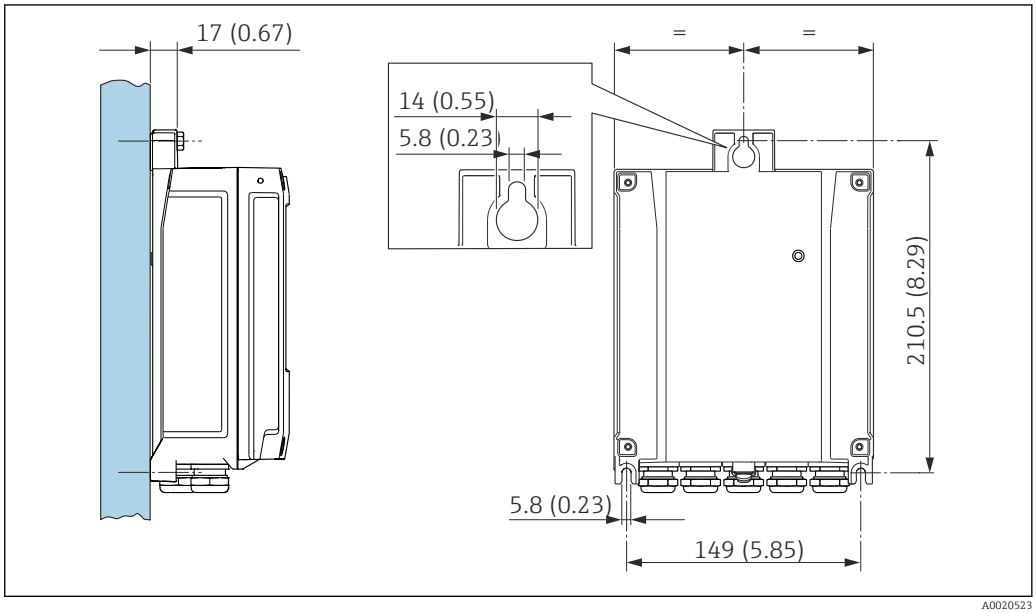
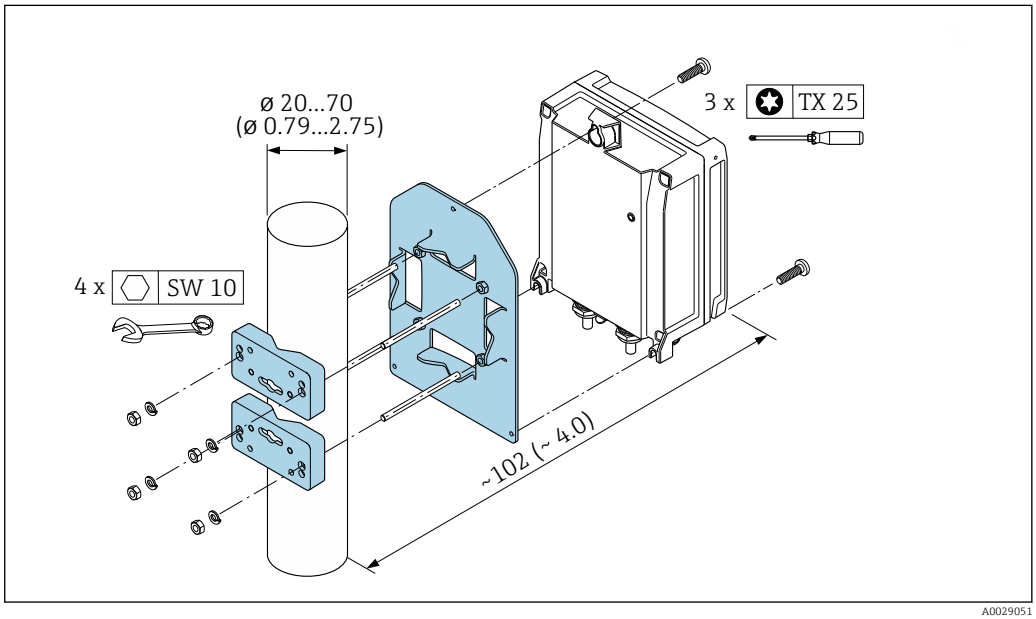
Mounting the transmitter housing

Wall mounting



18 *Engineering unit mm (in)*

Post mounting



19 *Engineering unit mm (in)*

Environment

Ambient temperature range

Transmitter	−40 to +60 °C (−40 to +140 °F)
Local display	−20 to +60 °C (−4 to +140 °F), the legibility of the local display may be impaired at temperatures outside the temperature range.

Sensor	▪ Process connection material, carbon steel: −10 to +60 °C (+14 to +140 °F) ▪ Process connection material, stainless steel: −40 to +60 °C (−40 to +140 °F) If both the ambient and the medium temperatures are high, mount the sensor separately from the transmitter.
Liner	Do not exceed or fall below the permitted temperature range of the liner → 🖹 48.

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.
- If the compact version of the device is insulated at low temperatures, the insulation must also include the device neck.
- Protect the display against impact.
- Protect the display from abrasion, e.g. caused by sand in desert areas.

Display guard available as an accessory → 🖹 103.

Temperature tables

Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.

For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

Storage temperature

The storage temperature corresponds to the operating temperature range of the transmitter and the sensor → 🖹 45.

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Atmosphere

If a plastic transmitter housing is permanently exposed to certain steam and air mixtures, this can damage the housing.

In cases of doubt, please contact the Sales Center.

Degree of protection

Transmitter

- IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

Sensor

Compact and remote version

IP66/67, type 4X enclosure

Optionally available for compact and remote version:

Order code for "Sensor option", option CA, C3
- IP66/67, type 4X enclosure
- Fully welded, with protective coating as per EN ISO 12944 C5-M
- For the operation of the device in corrosive environments

Optionally available for remote version:

Order code for "Sensor option", option CB, CC
- IP68, type 6P enclosure
- Fully welded, with protective coating as per EN ISO 12944 C5-M/Im1 and EN 60529
- For the operation of the device under water
- Operating duration at a maximum depth of:
  - 3 m (10 ft): permanent use
  - 10 m (30 ft): maximum 48 hours

Order code for "Sensor option", option CQ
- IP68, type 6P, temporarily waterproof
- Sensor with aluminum half-shell housing
- For the temporary operation of the device under non-corrosive water
- Operating duration at a maximum depth of:
  3 m (10 ft): maximum 168 hours

Order code for "Sensor option", option CD, CE
- IP68, type 6P enclosure
- Fully welded, with protective coating as per EN ISO 12944 Im2/Im3 and EN 60529
- For the operation of the device in buried applications
- For the operation of the device under water and in saline water
- Operating duration at a maximum depth of:
  - 3 m (10 ft): permanent use
  - 10 m (30 ft): maximum 48 hours

Vibration- and shock-resistance

Sinusoidal vibration according to IEC 60068-2-6

Compact version; order code for "Housing", option A "Compact, aluminum, coated"
- 2 to 8.4 Hz, 3.5 mm peak
- 8.4 to 2 000 Hz, 1 g peak

Compact version; order code for "Housing", option M "Compact, polycarbonate"
- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 2 000 Hz, 2 g peak

Remote version; order code for "Housing", option N "Remote, polycarbonate" and option P "Remote, aluminum, coated"
- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 2 000 Hz, 2 g peak

Vibration broad-band random, according to IEC 60068-2-64

Compact version; order code for "Housing", option A "Compact, aluminum, coated"
- 10 to 200 Hz, 0.003 g^2/Hz
- 200 to 2 000 Hz, 0.001 g^2/Hz
- Total: 1.54 g rms

Compact version; order code for "Housing", option M "Compact, polycarbonate"
- 10 to 200 Hz, 0.01 g^2/Hz
- 200 to 2 000 Hz, 0.003 g^2/Hz
- Total: 2.70 g rms

Remote version; order code for "Housing", option N "Remote, polycarbonate" and option P "Remote, aluminum, coated"
- 10 to 200 Hz, 0.01 g^2/Hz
- 200 to 2 000 Hz, 0.003 g^2/Hz
- Total: 2.70 g rms

Shock half-sine, according to IEC 60068-2-27

- Compact version; order code for "Housing", option A "Compact, aluminum, coated"
  6 ms 30 g
- Compact version; order code for "Housing", option M "Compact, polycarbonate"
  6 ms 50 g
- Remote version; order code for "Housing", option N "Remote, polycarbonate" and option P "Remote, aluminum, coated"
  6 ms 50 g

Rough handling shocks according to IEC 60068-2-31

Mechanical load

- Protect the transmitter housing against mechanical effects, such as shock or impact; the use of the remote version is sometimes preferable.
- Never use the transmitter housing as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- Complies with emission limits for industry as per EN 55011 (Class A)
- Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784

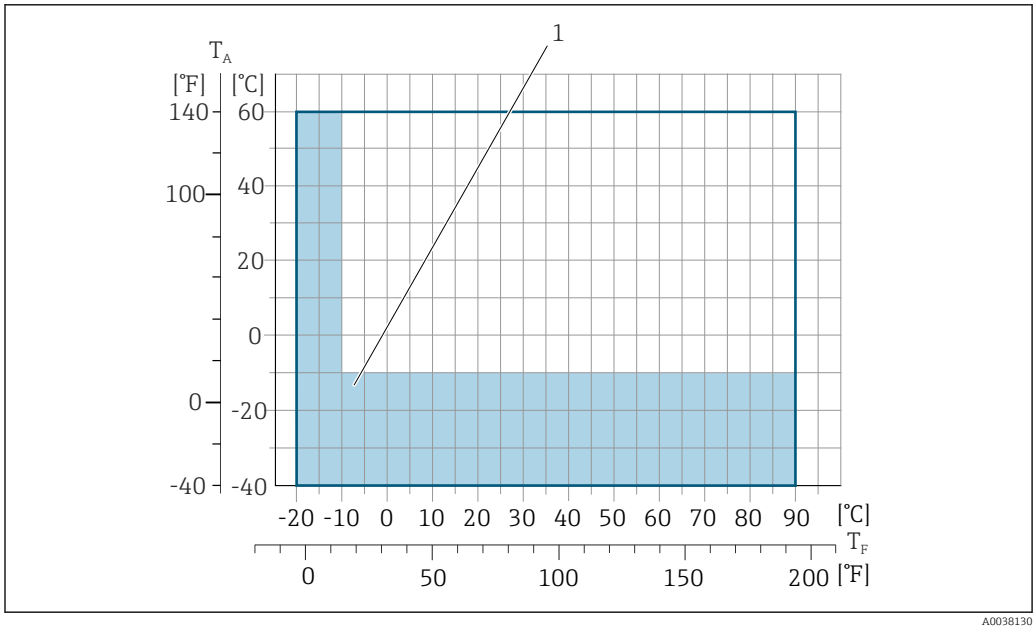
The following applies for PROFIBUS DP: If baud rates > 1.5 MBaud, an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

Details are provided in the Declaration of Conformity.

Process

Medium temperature range

- 0 to +80 °C (+32 to +176 °F) for hard rubber, DN 50 to 3000 (2 to 120")
- −20 to +50 °C (−4 to +122 °F) for polyurethane, DN 25 to 1200 (1 to 48")
- −20 to +90 °C (−4 to +194 °F) for PTFE, DN 25 to 300 (1 to 12")



T_A *Ambient temperature*
T_F *Medium temperature*
1 *Colored area: The ambient temperature range of −10 to −40 °C (+14 to −40 °F) and the medium temperature range of −10 to −20 °C (+14 to −4 °F) only apply for stainless flanges*

The permitted fluid temperature in custody transfer is 0 to +50 °C (+32 to +122 °F).

Conductivity

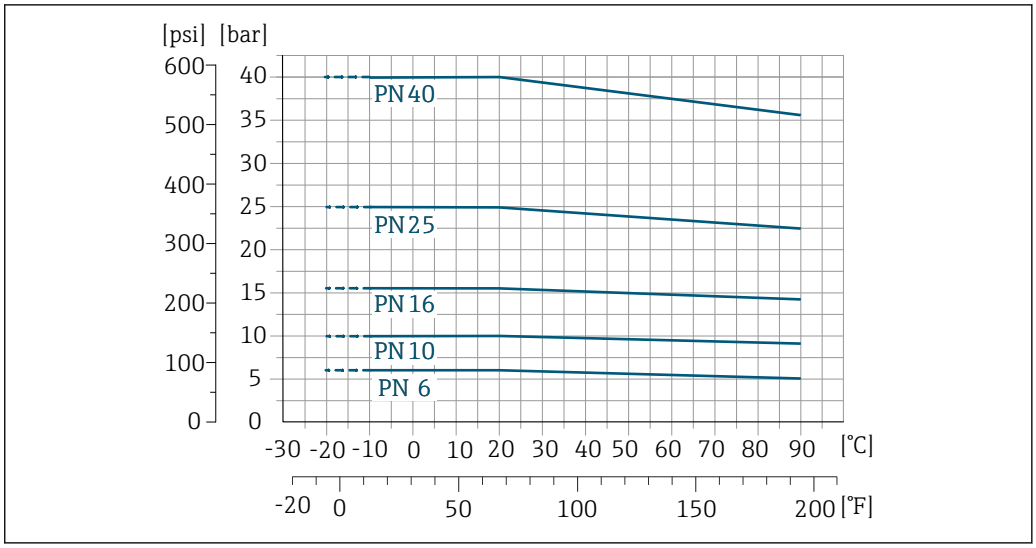
≥5 µS/cm for liquids in general.

- Note that in the case of the remote version, the requisite minimum conductivity additionally depends on the length of the connecting cable → 43.
- Maximum measured error for electrical conductivity → 35.

Pressure/temperature ratings

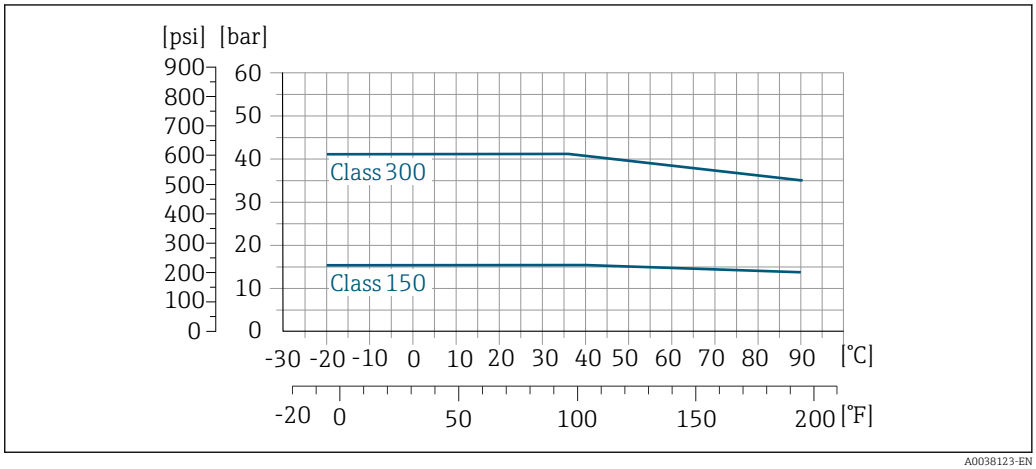
The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.

Process connection: fixed flange according to EN 1092-1 (DIN 2501)

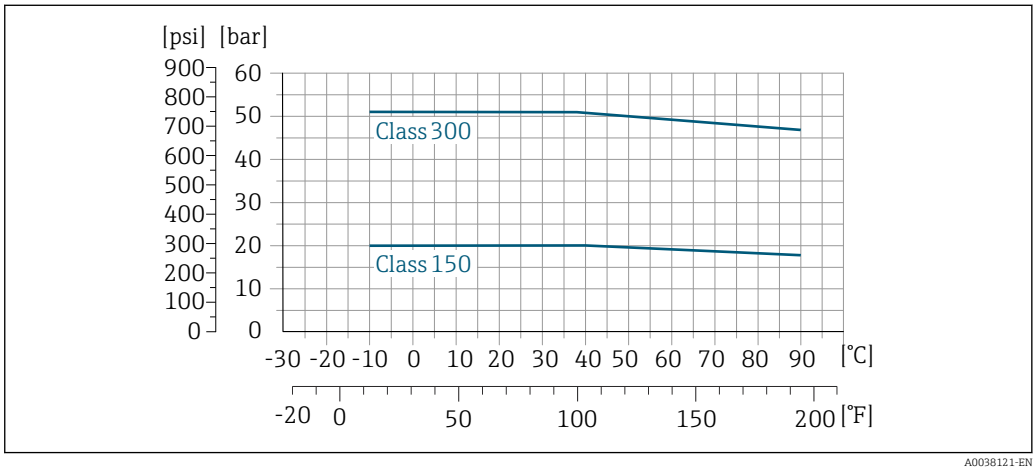


20 *Process connection material: stainless steel (−20 °C (−4 °F)); carbon steel (−10 °C (14 °F))*

Process connection: fixed flange according to ASME B16.5

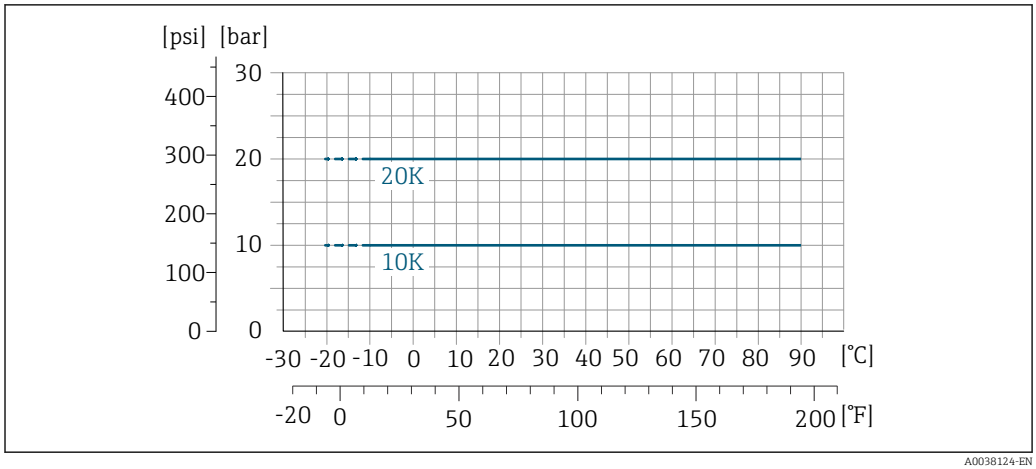


21 *Process connection material: stainless steel*



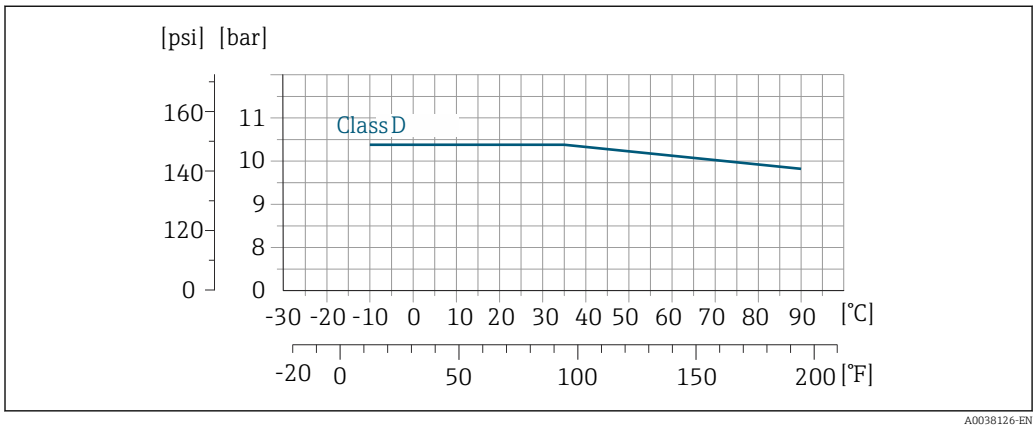
22 *Process connection material: carbon steel*

Process connection: fixed flange according to JIS B2220



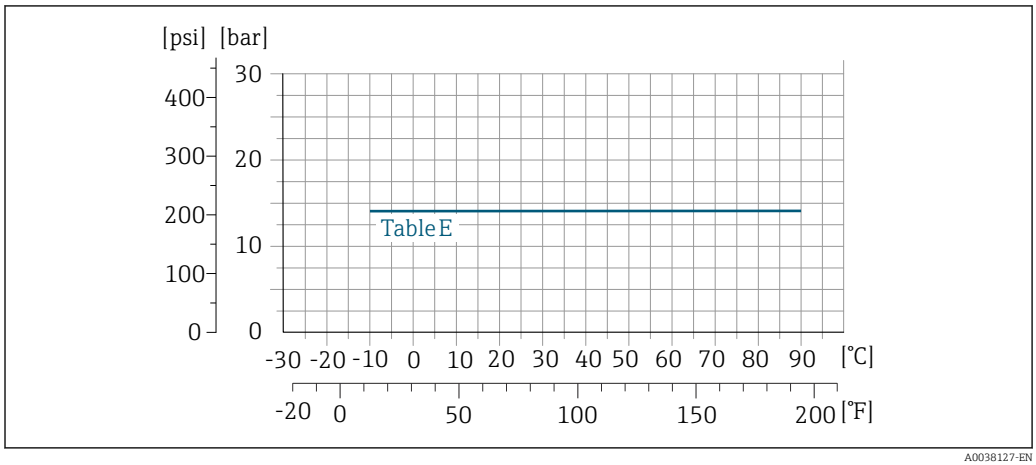
23 Process connection material: stainless steel (−20 °C (−4 °F)); carbon steel (−10 °C (14 °F))

Process connection: fixed flange according to AWWA C207



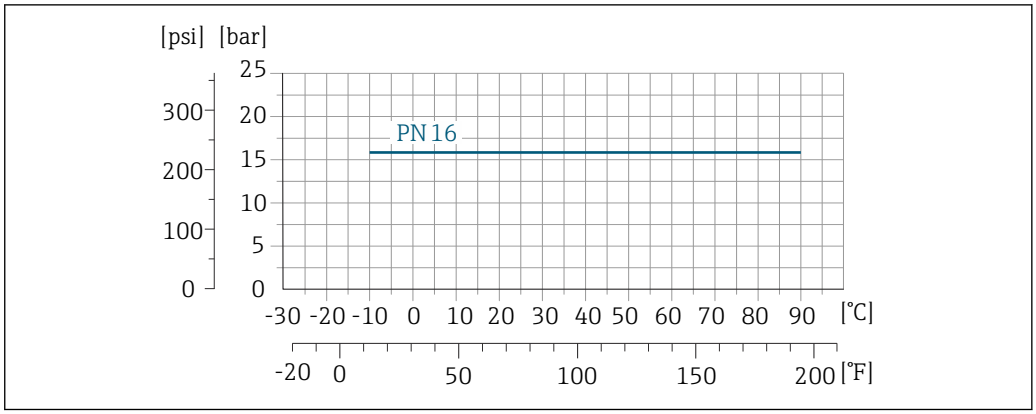
24 Process connection material: carbon steel

Process connection: fixed flange according to AS 2129



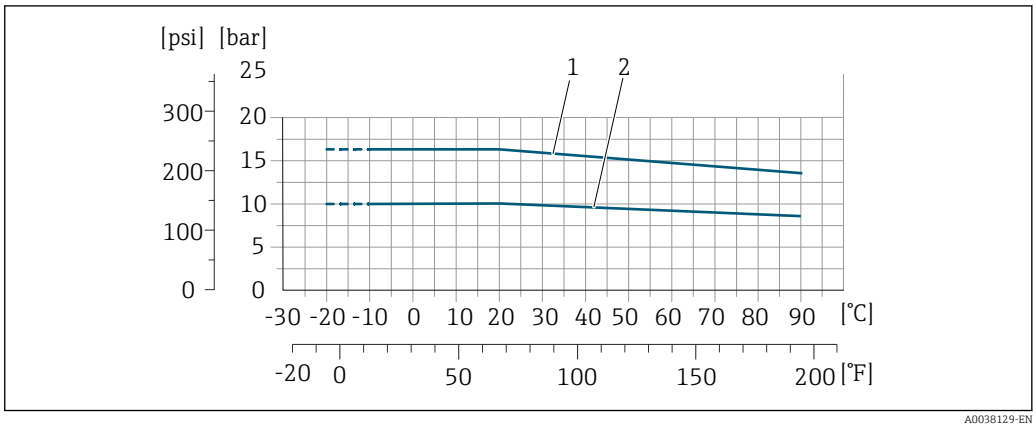
25 Process connection material: carbon steel

Process connection: fixed flange according to AS 4087



26 Process connection material: carbon steel

Process connection: lap joint flange/lap joint flange, stamped plate according to EN 1092-1 (DIN 2501) and ASME B16.5; DN 25 to 300 (1 to 12")



27 Process connection material: stainless steel (−20 °C (−4 °F)); carbon steel (−10 °C (14 °F))

1 Lap joint flange PN16/ Class150
2 Lap joint flange, stamped plate PN10, lap joint flange PN10

Pressure tightness

Liner: hard rubber

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+50 °C (+122 °F)	+80 °C (+176 °F)
50 … 3000	2 … 120	0 (0)	0 (0)	0 (0)

Liner: polyurethane

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures:	
[mm]	[in]	+25 °C (+77 °F)	+50 °C (+122 °F)
25 … 1200	1 … 48	0 (0)	0 (0)

Liner: PTFE

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures:	
[mm]	[in]	+25 °C (+77 °F)	+90 °C (+194 °F)
25	1	0 (0)	0 (0)
40	2	0 (0)	0 (0)

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures:	
[mm]	[in]	+25 °C (+77 °F)	+90 °C (+194 °F)
50	2	0 (0)	0 (0)
65	2 ½	0 (0)	40 (0.58)
80	3	0 (0)	40 (0.58)
100	4	0 (0)	135 (2.0)
125	5	135 (2.0)	240 (3.5)
150	6	135 (2.0)	240 (3.5)
200	8	200 (2.9)	290 (4.2)
250	10	330 (4.8)	400 (5.8)
300	12	400 (5.8)	500 (7.3)

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the medium:
- v < 2 m/s (6.56 ft/s): for abrasive media (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for media producing buildup (e.g. wastewater sludge)

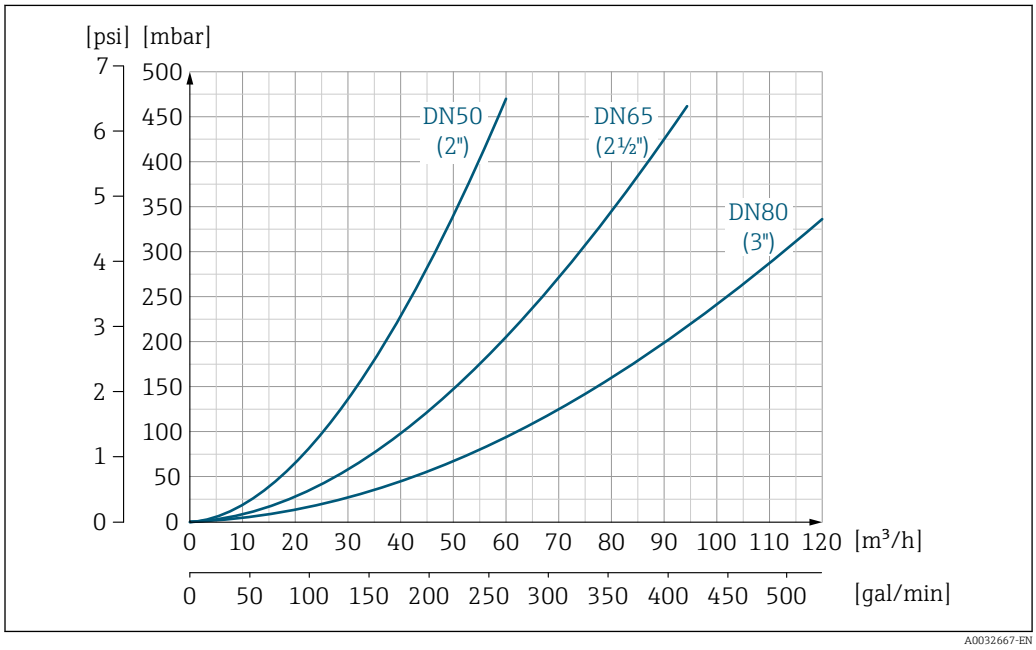
A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

For an overview of the full scale values for the measuring range, see the "Measuring range" section → 🖹 8

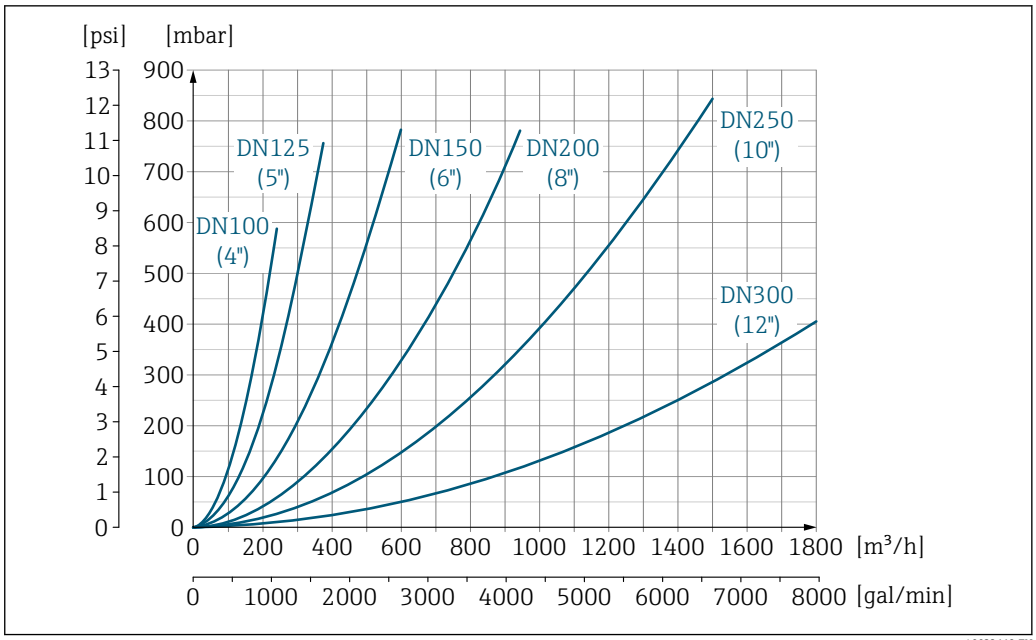
For custody transfer, the applicable approval determines the permitted measuring range.

Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 🖹 42



28 *Pressure loss DN 50 to 80 (2 to 3") for order code for "Design", option C "Fixed flange, constricted measuring tube", 0 x DN inlet/outlet runs"*



29 *Pressure loss DN 100 to 300 (4 to 12") for order code for "Design", option C "Fixed flange, constricted measuring tube", 0 x DN inlet/outlet runs"*

System pressure	Installation near pumps → 38
Vibrations	Installation in event of pipe vibrations → 39

Custody transfer mode

The measuring device is optionally tested in accordance with OIML R49 and has an EU type-examination certificate according to Measuring Instruments Directive 2014/32/EU for service subject to legal metrological control ("custody transfer") for cold water (Annex III).

The permitted medium temperature in these applications is 0 to +50 °C (+32 to +122 °F).

The device is used with a legally controlled totalizer on the local display and optionally with legally controlled outputs.

Measuring devices subject to legal metrological control totalize in both directions, i.e. all the outputs consider flow components in the positive (forward) and negative (reverse) flow direction.

Generally a measuring device subject to legal metrological control is secured against tampering by seals on the transmitter or sensor. These seals may normally only be opened by a representative of the competent authority for legal metrology controls.

After putting the device into circulation or after sealing the device, operation is only possible to a limited extent.

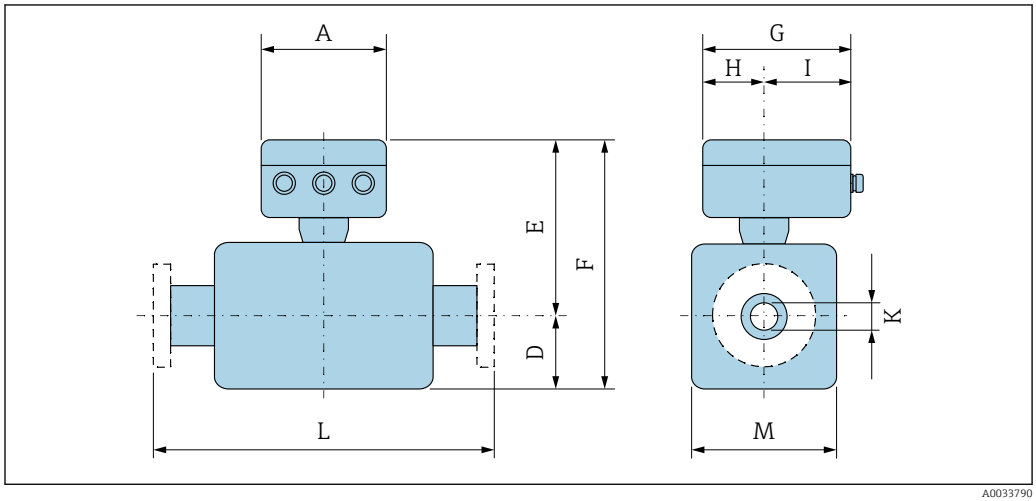
Detailed ordering information is available from your local Endress+Hauser sales center for national approvals (outside Europe) as cold water meters based on OIML R49.

Mechanical construction

Dimensions in SI units

Compact version

Order code for "Housing", option A "Compact, aluminum, coated" or option M "Compact, polycarbonate"



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A [mm]	G [1] [mm]	H [mm]	I [1] [mm]
167	193	90	103

1) Depending on the cable gland used: values up to + 30 mm

DN 25 to 300 mm (1 to 12 in): Sensor with aluminum half-shell housing

DN		Order code for "Design"								K	L
		Options D, E, H, I				Option C					
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]		
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1	84	201	285	120	–	–	–	–	[2]	200
32	–	84	201	285	120	–	–	–	–	[2]	200
40	1 ½	84	201	285	120	–	–	–	–	[2]	200
50	2	84	201	285	120	84	201	285	120	[2]	200
65	–	109	226	335	180	84	201	285	120	[2]	200
80	3	109	226	335	180	84	201	285	120	[2]	200
100	4	109	226	335	180	109	226	335	180	[2]	250
125	–	150	266	416	260	109	226	335	180	[2]	250
150	6	150	266	416	260	109	226	335	180	[2]	300
200	8	180	291	471	324	150	266	416	260	[2]	350
250	10	205	316	521	400	150	266	416	260	[2]	450
300	12	230	341	571	460	180	291	471	324	[2]	500

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 350 to 400 mm (14 to 16 in)

DN		Order code for "Design" Options E, I				K	L
		D [1]	E [1]	F [1]	M [1]		
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
350	14	282	379	679	564	[2]	550
375	15	308	423	731	616	[2]	600
400	16	308	423	731	616	[2]	600

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 450 to 900 mm (18 to 36 in)

DN		Order code for "Design"								K	L	
		Options F, J				Options G, K						
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
450	18	290	405	695	580	333	448	781	666	[2]	600 [3]	650 [4]
500	20	315	430	745	630	359	474	833	717	[2]	600 [3]	650 [4]
600	24	365	480	845	730	411	526	937	821	[2]	600 [3]	780 [4]
700	28	426	541	967	851	512	627	1139	1024	[2]	700 [3]	910 [4]
750	30	463	578	1041	926	512	627	1139	1024	[2]	750 [3]	975 [4]

DN		Order code for "Design"								K	L	
		Options F, J				Options G, K						
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
800	32	482	597	1079	964	534	649	1183	1065	[2]	800 [3]	1040 [4]
900	36	532	647	1179	1064	610	725	1335	1218	[2]	900 [3]	1170 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

DN 1000 to 2000 mm (40 to 78 in)

DN		Order code for "Design"				K	L	
		Options F, G, J, K						
		D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
1000	40	582	697	1279	1164	[2]	1000 [3]	1300 [4]
–	42	618	733	1351	1236	[2]	1050 [3]	1365 [4]
1200	48	696	811	1507	1392	[2]	1200 [3]	1560 [4]
–	54	809	924	1733	1617	[2]	1350 [3]	1755 [4]
1400	–	809	924	1733	1617	[2]	1400 [3]	1820 [4]
–	60	909	1024	1933	1817	[2]	1500 [3]	1950 [4]
1600	–	909	1024	1933	1817	[2]	1600 [3]	2080 [4]
–	66	960	1075	2035	1919	[2]	1650 [3]	2145 [4]
1800	72	1016	1131	2147	2032	[2]	1800 [3]	2340 [4]
–	78	1127	1242	2369	2254	[2]	2000 [3]	2600 [4]
2000	–	1127	1242	2369	2254	[2]	2000 [3]	2600 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

DN 2200 to 3000 mm (84 to 120 in)

DN		Order code for "Design"				K	L
		Option F, J					
		D [1]	E [1]	F [1]	M [1]		
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
–	84	1227	1342	2569	2454	[2]	2200
2200	–	1227	1342	2569	2454	[2]	2200
–	90	1332	1447	2779	2664	[2]	2400
2400	–	1332	1447	2783	2664	[2]	2400
–	96	1431	1546	2977	2861	[2]	2450

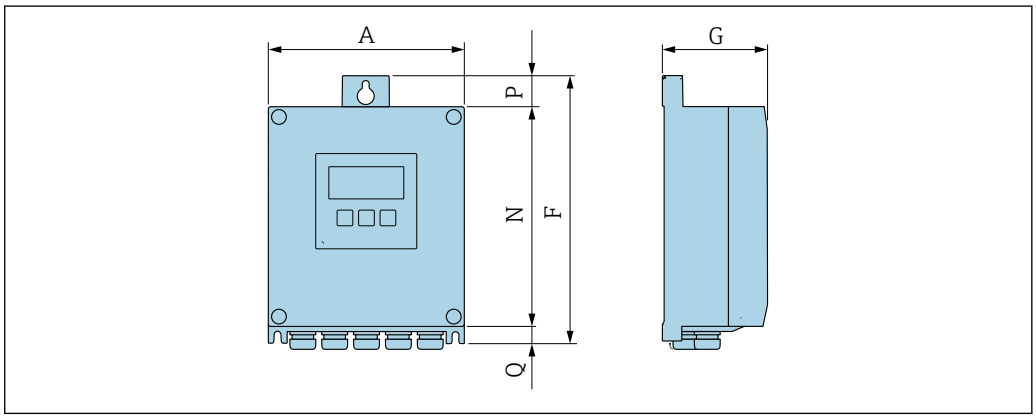
DN		Order code for "Design" Option F, J				K	L
		D [1]	E [1]	F [1]	M [1]		
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
–	102	1516	1631	3147	3032	[2]	2600
2600	–	1442	1557	2999	2883	[2]	2600
–	108	1602	1718	3320	3204	[2]	2750
2800	–	1547	1662	3209	3093	[2]	2800
–	114	1688	1803	3491	3375	[2]	2900
3000	–	1647	1762	3409	3293	[2]	3000
–	120	1774	1889	3663	3547	[2]	3050

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 90

Remote version

Transmitter remote version

Order code for "Housing", option N "Remote, polycarbonate" or option P "Remote, aluminum coated"



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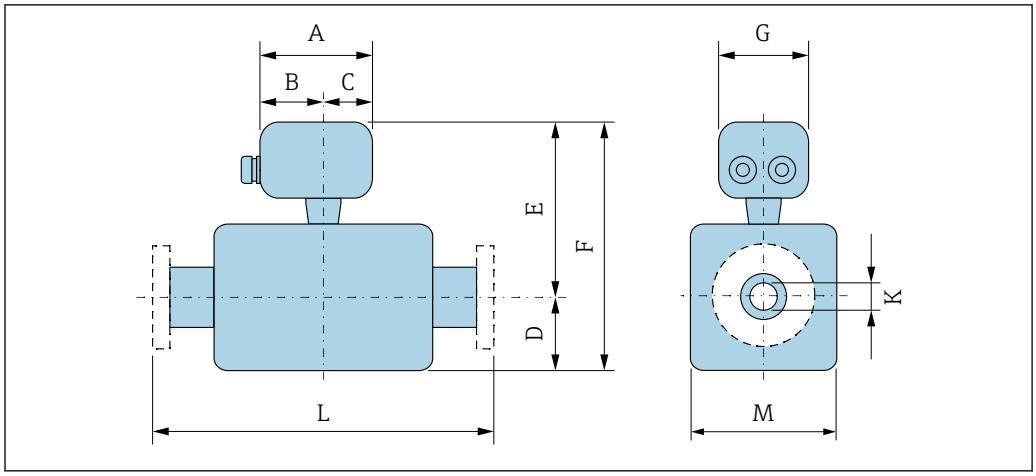
Order code for "Transmitter housing", option P "Remote, aluminum, coated"

A [mm]	F [mm]	G [mm]	N [mm]	P [mm]	Q [mm]
167	232	80	187	24	21

Order code for "Transmitter housing", option N "Remote, polycarbonate"

A [mm]	F [mm]	G [mm]	N [mm]	P [mm]	Q [mm]
177	234	90	197	17	22

Sensor connection housing



Aluminum, coated

A [mm]	B [mm]	C [mm]	G [mm]
148	94	54	136

Polycarbonate (only in conjunction with order code for "Sensor option", options CA...CE)

A [mm]	B [mm]	C [mm]	G [mm]
113	62	51	112

DN 25 to 300 mm (1 to 12 in): Sensor with aluminum half-shell housing

DN		Order code for "Design"									
		Options D, E, H, I				Option C					
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1	84	200	284	120	–	–	–	–	[2]	200
32	–	84	200	284	120	–	–	–	–	[2]	200
40	1 ½	84	200	284	120	–	–	–	–	[2]	200
50	2	84	200	284	120	84	200	284	120	[2]	200
65	–	109	225	334	180	84	200	284	120	[2]	200
80	3	109	225	334	180	84	200	284	120	[2]	200
100	4	109	225	334	180	109	225	334	180	[2]	250
125	–	150	265	415	260	109	225	334	180	[2]	250
150	6	150	265	415	260	109	225	334	180	[2]	300
200	8	180	290	470	324	150	265	415	260	[2]	350
250	10	205	315	520	400	150	265	415	260	[2]	450
300	12	230	340	570	460	180	290	470	324	[2]	500

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 25 to 300 mm (1 to 12 in): Sensor with fully welded carbon steel housing

DN		Order code for "Design"									
		Option E				Option C					
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1	70	200	270	140	–	–	–	–	[2]	200
32	–	70	200	270	140	–	–	–	–	[2]	200
40	1 ½	70	200	270	140	–	–	–	–	[2]	200
50	2	70	200	270	140	70	200	270	140	[2]	200
65	–	82	225	307	165	70	200	270	140	[2]	200
80	3	87	225	312	175	70	200	270	140	[2]	200
100	4	100	225	325	200	82	225	307	165	[2]	250
125	–	113	265	378	226	87	225	312	175	[2]	250
150	6	134	265	399	269	100	225	325	200	[2]	300
200	8	160	290	450	320	113	265	378	226	[2]	350
250	10	193	315	508	387	134	265	399	269	[2]	450
300	12	218	340	558	437	160	290	450	320	[2]	500

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 350 to 400 mm (14 to 16 in)

DN		Order code for "Design" Options E, I					
		D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
350	14	282	379	679	564	[2]	550
375	15	308	423	731	616	[2]	550
400	16	308	423	731	616	[2]	600

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 450 to 900 mm (18 to 36 in)

DN		Order code for "Design"										
		Options F, J				Options G, K						
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L	
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
450	18	290	405	695	580	333	448	781	666	[2]	600 [3]	650 [4]
500	20	315	430	745	630	359	474	833	717	[2]	600 [3]	650 [4]
600	24	365	480	845	730	411	526	937	821	[2]	600 [3]	780 [4]
700	28	426	541	967	851	512	627	1139	1024	[2]	700 [3]	910 [4]
750	30	463	578	1041	926	512	627	1139	1024	[2]	750 [3]	975 [4]

DN		Order code for "Design"								K	L	
		Options F, J				Options G, K						
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
800	32	482	597	1079	964	534	649	1183	1065	[2]	800 [3]	1040 [4]
900	36	532	647	1179	1064	610	725	1335	1218	[2]	900 [3]	1170 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

DN 1000 to 2000 mm (40 to 78 in)

DN		Order code for "Design" Options F, G, J, K				K	L	
		D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
1000	40	582	697	1279	1164	[2]	1000 [3]	1300 [4]
–	42	618	733	1351	1236	[2]	1050 [3]	1365 [4]
1200	48	696	811	1507	1392	[2]	1200 [3]	1560 [4]
–	54	809	924	1733	1617	[2]	1350 [3]	1755 [4]
1400	–	809	924	1733	1617	[2]	1400 [3]	1820 [4]
–	60	909	1024	1933	1817	[2]	1500 [3]	1950 [4]
1600	–	909	1024	1933	1817	[2]	1600 [3]	2080 [4]
–	66	960	1075	2035	1919	[2]	1650 [3]	2145 [4]
1800	72	1016	1131	2147	2032	[2]	1800 [3]	2340 [4]
–	78	1127	1242	2369	2254	[2]	2000 [3]	2600 [4]
2000	–	1127	1242	2369	2254	[2]	2000 [3]	2600 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Internal diameter depends on the liner, see the measuring tube specification → 🖹 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

DN 2200 to 3000 mm (84 to 120 in)

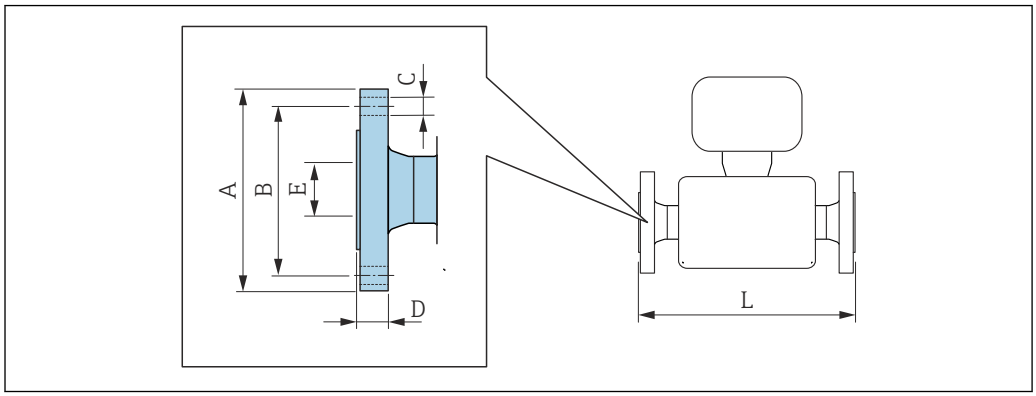
DN		Order code for "Design" Option F, J				K	L
		D [1]	E [1]	F [1]	M [1]		
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
–	84	1227	1342	2569	2454	[2]	2200
2200	–	1227	1342	2569	2454	[2]	2200
–	90	1332	1447	2779	2664	[2]	2400
2400	–	1332	1447	2783	2664	[2]	2400
–	96	1431	1546	2977	2861	[2]	2450

DN		Order code for "Design" Option F, J					
		D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
–	102	1516	1631	3147	3032	[2]	2600
2600	–	1442	1557	2999	2883	[2]	2600
–	108	1602	1718	3320	3204	[2]	2750
2800	–	1547	1662	3209	3093	[2]	2800
–	114	1688	1803	3491	3375	[2]	2900
3000	–	1647	1762	3409	3293	[2]	3000
–	120	1774	1889	3663	3547	[2]	3050

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Internal diameter depends on the liner, see the measuring tube specification → 90

Flange connections

Fixed flange



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Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 6 **Carbon steel:** *order code for "Process connection", option* **D1K** **Stainless steel:** *order code for "Process connection", option* **D1S**						
DN **[mm]**	**A** **[mm]**	**B** **[mm]**	**C** **[mm]**	**D** **[mm]**	**E** **[mm]**	**L** **[mm]**
350	490	445	12 × Ø22	22	1)	2)
400	540	495	16 × Ø22	22		
450	595	565	20 × Ø26	26		
500	645	600	20 × Ø22	24		
600	755	705	20 × Ø26	30		
700	860	810	24 × Ø26	30		
800	975	920	24 × Ø30	30		
900	1075	1020	24 × Ø30	34		
1000	1175	1120	28 × Ø30	38		
1200	1405	1340	32 × Ø33	42		
1400	1630	1560	36 × Ø36	56		
1600	1830	1760	40 × Ø36	63		
1800	2045	1970	44 × Ø39	69		
2000	2265	2180	48 × Ø42	74		
2200	2475	2390	52 × Ø42	81		
2400	2685	2600	56 × Ø42	87		
2600	2905	2810	60 × Ø48	91		
2800	3115	3020	64 × Ø48	101		
3000	3315	3220	68 × Ø48	102		
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm						

1) Depends on the liner → 🖹 90
2) Total installed length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 10
Carbon steel: *order code for "Process connection", option* **D2K**
Stainless steel: *order code for "Process connection", option* **D2S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
200	340	295	8 × Ø22	26	1)	2)
250	395	350	12 × Ø22	28		
300	445	400	12 × Ø22	28		
350	505	460	16 × Ø22	26		
400	565	515	16 × Ø26	26		
450	615	565	20 × Ø26	26		
500	670	620	20 × Ø26	28		
600	780	725	20 × Ø30	30		
700	895	840	24 × Ø30	35		
800	1015	950	24 × Ø33	38		
900	1115	1050	28 × Ø33	38		
1000	1230	1160	28 × Ø36	44		
1200	1455	1380	32 × Ø39	55		
1400	1675	1590	36 × Ø42	65		
1600	1915	1820	40 × Ø48	75		
1800	2115	2020	44 × Ø48	85		
2000	2325	2230	48 × Ø48	90		
2200	2550	2440	52 × Ø56	100		
2400	2760	2650	56 × Ø56	110		
2600	2960	2850	60 × Ø56	110		
2800	3180	3070	64 × Ø56	124		
3000	3405	3290	68 × Ø62	132		

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm

1) Depends on the liner → 🖹 90
2) Total installed length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 16
Carbon steel: *order code for "Process connection", option* **D3K**
Stainless steel: *order code for "Process connection", option* **D3S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
65	185	145	8 × Ø18	20	1)	2)
80	200	160	8 × Ø18	20		
100	220	180	8 × Ø18	22		
125	250	210	8 × Ø18	24		
150	285	240	8 × Ø22	24		
200	340	295	12 × Ø22	26		
250	405	355	12 × Ø26	32		
300	460	410	12 × Ø26	32		

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 16 **Carbon steel:** *order code for "Process connection", option* **D3K** **Stainless steel:** *order code for "Process connection", option* **D3S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
350	520	470	16 × Ø26	30		
400	580	525	16 × Ø30	32		
450	640	585	20 × Ø30	34		
500	715	650	20 × Ø33	36		
600	840	770	20 × Ø36	40		
700	910	840	24 × Ø36	40		
800	1025	950	24 × Ø39	41		
900	1125	1050	28 × Ø39	48		
1000	1255	1170	28 × Ø42	59		
1200	1485	1390	32 × Ø48	78		
1400	1685	1590	36 × Ø48	84		
1600	1930	1820	40 × Ø56	102		
1800	2130	2020	44 × Ø56	110		
2000	2345	2230	48 × Ø62	124		
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm						

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 25 **Carbon steel:** *order code for "Process connection", option* **D4K** **Stainless steel:** *order code for "Process connection", option* **D4S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
200	360	310	12 × Ø26	32	1)	2)
250	425	370	12 × Ø30	36		
300	485	430	16 × Ø30	40		
350	555	490	16 × Ø33	38		
400	620	550	16 × Ø36	40		
450	670	600	20 × Ø36	46		
500	730	660	20 × Ø36	48		
600	845	770	20 × Ø39	48		
700	960	875	24 × Ø42	50		
800	1085	990	24 × Ø48	53		
900	1185	1090	28 × Ø48	57		
1000	1320	1210	28 × Ø56	63		
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm						

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 40
Carbon steel: *order code for "Process connection", option* **D5K**
Stainless steel: *order code for "Process connection", option* **D5S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	115	85	4 × Ø14	16	1)	2)
32	140	100	4 × Ø18	18		
40	150	110	4 × Ø18	18		
50	165	125	4 × Ø18	20		
65	185	145	8 × Ø18	24		
80	200	160	8 × Ø18	26		
100	235	190	8 × Ø22	26		
125	270	220	8 × Ø26	28		
150	300	250	8 × Ø26	30		

Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange according to ASME B16.5, Class 150
Carbon steel: *order code for "Process connection", option* **A1K**
Stainless steel: *order code for "Process connection", option* **A1S**

DN		A	B	C	D	E	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1	108	79.2	4 × Ø16	12.6	1)	2)
40	1 ½	127	98.6	4 × Ø16	15.9		
50	2	152.4	120.7	4 × Ø19.1	17.5		
80	3	190.5	152.4	4 × Ø19.1	22.3		
100	4	228.6	190.5	8 × Ø19.1	22.3		
150	6	279.4	241.3	8 × Ø22.4	23.8		
200	8	342.9	298.5	8 × Ø22.4	26.8		
250	10	406.4	362	12 × Ø25.4	29.6		
300	12	482.6	431.8	12 × Ø25.4	30.2		
350	14	535	476.3	12 × Ø28.6	35.4		
400	16	595	539.8	16 × Ø28.6	37		
450	18	635	577.9	16 × Ø31.8	40.1		
500	20	700	635	20 × Ø31.8	43.3		
600	24	815	749.3	20 × Ø34.9	48.1		

Surface roughness (flange): Ra 6.3 to 12.5 µm

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange according to ASME B16.5, Class 300
Carbon steel: *order code for "Process connection", option* **A2K**
Stainless steel: *order code for "Process connection", option* **A2S**

DN		A	B	C	D	E	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1	123.9	88.9	4 × Ø19.1	15.9	1)	2)
40	1 ½	155.4	114.3	4 × Ø22.4	19		
50	2	165.1	127	8 × Ø19.1	20.8		
80	3	209.6	168.1	8 × Ø22.4	26.8		
100	4	254	200.2	8 × Ø22.4	30.2		
150	6	317.5	269.7	12 × Ø22.4	35		
Surface roughness (flange): Ra 6.3 to 12.5 µm							

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange according to JIS B2220, 10K
Carbon steel: *order code for "Process connection", option* **N3K**
Stainless steel: *order code for "Process connection", option* **N3S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
50	155	120	4 × Ø19	16	1)	2)
65	175	140	4 × Ø19	18		
80	185	150	8 × Ø19	18		
100	210	175	8 × Ø19	18		
125	250	210	8 × Ø23	20		
150	280	240	8 × Ø23	22		
200	330	290	12 × Ø23	22		
250	400	355	12 × Ø25	24		
300	445	400	16 × Ø25	24		
Surface roughness (flange): Ra 6.3 to 12.5 µm						

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange according to JIS B2220, 20K
Carbon steel: *order code for "Process connection", option* **N4K**
Stainless steel: *order code for "Process connection", option* **N4S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
25	125	90	4 × Ø19	16	1)	2)
32	135	100	4 × Ø19	18		
40	140	105	4 × Ø19	18		
50	155	120	8 × Ø19	18		
65	175	140	8 × Ø19	20		
80	200	160	8 × Ø23	22		
100	225	185	8 × Ø23	24		

Flange according to JIS B2220, 20K
Carbon steel: *order code for "Process connection", option* **N4K**
Stainless steel: *order code for "Process connection", option* **N4S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [mm]
125	270	225	8 × Ø25	26		
150	305	260	12 × Ø25	28		
200	350	305	12 × Ø25	30		
250	430	380	12 × Ø27	34		
300	480	430	16 × Ø27	36		
Surface roughness (flange): Ra 6.3 to 12.5 µm						

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange according to AWWA, Class D
Order code for "Process connection", option **W1K**

DN		A	B	C	D	E	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
700	28	927	863.6	28 × Ø35	33.4	1)	2)
750	30	984	914.4	28 × Ø35	35.0		
800	32	1060	977.9	28 × Ø42	38.1		
900	36	1168	1085.9	32 × Ø42	41.3		
1000	40	1289	1200.2	36 × Ø42	41.3		
–	42	1346	1257.3	36 × Ø42	44.5		
1200	48	1511	1422.4	44 × Ø42	47.7		
–	54	1683	1593.9	44 × Ø48	54.0		
–	60	1855	1759.0	52 × Ø48	57.2		
–	66	2032	1930.4	52 × Ø48	63.5		
1800	72	2197	2095.5	60 × Ø48	66.7		
–	78	2362	2260.6	64 × Ø54	69.9		
–	84	2535	2425.7	64 × Ø54	73.1		
–	90	2705	2717.8	68 × Ø60	76.2		
–	96	2877	2755.9	68 × Ø60.3	82.55		
–	102	3048	2908.3	68 × Ø66.7	82.55		
–	108	3219	3067.0	68 × Ø66.7	85.73		
–	114	3391	3219.5	68 × Ø73	88.90		
–	120	3562	3371.8	68 × Ø73	88.90		
Surface roughness (flange): Ra 6.3 to 12.5 µm							

1) Depends on the liner → 🖹 90
2) Total length is independent of the process connections. Installed length according to DVGW → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange according to AS 2129, Tab. E *Order code for "Process connection", option* **M2K**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
80	185	146	4 × Ø18	12	1)	2)
100	215	178	8 × Ø18	13		
150	280	235	8 × Ø22	17		
200	335	292	8 × Ø22	19		
250	405	356	12 × Ø22	22		
300	455	406	12 × Ø26	25		
350	525	470	12 × Ø26	30		
400	580	521	12 × Ø26	32		
450	640	584	16 × Ø26	35		
500	705	641	16 × Ø26	38		
600	825	756	16 × Ø33	48		
700	910	845	20 × Ø33	51		
750	995	927	20 × Ø36	54		
800	1060	984	20 × Ø36	54		
900	1175	1092	24 × Ø36	64		
1000	1255	1175	24 × Ø39	67		
1200	1490	1410	32 × Ø39	79		
Surface roughness (flange): Ra 6.3 to 12.5 µm						

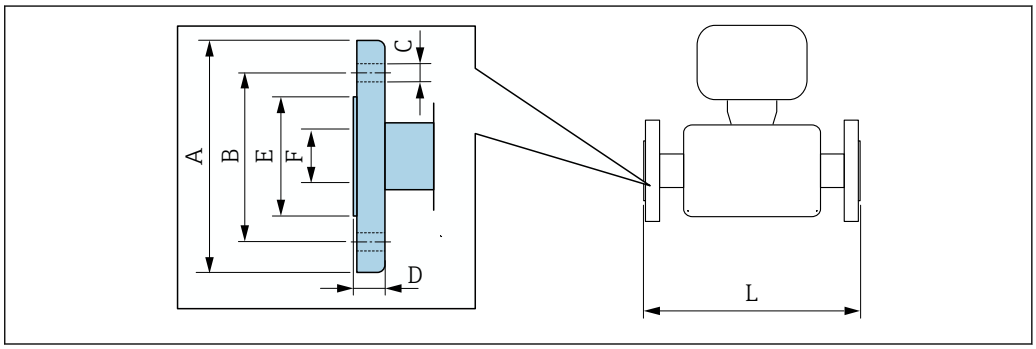
1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Flange according to AS 4087, PN 16 *Order code for "Process connection", option* **M3K**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
80	185	146	4 × Ø18	12	1)	2)
100	215	178	4 × Ø18	13		
150	280	235	8 × Ø18	13		
200	335	292	8 × Ø18	19		
250	405	356	8 × Ø22	19		
300	455	406	12 × Ø22	23		
350	525	470	12 × Ø26	30		
375	550	495	12 × Ø26	30		
400	580	521	12 × Ø26	32		
450	640	584	12 × Ø26	30		
500	705	641	16 × Ø26	38		
600	825	756	16 × Ø30	48		
700	910	845	20 × Ø30	56		
750	995	927	20 × Ø33	56		
800	1060	984	20 × Ø36	56		

Flange according to AS 4087, PN 16 *Order code for "Process connection", option* **M3K**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [mm]**
900	1175	1092	24 × Ø36	66		
1000	1255	1175	24 × Ø36	66		
1200	1490	1410	32 × Ø36	76		
Surface roughness (flange): Ra 6.3 to 12.5 µm						

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Lap joint flange



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Lap joint flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 10 **Carbon steel:** *order code for "Process connection", option* **D22** **Stainless steel:** *order code for "Process connection", option* **D24**								
DN		**A**	**B**	**C**	**D**	**E**	**F**	**L**
[mm]	**[in]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**
200	8	340	295	8 × Ø22	24	264	1)	2)
250	10	395	350	12 × Ø22	26	317		
300	12	445	400	12 × Ø22	26	367		
Surface roughness (flange): Ra 6.3 to 12.5 µm								

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Lap joint flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 16 **Carbon steel:** *order code for "Process connection", option* **D32** **Stainless steel:** *order code for "Process connection", option* **D34**								
DN		**A**	**B**	**C**	**D**	**E**	**F**	**L**
[mm]	**[in]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**	**[mm]**
25	1	115	85	4 × Ø14	16	49	1)	2)
32	-	140	100	4 × Ø18	18	65		
40	1 ½	150	110	4 × Ø18	18	71		
50	2	165	125	4 × Ø18	20	88		
65	-	185	145	8 × Ø18	20	103		
80	3	200	160	8 × Ø18	20	120		

Lap joint flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 16
Carbon steel: *order code for "Process connection", option* **D32**
Stainless steel: *order code for "Process connection", option* **D34**

DN		A	B	C	D	E	F	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
100	4	220	180	8 × Ø18	22	148		
125	-	250	210	8 × Ø18	22	177		
150	6	285	240	8 × Ø22	24	209		
200	8	340	295	12 × Ø22	26	264		
250	10	405	355	12 × Ø26	29	317		
300	12	460	410	12 × Ø26	32	367		
Surface roughness (flange): Ra 6.3 to 12.5 µm								

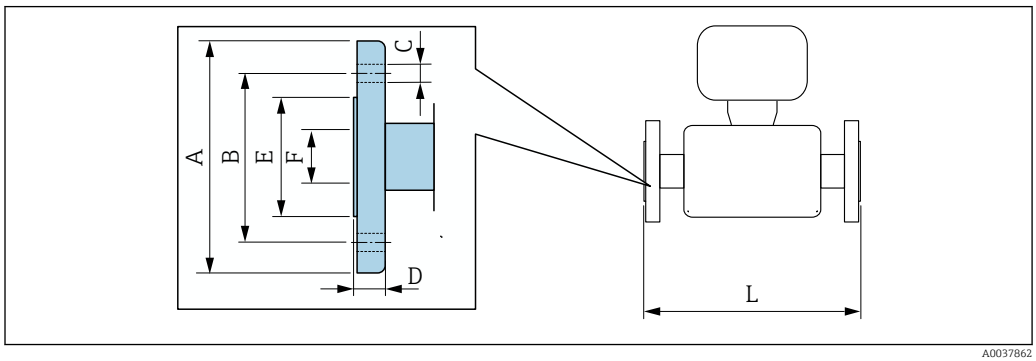
1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Lap joint flange according to ASME B16.5, Class 150
Carbon steel: *order code for "Process connection", option* **A12**
Stainless steel: *order code for "Process connection", option* **A14**

DN		A	B	C	D	E	F	L
[mm]	[in]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1	110	80	4 × Ø16	14	49	1)	2)
40	1 ½	125	98	4 × Ø16	17.5	71		
50	2	150	121	4 × Ø19	19	88		
80	3	190	152	4 × Ø19	24	120		
100	4	230	190	8 × Ø19	24	148		
150	6	280	241	8 × Ø23	25	209		
200	8	345	298	8 × Ø23	29	264		
250	10	405	362	12 × Ø25	30	317		
300	12	485	432	12 × Ø25	32	378		
Surface roughness (flange): Ra 6.3 to 12.5 µm								

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Lap joint flange, stamped plate



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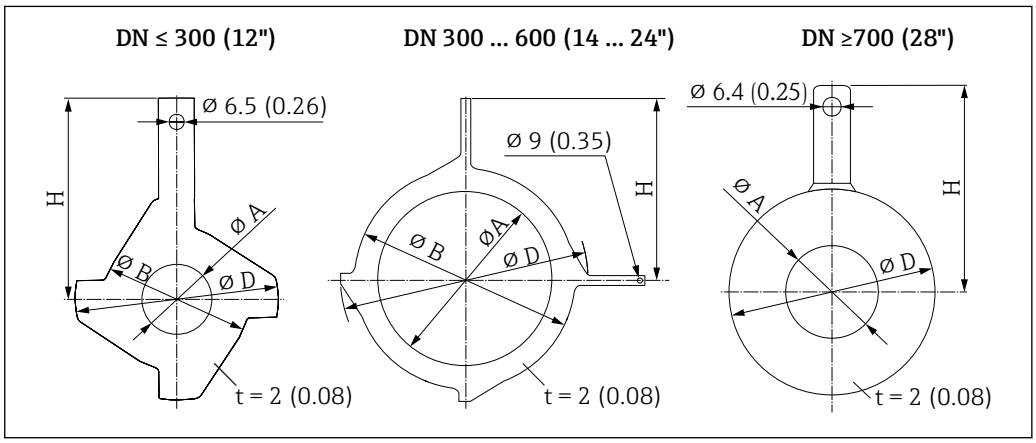
Lap joint flange, stamped plate in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 10 **Carbon steel:** *order code for "Process connection", option* **D21** **Stainless steel:** *order code for "Process connection", option* **D23**							
DN **[mm]**	**A** **[mm]**	**B** **[mm]**	**C** **[mm]**	**D** **[mm]**	**E** **[mm]**	**F** **[mm]**	**L** **[mm]**
25	115	85	4 x Ø13.5	16.5	49	1)	2)
32	140	100	4 x Ø17.5	17	65		
40	150	110	4 x Ø17.5	16.5	71		
50	165	125	4 x Ø17.5	18.5	88		
65	185	145	4 x Ø17.5	20	103		
80	200	160	8 x Ø17.5	23.5	120		
100	220	180	8 x Ø17.5	24.5	148		
125	250	210	8 x Ø17.5	24	177		
150	285	240	8 x Ø21.5	25	209		
200	340	295	8 x Ø21.5	27.5	264		
250	405	350	12 x Ø21.5	30.5	317		
300	445	400	12 x Ø21.5	34.5	367		
Surface roughness (flange): Ra 6.3 to 12.5 µm							

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 54 (compact version) → 🖹 58 (remote version)

Accessories

Ground disks for flange connections



DN		**Pressure rating**	**A**		**B**		**D**		**H**	
[mm]	**[inch]**		**[mm]**	**[inch]**	**[mm]**	**[inch]**	**[mm]**	**[inch]**	**[mm]**	**[inch]**
25	1"	1)	26	1.02	62	2.44	77.5	3.05	87.5	3.44
32	1 ¼"	1)	35	1.38	80	3.15	87.5	3.44	94.5	3.72
40	1 ½"	1)	41	1.61	82	3.23	101	3.98	103	4.06
50	2"	1)	52	2.05	101	3.98	115.5	4.55	108	4.25
65	2 ½"	1)	68	2.68	121	4.76	131.5	5.18	118	4.65
80	3"	1)	80	3.15	131	5.16	154.5	6.08	135	5.31

DN		Pressure rating	A		B		D		H	
[mm]	[inch]		[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
100	4"	[1]	104	4.09	156	6.14	186.5	7.34	153	6.02
125	5"	[1]	130	5.12	187	7.36	206.5	8.13	160	6.30
150	6"	[1]	158	6.22	217	8.54	256	10.08	184	7.24
200	8"	[1]	206	8.11	267	10.51	288	11.34	205	8.07
250	10"	[1]	260	10.2	328	12.91	359	14.13	240	9.45
300	12"	PN 10 PN 16 Cl. 150	312	12.3	375	14.76	413	16.26	273	10.75
		PN 25 JIS 10K JIS 20K	310	12.2	375	14.76	404	15.91	268	10.55
350	14"	PN 6	420	16.5	420	16.54	479	18.86	365	14.37
		PN 10								
		PN 16								
375	15"	PN 16	461	18.2	461	18.2	523	20.6	395	15.6
400	16"	PN 6	470	18.5	470	18.50	542	21.34	395	15.55
		PN 10								
		PN 16								
450	18"	PN 6	525	20.7	525	20.67	583	22.95	417	16.42
		PN 10								
		PN 16								
500	20"	PN 6	575	22.6	575	22.64	650	25.59	460	18.11
		PN 10								
		PN 16								
600	24"	PN 6	676	26.6	676	26.61	766	30.16	522	20.55
		PN 10								
		PN 16								
700	28"	PN 6	697	27.4	–	–	786	30.94	460	18.11
		PN10	693	27.3	–	–	813	32.01	480	18.9
		PN16	687	27.1	–	–	807	31.77	490	19.29
		Cl, D	693	27.3	–	–	832	32.76	494	19.45
750	30"	Cl, D	743	29.3	–	–	833	32.8	523	20.59
800	32"	PN 6	799	31.5	–	–	893	35.16	520	20.47
		PN 10	795	31.3	–	–	920	36.22	540	21.26
		PN 16	789	31.1	–	–	914	35.98	550	21.65
		Cl, D	795	31.3	–	–	940	37.01	561	22.09
900	36"	PN 6	897	35.3	–	–	993	39.09	570	22.44
		PN 10	893	35.2	–	–	1020	40.16	590	23.23
		PN 16	886	34.9	–	–	1014	39.92	595	23.43
		Cl, D	893	35.2	–	–	1048	41.26	615	24.21
1000	40"	PN 6	999	39.3	–	–	1093	43.03	620	24.41
		PN 10	995	39.2	–	–	1127	44.37	650	25.59
		PN 16	988	38.9	–	–	1131	44.53	660	25.98

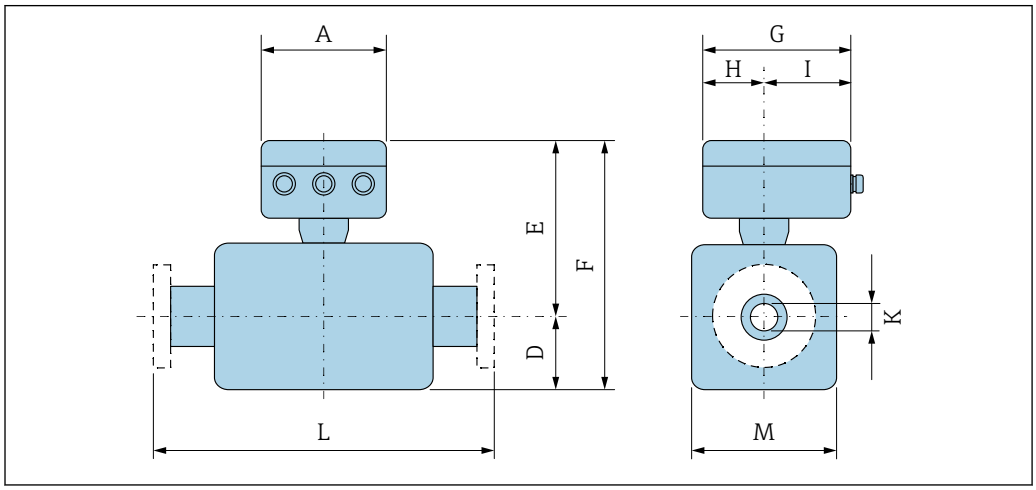
DN		Pressure rating	A		B		D		H	
[mm]	[inch]		[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
		Cl, D	995	39.2	–	–	1163	45.79	675	26.57
–	42"	PN 6	1044	41.1	–	–	1220	48.03	704	27.72
1200	48"	PN 6	1203	47.4	–	–	1310	51.57	733	28.86
		PN 10	1196	47.1	–	–	1344	52.91	760	29.92
		PN 16	1196	47.1	–	–	1385	54.53	786	30.94
		Cl, D	1188	46.8	–	–	1345	52.95	775	30.51

1) In the case of DN 25 to 250, ground disks can be used for all the flange standards/pressure ratings which can be supplied in the standard version

Dimensions in US units

Compact version

Order code for "Housing", option A "Compact, aluminum, coated" or option M "Compact, polycarbonate"



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A [in]	G [1] [in]	H [in]	I [1] [in]
6.57	7.60	3.54	4.06

1) Depending on the cable gland used: values up to + 1.18 in

DN 1 to 12 in (25 to 300 mm): Sensor with aluminum half-shell housing

DN		Order code for "Design"									
		Options D, E, H, I				Option C					
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
25	1	3.31	7.91	11.22	4.72	–	–	–	–	[2]	7.87
32	–	3.31	7.91	11.22	4.72	–	–	–	–	[2]	7.87
40	1 ½	3.31	7.91	11.22	4.72	–	–	–	–	[2]	7.87
50	2	3.31	7.91	11.22	4.72	3.31	7.91	11.22	4.72	[2]	7.87
65	–	4.29	8.9	13.19	7.09	3.31	7.91	11.22	4.72	[2]	7.87
80	3	4.29	8.9	13.19	7.09	3.31	7.91	11.22	4.72	[2]	7.87
100	4	4.29	8.9	13.19	7.09	4.29	8.9	13.19	7.09	[2]	9.84
125	–	5.91	10.47	16.38	10.24	4.29	8.9	13.19	7.09	[2]	9.84
150	6	5.91	10.47	16.38	10.24	4.29	8.9	13.19	7.09	[2]	11.81
200	8	7.09	11.46	18.54	12.76	5.91	10.47	16.38	10.24	[2]	13.78
250	10	8.07	12.44	20.51	15.75	5.91	10.47	16.38	10.24	[2]	17.72
300	12	9.06	13.43	22.48	18.11	7.09	11.46	18.54	12.76	[2]	19.69

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 14 to 16 in (350 to 400 mm)

DN		Order code for "Design" Options E, I				K	L
		D [1]	E [1]	F [1]	M [1]		
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
350	14	11.10	15.63	26.73	22.20	[2]	21.65
375	15	12.13	16.65	28.78	24.25	[2]	23.62
400	16	12.13	16.65	28.78	24.25	[2]	23.62

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 90

DN 18 to 36 in (450 to 900 mm)

DN		Order code for "Design" Options F, J				Options G, K				K	L	
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	
450	18	11.42	15.94	27.36	22.83	13.11	17.64	30.75	26.22	[2]	23.62 [3]	25.59 [4]
500	20	12.40	16.93	29.33	24.80	14.13	18.66	32.80	28.23	[2]	23.62 [2]	25.59 [4]
600	24	14.37	18.90	33.27	28.74	16.18	20.71	36.89	32.32	[2]	23.62 [2]	30.71 [4]
700	28	16.77	21.30	38.07	33.50	20.16	24.69	44.84	40.31	[2]	27.56 [2]	35.83 [4]
750	30	18.23	22.76	40.98	36.46	20.16	24.69	44.84	40.31	[2]	29.53 [2]	38.39 [4]
800	32	18.98	23.50	42.48	37.95	21.02	25.55	46.57	41.93	[2]	31.5 [2]	40.94 [4]
900	36	20.94	25.47	46.42	41.89	24.02	28.54	52.56	47.95	[2]	35.43 [2]	46.06 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

DN 40 to 78 in (1000 to 2000 mm)

DN		Order code for "Design" Options F, G, J, K				K	L	
		D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	
1000	40	22.91	27.44	50.35	45.83	[2]	39.37 [3]	51.18 [4]
–	42	24.33	28.86	53.19	48.66	[2]	41.34 [3]	53.74 [4]
1200	48	27.40	31.93	59.33	54.80	[2]	47.24 [3]	61.42 [4]
–	54	31.85	36.38	68.23	63.66	[2]	53.15 [3]	69.09 [4]
1400	–	31.85	36.38	68.23	63.66	[2]	55.12 [3]	71.65 [4]
–	60	35.79	40.31	76.10	71.54	[2]	59.06 [3]	76.77 [4]
1600	–	35.79	40.31	76.10	71.54	[2]	62.99 [3]	81.89 [4]
–	66	37.80	42.32	80.12	75.55	[2]	64.96 [3]	84.45 [4]
1800	72	40.00	44.53	84.53	80.00	[2]	70.87 [3]	92.13 [4]

DN		Order code for "Design" Options F, G, J, K				K	L	
		D [1]	E [1]	F [1]	M [1]			
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	
–	78	44.37	48.90	93.27	88.74	[2]	78.74 [3]	102.36 [4]
2000	–	44.37	48.90	93.27	88.74	[2]	78.74 [3]	102.36 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

DN 84 to 120 in (2200 to 3000 mm)

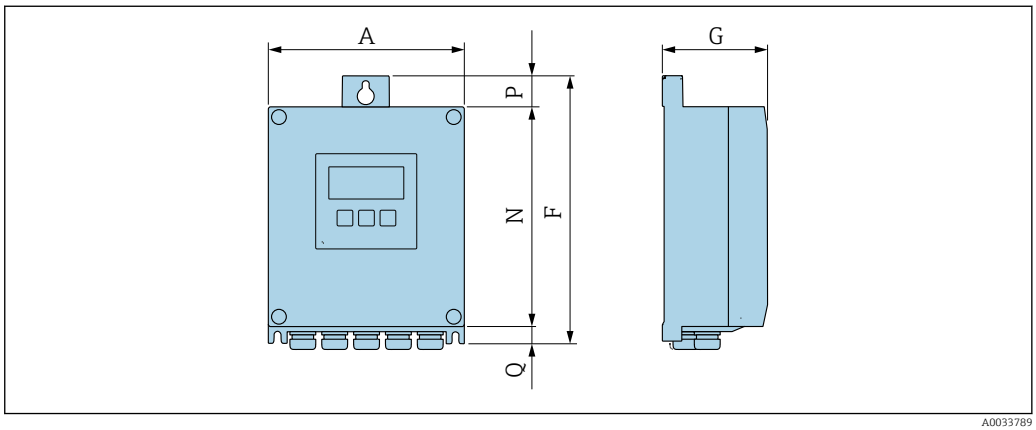
DN		Order code for "Design" Option F, J				K	L
		D [1]	E [1]	F [1]	M [1]		
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
–	84	48.31	52.83	101.14	96.61	[2]	86.61
2200	–	48.31	52.83	101.14	96.61	[2]	86.61
–	90	52.44	56.97	109.41	104.88	[2]	94.49
2400	–	52.44	56.97	109.57	104.88	[2]	94.49
–	96	56.34	60.87	117.20	112.64	[2]	96.46
–	102	59.69	64.21	123.90	119.37	[2]	102.36
2600	–	56.77	61.30	118.07	113.50	[2]	102.36
–	108	63.07	67.64	130.71	126.14	[2]	108.27
2800	–	60.91	65.43	126.34	121.77	[2]	110.24
–	114	66.46	70.98	137.44	132.87	[2]	114.17
3000	–	64.84	69.37	134.21	129.65	[2]	118.11
–	120	69.84	74.37	144.21	139.65	[2]	120.08

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

Remote version

Transmitter remote version

Order code for "Housing", option N "Remote, polycarbonate" or option P "Remote, aluminum coated"



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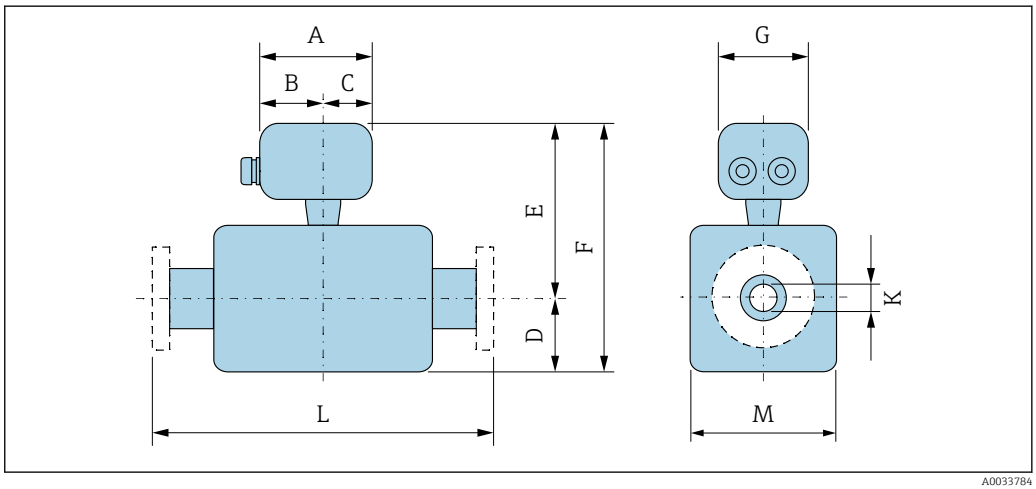
Order code for "Transmitter housing", option P "Remote, aluminum, coated"

A [in]	F [in]	G [in]	N [in]	P [in]	Q [in]
6.57	9.13	3.15	7.36	0.94	0.83

Order code for "Transmitter housing", option N "Remote, polycarbonate"

A [in]	F [in]	G [in]	N [in]	P [in]	Q [in]
6.97	9.21	3.54	7.76	0.67	0.87

Sensor connection housing



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Aluminum, coated

A [in]	B [in]	C [in]	G [in]
5.83	3.7	2.13	5.35

Polycarbonate (only in conjunction with order code for "Sensor option", options CA...CE)

A [in]	B [in]	C [in]	G [in]
4.45	2.44	2.01	4.41

DN 1 to 12 in (25 to 300 mm): Sensor with aluminum half-shell housing

DN		Order code for "Design"									
		Options D, E, H, I				Option C					
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
25	1	3.31	7.87	11.18	4.72	–	–	–	–	[2]	7.87
32	–	3.31	7.87	11.18	4.72	–	–	–	–	[2]	7.87
40	1 ½	3.31	7.87	11.18	4.72	–	–	–	–	[2]	7.87
50	2	3.31	7.87	11.18	4.72	3.31	7.87	11.18	4.72	[2]	7.87
65	–	4.29	8.86	13.15	7.09	3.31	7.87	11.18	4.72	[2]	7.87
80	3	4.29	8.86	13.15	7.09	3.31	7.87	11.18	4.72	[2]	7.87
100	4	4.29	8.86	13.15	7.09	4.29	8.86	13.15	7.09	[2]	9.84
125	–	5.91	10.43	16.34	10.24	4.29	8.86	13.15	7.09	[2]	9.84
150	6	5.91	10.43	16.34	10.24	4.29	8.86	13.15	7.09	[2]	11.81
200	8	7.09	11.42	18.5	12.76	5.91	10.43	16.34	10.24	[2]	13.78
250	10	8.07	12.4	20.47	15.75	5.91	10.43	16.34	10.24	[2]	17.72
300	12	9.06	13.39	22.44	18.11	7.09	11.42	18.5	12.76	[2]	19.69

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 1 to 12 in (25 to 300 mm): Sensor with fully welded carbon steel housing

DN		Order code for "Design"									
		Option E				Option C					
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
25	1	2.76	7.87	10.63	5.51	–	–	–	–	[2]	7.87
32	–	2.76	7.87	10.63	5.51	–	–	–	–	[2]	7.87
40	1 ½	2.76	7.87	10.63	5.51	–	–	–	–	[2]	7.87
50	2	2.76	7.87	10.63	5.51	2.76	7.87	10.63	5.51	[2]	7.87
65	–	3.23	8.86	12.09	6.5	2.76	7.87	10.63	5.51	[2]	7.87
80	3	3.43	8.86	12.28	6.89	2.76	7.87	10.63	5.51	[2]	7.87
100	4	3.94	8.86	12.8	7.87	3.23	8.86	12.09	6.5	[2]	9.84
125	–	4.45	10.43	14.88	8.9	3.43	8.86	12.28	6.89	[2]	9.84
150	6	5.28	10.43	15.71	10.59	3.94	8.86	12.8	7.87	[2]	11.81
200	8	6.3	11.42	17.72	12.6	4.45	10.43	14.88	8.9	[2]	13.78

DN		Order code for "Design"									
		Option E				Option C					
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
250	10	7.6	12.4	20	15.24	5.28	10.43	15.71	10.59	[2]	17.72
300	12	8.58	13.39	21.97	17.2	6.3	11.42	17.72	12.6	[2]	19.69

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 14 to 16 in (350 to 400 mm)

DN		Order code for "Design" Options E, I					
		D [1]	E [1]	F [1]	M [1]	K	L
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
350	14	11.10	15.63	26.73	22.20	[2]	21.65
375	15	12.13	16.65	28.78	24.25	[2]	23.62
400	16	12.13	16.65	28.78	24.25	[2]	23.62

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90

DN 18 to 36 in (450 to 900 mm)

DN		Order code for "Design"										
		Options F, J				Options G, K						
		D [1]	E [1]	F [1]	M [1]	D [1]	E [1]	F [1]	M [1]	K	L	
[mm]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]	
450	18	11.42	15.94	27.36	22.83	13.11	17.64	30.75	26.22	[2]	23.62 [3]	25.59 [4]
500	20	12.40	16.93	29.33	24.80	14.13	18.66	32.80	28.23	[2]	23.62 [3]	25.59 [4]
600	24	14.37	18.90	33.27	28.74	16.18	20.71	36.89	32.32	[2]	23.62 [3]	30.71 [4]
700	28	16.77	21.30	38.07	33.50	20.16	24.69	44.84	40.31	[2]	27.56 [3]	35.83 [4]
750	30	18.23	22.76	40.98	36.46	20.16	24.69	44.84	40.31	[2]	29.53 [3]	38.39 [4]
800	32	18.98	23.50	42.48	37.95	21.02	25.55	46.57	41.93	[2]	31.5 [3]	40.94 [4]
900	36	20.94	25.47	46.42	41.89	24.02	28.54	52.56	47.95	[2]	35.43 [3]	46.06 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Depends on the liner → 🖹 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

DN 40 to 78 in (1000 to 2000 mm)

DN		Order code for "Design" Options F, G, J, K				K	L	
[mm]	[in]	D [1] [in]	E [1] [in]	F [1] [in]	M [1] [in]	[in]	[in]	
1000	40	22.91	27.44	50.35	45.83	[2]	39.37 [3]	51.18 [4]
–	42	24.33	28.86	53.19	48.66	[2]	41.34 [3]	53.74 [4]
1200	48	27.40	31.93	59.33	54.80	[2]	47.24 [3]	61.42 [4]
–	54	31.85	36.38	68.23	63.66	[2]	53.15 [3]	69.09 [4]
1400	–	31.85	36.38	68.23	63.66	[2]	55.12 [3]	71.65 [4]
–	60	35.79	40.31	76.10	71.54	[2]	59.06 [3]	76.77 [4]
1600	–	35.79	40.31	76.10	71.54	[2]	62.99 [3]	81.89 [4]
–	66	37.80	42.32	80.12	75.55	[2]	64.96 [3]	84.45 [4]
1800	72	40.00	44.53	84.53	80.00	[2]	70.87 [3]	92.13 [4]
–	78	44.37	48.90	93.27	88.74	[2]	78.74 [3]	102.36 [4]
2000	–	44.37	48.90	93.27	88.74	[2]	78.74 [3]	102.36 [4]

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Internal diameter depends on the liner, see the measuring tube specification → 🖹 90
3) Order code for "Design", option F "Fixed flange, short installed length" and option J "Fixed flange, short installed length, 0 x DN inlet/outlet runs"
4) Order code for "Design", option G "Fixed flange, long installed length" and option K "Fixed flange, long installed length 0 x DN inlet/outlet runs"

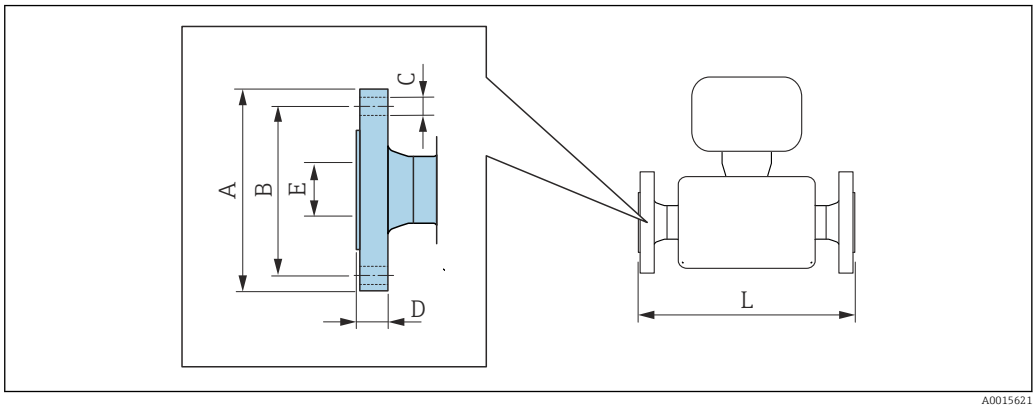
DN 84 to 120 in (2200 to 3000 mm)

DN		Order code for "Design" Option F, J				K	L
[mm]	[in]	D [1] [in]	E [1] [in]	F [1] [in]	M [1] [in]	[in]	[in]
–	84	48.31	52.83	101.14	96.61	[2]	86.61
2200	–	48.31	52.83	101.14	96.61	[2]	86.61
–	90	52.44	56.97	109.41	104.88	[2]	94.49
2400	–	52.44	56.97	109.57	104.88	[2]	94.49
–	96	56.34	60.87	117.20	112.64	[2]	96.46
–	102	59.69	64.21	123.90	119.37	[2]	102.36
2600	–	56.77	61.30	118.07	113.50	[2]	102.36
–	108	63.07	67.64	130.71	126.14	[2]	108.27
2800	–	60.91	65.43	126.34	121.77	[2]	110.24
–	114	66.46	70.98	137.44	132.87	[2]	114.17
3000	–	64.84	69.37	134.21	129.65	[2]	118.11
–	120	69.84	74.37	144.21	139.65	[2]	120.08

1) The dimensions are reference values. They may vary depending on the pressure rating, design and order option.
2) Internal diameter depends on the liner, see the measuring tube specification → 🖹 90

Flange connections

Fixed flange



A0015621

Flange according to ASME B16.5, Class 150 **Carbon steel:** *order code for "Process connection", option* **A1K** **Stainless steel:** *order code for "Process connection", option* **A1S**							
DN		**A**	**B**	**C**	**D**	**E**	**L**
[mm]	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**
25	1	4.25	3.12	4 × Ø0.63	0.5	1)	2)
40	1 ½	5	3.88	4 × Ø0.63	0.63		
50	2	6	4.75	4 × Ø0.75	0.69		
80	3	7.5	6	4 × Ø0.75	0.88		
100	4	9	7.5	8 × Ø0.75	0.88		
150	6	11	9.5	8 × Ø0.88	0.94		
200	8	13.5	11.75	8 × Ø0.88	1.06		
250	10	16	14.25	12 × Ø1	1.17		
300	12	19	17	12 × Ø1	1.19		
350	14	21.06	18.75	12 × Ø1.13	1.39		
400	16	23.43	21.25	16 × Ø1.13	1.46		
450	18	25	22.75	16 × Ø1.25	1.58		
500	20	27.56	25	20 × Ø1.25	1.7		
600	24	32.09	29.5	20 × Ø1.37	1.89		
Surface roughness (flange): Ra 250 to 492 µm							

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 74 (compact version) → 🖹 77 (remote version)

Flange according to ASME B16.5, Class 300 **Carbon steel:** *order code for "Process connection", option* **A2K** **Stainless steel:** *order code for "Process connection", option* **A2S**							
DN		**A**	**B**	**C**	**D**	**E**	**L**
[in]	**[mm]**	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**
1	25	4.88	3.5	4 × Ø0.75	0.63	1)	2)
1 ½	40	6.12	4.5	4 × Ø0.88	0.75		
2	50	6.5	5	8 × Ø0.75	0.82		

Flange according to ASME B16.5, Class 300
Carbon steel: *order code for "Process connection", option* **A2K**
Stainless steel: *order code for "Process connection", option* **A2S**

DN		A	B	C	D	E	L
[in]	[mm]	[in]	[in]	[in]	[in]	[in]	[in]
3	80	8.25	6.62	8 × Ø0.88	1.06		
4	100	10	7.88	8 × Ø0.88	1.19		
6	150	12.5	10.62	12 × Ø0.88	1.38		
Surface roughness (flange): Ra 250 to 492 µm							

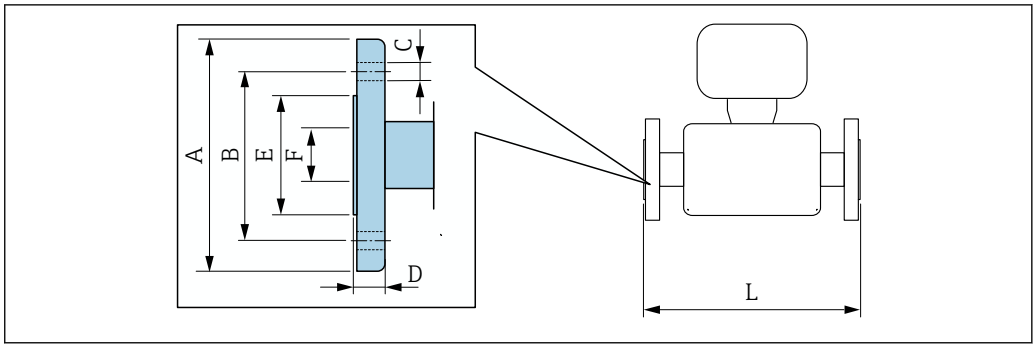
1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 74 (compact version) → 🖹 77 (remote version)

Flange according to AWWA, Cl. D
Order code for "Process connection", option **W1K**

DN		A	B	C	D	E	L
[in]	[mm]	[in]	[in]	[in]	[in]	[in]	[in]
28	700	36.50	34.00	28 × Ø1.38	1.31	1)	2)
30	–	38.74	36.00	28 × Ø1.38	1.38		
32	800	41.73	38.50	28 × Ø1.65	1.50		
36	900	45.98	42.75	32 × Ø1.65	1.63		
40	1000	50.75	47.25	36 × Ø1.65	1.63		
42	–	52.99	49.50	36 × Ø1.65	1.75		
48	1200	59.49	56.00	44 × Ø1.65	1.88		
54	–	66.26	62.75	44 × Ø1.89	2.13		
60	–	73.03	69.25	52 × Ø1.89	2.25		
66	–	80.00	76.00	52 × Ø1.89	2.50		
72	1800	86.50	82.50	60 × Ø1.89	2.63		
78	–	92.99	89.00	64 × Ø2.13	2.75		
84	–	99.80	95.50	64 × Ø2.13	2.88		
90	–	106.50	107.00	68 × Ø2.36	3.00		
96	–	113.27	108.50	68 × Ø2.37	3.25		
102	–	120.00	114.50	68 × Ø2.63	3.25		
108	–	126.73	120.75	68 × Ø2.63	3.38		
114	–	133.50	126.75	68 × Ø2.87	3.50		
120	–	140.24	132.75	68 × Ø2.87	3.50		
Surface roughness (flange): Ra 250 to 492 µin							

1) Depends on the liner → 🖹 90
2) Total length is independent of the process connections. Installed length according to DVGW → 🖹 74 (compact version) → 🖹 77 (remote version)

Lap joint flange



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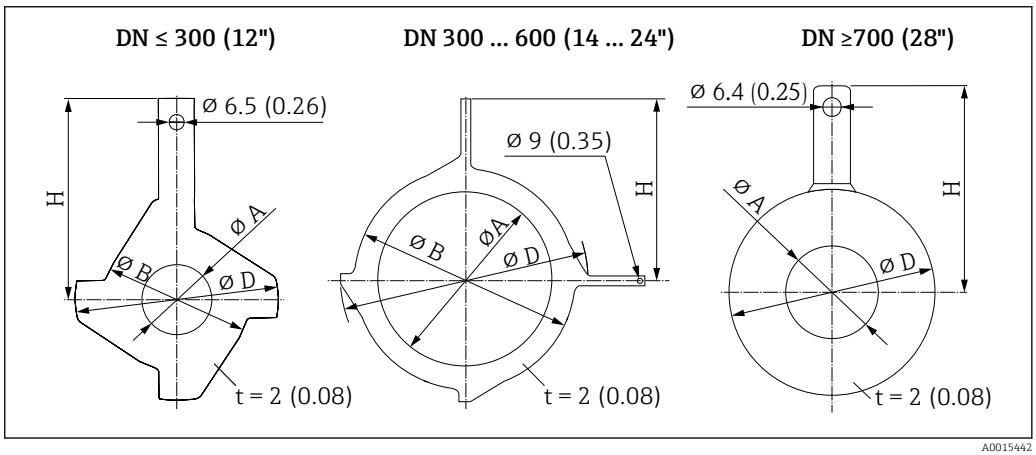
Lap joint flange according to ASME B16.5, Class 150 **Carbon steel:** *order code for "Process connection", option* **A12** **Stainless steel:** *order code for "Process connection", option* **A14**								
DN		**A**	**B**	**C**	**D**	**E**	**F**	**L**
[mm]	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**	**[in]**
25	1	4.33	3.15	4 × Ø0.63	0.55	1.93	1)	2)
40	1 ½	4.92	3.86	4 × Ø0.63	0.69	2.8		
50	2	5.91	4.76	4 × Ø0.75	0.75	3.46		
80	3	7.48	5.98	4 × Ø0.75	0.94	4.72		
100	4	9.06	7.48	8 × Ø0.75	0.94	5.83		
150	6	11.02	9.49	8 × Ø0.91	0.98	8.23		
200	8	13.58	11.73	8 × Ø0.91	1.14	10.39		
250	10	15.94	14.25	12 × Ø0.98	1.18	12.48		
300	12	19.09	17.01	12 × Ø0.98	1.26	14.88		
Surface roughness (flange): Ra 248 to 492 µin								

1) Depends on the liner→ 🖹 90
2) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water) → 🖹 74 (compact version) → 🖹 77 (remote version)

Accessories

Ground disks for flange connections



A0015442

DN		Pressure rating	A		B		D		H	
[mm]	[inch]		[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
25	1"	[1]	26	1.02	62	2.44	77.5	3.05	87.5	3.44
32	1 ¼"	[1]	35	1.38	80	3.15	87.5	3.44	94.5	3.72
40	1 ½"	[1]	41	1.61	82	3.23	101	3.98	103	4.06
50	2"	[1]	52	2.05	101	3.98	115.5	4.55	108	4.25
65	2 ½"	[1]	68	2.68	121	4.76	131.5	5.18	118	4.65
80	3"	[1]	80	3.15	131	5.16	154.5	6.08	135	5.31
100	4"	[1]	104	4.09	156	6.14	186.5	7.34	153	6.02
125	5"	[1]	130	5.12	187	7.36	206.5	8.13	160	6.30
150	6"	[1]	158	6.22	217	8.54	256	10.08	184	7.24
200	8"	[1]	206	8.11	267	10.51	288	11.34	205	8.07
250	10"	[1]	260	10.2	328	12.91	359	14.13	240	9.45
300	12"	PN 10 PN 16 Cl. 150	312	12.3	375	14.76	413	16.26	273	10.75
		PN 25 JIS 10K JIS 20K	310	12.2	375	14.76	404	15.91	268	10.55
350	14"	PN 6	420	16.5	420	16.54	479	18.86	365	14.37
		PN 10								
		PN 16								
375	15"	PN 16	461	18.2	461	18.2	523	20.6	395	15.6
400	16"	PN 6	470	18.5	470	18.50	542	21.34	395	15.55
		PN 10								
		PN 16								
450	18"	PN 6	525	20.7	525	20.67	583	22.95	417	16.42
		PN 10								
		PN 16								
500	20"	PN 6	575	22.6	575	22.64	650	25.59	460	18.11
		PN 10								
		PN 16								
600	24"	PN 6	676	26.6	676	26.61	766	30.16	522	20.55
		PN 10								
		PN 16								
700	28"	PN 6	697	27.4	–	–	786	30.94	460	18.11
		PN10	693	27.3	–	–	813	32.01	480	18.9
		PN16	687	27.1	–	–	807	31.77	490	19.29
		Cl, D	693	27.3	–	–	832	32.76	494	19.45
750	30"	Cl, D	743	29.3	–	–	833	32.8	523	20.59
800	32"	PN 6	799	31.5	–	–	893	35.16	520	20.47
		PN 10	795	31.3	–	–	920	36.22	540	21.26
		PN 16	789	31.1	–	–	914	35.98	550	21.65
		Cl, D	795	31.3	–	–	940	37.01	561	22.09
900	36"	PN 6	897	35.3	–	–	993	39.09	570	22.44

DN		Pressure rating	A		B		D		H	
[mm]	[inch]		[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]
		PN 10	893	35.2	–	–	1020	40.16	590	23.23
		PN 16	886	34.9	–	–	1014	39.92	595	23.43
		Cl, D	893	35.2	–	–	1048	41.26	615	24.21
1000	40"	PN 6	999	39.3	–	–	1093	43.03	620	24.41
		PN 10	995	39.2	–	–	1127	44.37	650	25.59
		PN 16	988	38.9	–	–	1131	44.53	660	25.98
		Cl, D	995	39.2	–	–	1163	45.79	675	26.57
–	42"	PN 6	1044	41.1	–	–	1220	48.03	704	27.72
1200	48"	PN 6	1203	47.4	–	–	1310	51.57	733	28.86
		PN 10	1196	47.1	–	–	1344	52.91	760	29.92
		PN 16	1196	47.1	–	–	1385	54.53	786	30.94
		Cl, D	1188	46.8	–	–	1345	52.95	775	30.51

1) In the case of DN 25 to 250, ground disks can be used for all the flange standards/pressure ratings which can be supplied in the standard version

Weight

All values (weight exclusive of packaging material) refer to devices with flanges of the standard pressure rating.
The weight may be lower than indicated depending on the pressure rating and design.

Weight in SI units

Order code for "Design", option C, D, E, H, I : DN 25 to 400 mm (1 to 16 in)			
Nominal diameter		Reference values EN (DIN), AS, JIS	
[mm]	[in]	Pressure rating	[kg]
25	1	PN 40	10
32	–	PN 40	11
40	1 ½	PN 40	12
50	2	PN 40	13
65	–	PN 16	13
80	3	PN 16	15
100	4	PN 16	18
125	–	PN 16	25
150	6	PN 16	31
200	8	PN 10	52
250	10	PN 10	81
300	12	PN 10	95
350	14	PN 6	106
375	15	PN 6	121
400	16	PN 6	121

Order code for "Design", option F, J: DN 450 to 2 000 mm (18 to 78 in)			
Nominal diameter		Reference values EN (DIN) (PN16)	AS (PN 16)
[mm]	[in]	[kg]	[kg]
450	18	142	138
500	20	182	186
600	24	227	266
700	28	291	369
–	30	–	447
800	32	353	524
900	36	444	704
1000	40	566	785
–	42	–	–
1200	48	843	1 229
–	54	–	–
1400	–	1 204	–
–	60	–	–
1600	–	1 845	–
–	66	–	–

Order code for "Design", option F, J: DN 450 to 2 000 mm (18 to 78 in)			
		Reference values	
Nominal diameter		EN (DIN) (PN16)	AS (PN 16)
[mm]	[in]	[kg]	[kg]
1800	72	2 357	–
–	78	2 929	–
2000	–	2 929	–

Order code for "Design", option F, J: DN 2 200 to 3 000 mm (84 to 120 in)		
		Reference values
Nominal diameter		EN (DIN) (PN6)
[mm]	[in]	[kg]
–	84	–
2200	–	3 422
–	90	–
2400	–	4 094
–	96	–
–	102	–
2600	–	7 601.5
–	108	–
2800	–	9 466.5
–	114	–
3000	–	11 911
–	120	–

Order code for "Design", option G, K: DN 450 to 2 000 mm (18 to 78 in)		
		Reference values
Nominal diameter		EN (DIN) (PN 6)
[mm]	[in]	[kg]
450	18	161
500	20	156
600	24	208
700	28	304
–	30	–
800	32	357
900	36	485
1000	40	589
–	42	–
1200	48	850
–	54	850
1400	–	1 300
–	60	–
1600	–	1 845

Order code for "Design", option G, K: DN 450 to 2 000 mm (18 to 78 in)		
Nominal diameter		Reference values EN (DIN) (PN 6)
[mm]	[in]	[kg]
–	66	–
1800	72	2 357
–	78	2 929
2000	–	2 929

Weight in US units

Order code for "Design", option C, D, E, H, I: DN 1 to 16 in (25 to 400 mm)		
Nominal diameter		Reference values ASME (Class 150)
[mm]	[in]	[lb]
25	1	11
32	–	–
40	1 ½	15
50	2	20
65	–	–
80	3	31
100	4	42
125	–	–
150	6	73
200	8	115
250	10	198
300	12	284
350	14	379
375	15	–
400	16	448

Order code for "Design", option F, J: DN 18 to 120 in (450 to 3 000 mm)		
Nominal diameter		Reference values ASME (Class 150), AWWA (Class D)
[mm]	[in]	[lb]
450	18	421
500	20	503
600	24	666
700	28	587
–	30	701
800	32	845
900	36	1036
1000	40	1294
–	42	1477
1200	48	1987

Order code for "Design", option F, J: DN 18 to 120 in (450 to 3 000 mm)		
Nominal diameter		Reference values ASME (Class 150), AWWA (Class D)
[mm]	[in]	[lb]
–	54	2 807
1400	–	–
–	60	3 515
1600	–	–
–	66	4 699
1800	72	5 662
–	78	6 864
2000	–	6 864
–	84	8 280
2200	–	–
–	90	10 577
2400	–	–
–	96	15 574.6
–	102	18 023.9
2600	–	–
–	108	20 783.0
2800	–	–
–	114	24 060.2
3000	–	–
–	120	27 724.3

Order code for "Design", option G, K: DN 18 to 78 in (450 to 2 000 mm)		
Nominal diameter		Reference values ASME (Class 150), AWWA (Class D)
[mm]	[in]	[lb]
450	18	562
500	20	628
600	24	893
700	28	882
–	30	1 014
800	32	1 213
900	36	1 764
1000	40	1 984
–	42	2 426
1200	48	3 087
–	54	4 851
1400	–	–
–	60	5 954
1600	–	–
–	66	8 158

Order code for "Design", option G, K: DN 18 to 78 in (450 to 2000 mm)		
Nominal diameter		Reference values ASME (Class 150), AWWA (Class D)
[mm]	[in]	[lb]
1800	72	9040
–	78	10143
2000	–	–

Measuring tube specification

The values are reference values and can vary depending on the pressure rating, design and order option.

Nominal diameter		Pressure rating				Measuring tube internal diameter					
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	JIS	Hard rubber		Polyurethane		PTFE	
[mm]	[in]					[mm]	[in]	[mm]	[in]	[mm]	[in]
25	1	PN 40	Class 150	–	20K	–	–	24	0.93	25	1.00
32	–	PN 40	–	–	20K	–	–	32	1.28	34	1.34
40	1 ½	PN 40	Class 150	–	20K	–	–	38	1.51	40	1.57
50	2	PN 40	Class 150	Table E, PN 16	10K	50	1.98	50	1.98	52	2.04
50 [1]	2	PN 40	Class 150	Table E, PN 16	10K	32	1.26	–	–	–	–
65	–	PN 16	–	–	10K	66	2.60	66	2.60	68	2.67
65 [1]	–	PN 16	–	–	10K	38	1.50	–	–	–	–
80	3	PN 16	Class 150	Table E, PN 16	10K	79	3.11	79	3.11	80	3.15
80 [1]	3	PN 16	Class 150	Table E, PN 16	10K	50	1.97	–	–	–	–
100	4	PN 16	Class 150	Table E, PN 16	10K	101	3.99	104	4.11	104	4.09
100 [1]	4	PN 16	Class 150	Table E, PN 16	10K	66	2.60	–	–	–	–
125	–	PN 16	–	–	10K	127	4.99	130	5.11	129	5.08
125 [1]	–	PN 16	–	–	10K	79	3.11	–	–	–	–
150	6	PN 16	Class 150	Table E, PN 16	10K	155	6.11	158	6.23	156	6.15
150 [1]	6	PN 16	Class 150	Table E, PN 16	10K	102	4.02	–	–	–	–
200	8	PN 10	Class 150	Table E, PN 16	10K	204	8.02	207	8.14	202	7.96
200 [1]	8	PN 16	Class 150	Table E, PN 16	10K	127	5.00	–	–	–	–
250	10	PN 10	Class 150	Table E, PN 16	10K	258	10.14	261	10.26	256	10.09
250 [1]	10	PN 16	Class 150	Table E, PN 16	10K	156	6.14	–	–	–	–
300	12	PN 10	Class 150	Table E, PN 16	10K	309	12.15	312	12.26	306	12.03
300 [1]	12	PN 16	Class 150	Table E, PN 16	10K	204	8.03	–	–	–	–
350	14	PN 10	Class 150	Table E, PN 16	10K	337	13.3	340	13.4	–	–
375	15	–	–	PN 16	10K	389	15.3	392	15.4	–	–
400	16	PN 10	Class 150	Table E, PN 16	10K	387	15.2	390	15.4	–	–
450	18	PN 10	Class 150	–	10K	436	17.2	439	17.3	–	–
500	20	PN 10	Class 150	Table E, PN 16	10K	487	19.2	490	19.3	–	–
600	24	PN 10	Class 150	Table E, PN 16	10K	585	23.0	588	23.1	–	–
700	28	PN 10	Class D	Table E, PN 16	10K	694	27.3	697	27.4	–	–
750	30	–	Class D	Table E, PN 16	10K	743	29.3	746	29.4	–	–
800	32	PN 10	Class D	Table E, PN 16	–	794	31.3	797	31.4	–	–

Nominal diameter		Pressure rating				Measuring tube internal diameter					
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	JIS	Hard rubber		Polyurethane		PTFE	
[mm]	[in]					[mm]	[in]	[mm]	[in]	[mm]	[in]
900	36	PN 10	Class D	Table E, PN 16	–	895	35.2	898	35.4	–	–
1000	40	PN 6	Class D	Table E, PN 16	–	991	39.0	994	39.1	–	–
–	42	–	Class D	–	–	1043	41.1	1043	41.1	–	–
1200	48	PN 6	Class D	Table E, PN 16	–	1191	46.9	1197	47.1	–	–
–	54	–	Class D	–	–	1339	52.7	–	–	–	–
1400	–	PN 6	–	–	–	1402	55.2	–	–	–	–
–	60	–	Class D	–	–	1492	58.7	–	–	–	–
1600	–	PN 6	–	–	–	1600	63.0	–	–	–	–
–	66	–	Class D	–	–	1638	64.5	–	–	–	–
1800	72	PN 6	–	–	–	1786	70.3	–	–	–	–
–	78	–	Class D	–	–	1989	78.3	–	–	–	–
2000	–	PN 6	–	–	–	1989	78.3	–	–	–	–
–	84	–	Class D	–	–	2099	84.0	–	–	–	–
2200	–	PN 6	–	–	–	2194	87.8	–	–	–	–
–	90	–	Class D	–	–	2246	89.8	–	–	–	–
2400	–	PN 6	–	–	–	2391	94.1	–	–	–	–
–	96	–	Class D	–		2382	93.8	–	–	–	–
–	102	–	Class D	–		2533	99.7	–	–	–	–
2600	–	PN 6	–	–		2580	101.6	–	–	–	–
–	108	–	Class D	–		2683	105.6	–	–	–	–
2800	–	PN 6	–	–		2780	109.5	–	–	–	–
–	114	–	Class D	–		2832	111.5	–	–	–	–
3000	–	PN 6	–	–		2976	117.2	–	–	–	–
–	120	–	Class D	–		2980	117.3	–	–	–	–

1) Order code for "Design", option C

Materials

Transmitter housing

Compact version

- Order code for "Housing", option **A** "Compact, alu, coated": Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **M**: polycarbonate plastic
- Window material:
  - For order code for "Housing", option **A**: glass
  - For order code for "Housing", option **M**: plastic

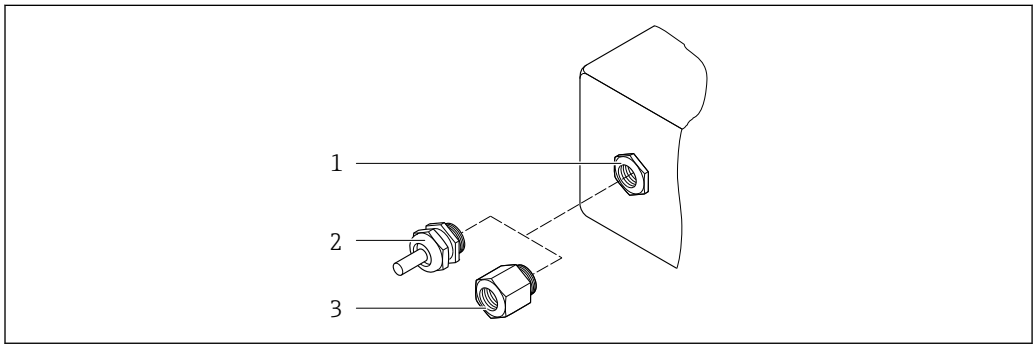
Remote version (wall-mount housing)

- Order code for "Housing", option **P** "Remote, alu, coated": Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **N**: polycarbonate plastic
- Window material:
  - For order code for "Housing", option **P**: glass
  - For order code for "Housing", option **N**: plastic

Sensor connection housing

- Aluminum, AlSi10Mg, coated
- Polycarbonate plastic (only in conjunction with order code for "Sensor option", options CA, C3, CB, CC, CD, CD)

Cable entries/cable glands



30 Possible cable entries/cable glands

1 Female thread M20 × 1.5
2 Cable gland M20 × 1.5
3 Adapter for cable entry with female thread G ½" or NPT ½"

Compact and remote versions and sensor connection housing

Cable entry/cable gland	Material
Cable gland M20 × 1.5	▪ Plastic ▪ Nickel-plated brass
Remote version: cable gland M20 × 1.5 Option of armored connecting cable	▪ Sensor connection housing: Nickel-plated brass ▪ Transmitter wall-mount housing: Plastic
Adapter for cable entry with female thread G ½" or NPT ½"	Nickel-plated brass

Device plug

Electrical connection	Material
Plug M12x1	▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Remote version connecting cable

UV rays can impair the cable outer sheath. Protect the cable from exposure to sun as much as possible.

Electrode and coil current cable:
- Standard cable: PVC cable with copper shield
- Armored cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor housing

- DN 25 to 300 (1 to 12")
  - Aluminum half-shell housing, aluminum, AlSi10Mg, coated
  - Fully welded carbon steel housing with protective varnish
- DN 350 to 3000 (14 to 120")
  Fully welded carbon steel housing with protective varnish

Measuring tubes

- DN 25 to 600 (1 to 24")
  Stainless steel: 1.4301, 1.4306, 304, 304L
- DN 700 to 3000 (28 to 120")
  Stainless steel: 1.4301, 304

Liner

- DN 25 to 300 (1 to 12"): PTFE
- DN 25 to 1200 (1 to 48"): polyurethane
- DN 50 to 3000 (2 to 120"): hard rubber

Electrodes

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Process connections

For flanges made of carbon steel:
- DN ≤ 300 (12"): with Al/Zn protective coating or protective varnish
- DN ≥ 350 (14"): protective varnish

All carbon steel lap joint flanges are supplied with a hot-dip galvanized finish.

EN 1092-1 (DIN 2501)

Fixed flange
- Carbon steel:
  - DN ≤ 300: S235JRG2, S235JR+N, P245GH, A105, E250C
  - DN 350 to 3000: P245GH, S235JRG2, A105, E250C
- Stainless steel:
  - DN ≤ 300: 1.4404, 1.4571, F316L
  - DN 350 to 600: 1.4571, F316L, 1.4404
  - DN 700 to 1000: 1.4404, F316L

Lap joint flange
- Carbon steel DN ≤ 300: S235JRG2, A105, E250C
- Stainless steel DN ≤ 300: 1.4306,1.4404, 1.4571, F316L

Lap joint flange, stamped plate
- Carbon steel DN ≤ 300: S235JRG2 similar to S235JR+AR or 1.0038
- Stainless steel DN ≤ 300: 1.4301 similar to 304

ASME B16.5

Fixed flange, lap joint flange
- Carbon steel: A105
- Stainless steel: F316L

JIS B2220

- Carbon steel: A105, A350 LF2
- Stainless steel: F316L

AWWA C207

Carbon steel: A105, P265GH, A181 Class 70, E250C, S275JR

AS 2129

Carbon steel: A105, E250C, P235GH, P265GH, S235JRG2

AS 4087

Carbon steel: A105, P265GH, S275JR

Seals

As per DIN EN 1514-1, form IBC

Accessories

Display guard

Stainless steel, 1.4301 (304L)

Ground disks

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Fitted electrodes

Measurement, reference and empty pipe detection electrodes available as standard with:
- 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Process connections

- EN 1092-1 (DIN 2501)
- ASME B16.5
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16
- AWWA C207 Class D

For information on the different materials used in the process connections → 93

Surface roughness

Electrodes with 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); tantalum: < 0.5 µm (19.7 µin)

(All data relate to parts in contact with medium)

Human interface

Operating concept

Operator-oriented menu structure for user-specific tasks
- Commissioning
- Operation
- Diagnostics
- Expert level

Fast and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief descriptions of the individual parameter functions
- Access to the device via Web server
- WLAN access to the device via mobile handheld terminal, tablet or smart phone

Reliable operation
- Operation in local language
- Uniform operating philosophy applied to device and operating tools
- If replacing electronic modules, transfer the device configuration via the integrated memory (HistoROM backup) which contains the process and measuring device data and the event logbook. No need to reconfigure.

Efficient diagnostic behavior increases measurement availability
- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

Languages

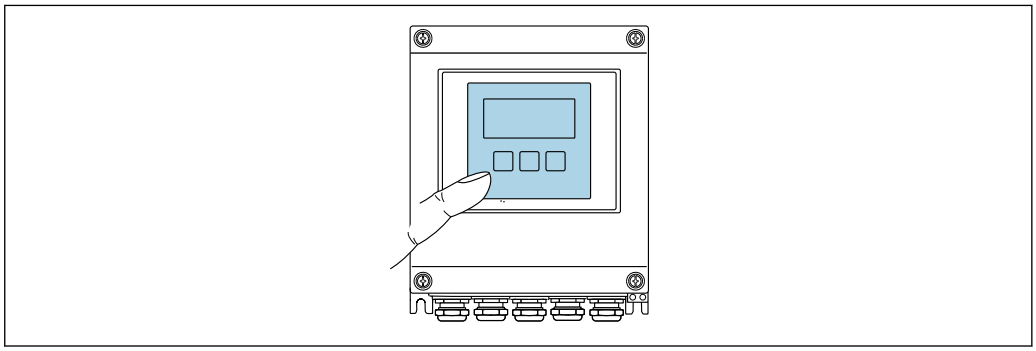
Can be operated in the following languages:
- Via local operation:
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool:
  English, German, French, Spanish, Italian, Chinese, Japanese
- Via Web browser (only available for device versions with HART, PROFIBUS DP and EtherNet/IP):
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish

Local operation

Via display module

Equipment:
- Standard features 4-line, illuminated, graphic display; touch control
- Order code for "Display; operation", option BA "WLAN" offers standard equipment features in addition to access via Web browser

Information about WLAN interface → 98



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31 *Operation with touch control*

Display elements

- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: –20 to +60 °C (–4 to +140 °F)
  The readability of the display may be impaired at temperatures outside the temperature range.

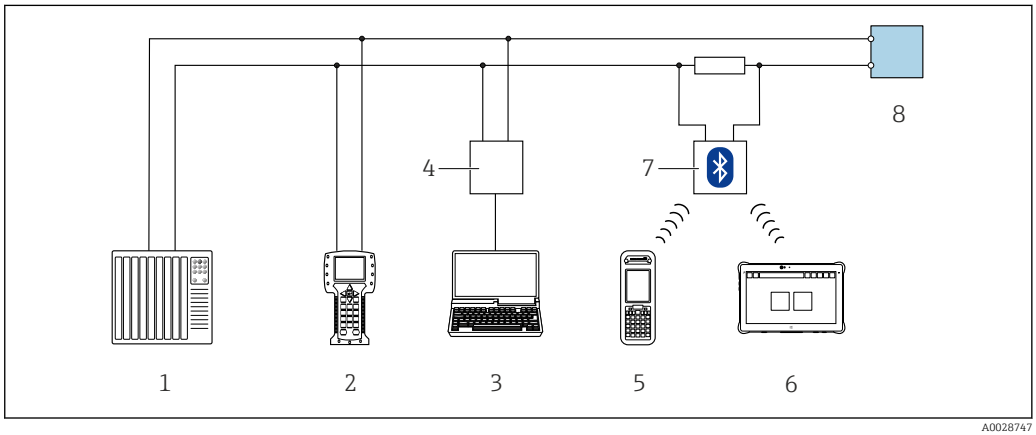
Operating elements

- External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, Ⓔ
- Operating elements also accessible in the various zones of the hazardous area

Remote operation

Via HART protocol

This communication interface is available in device versions with a HART output.



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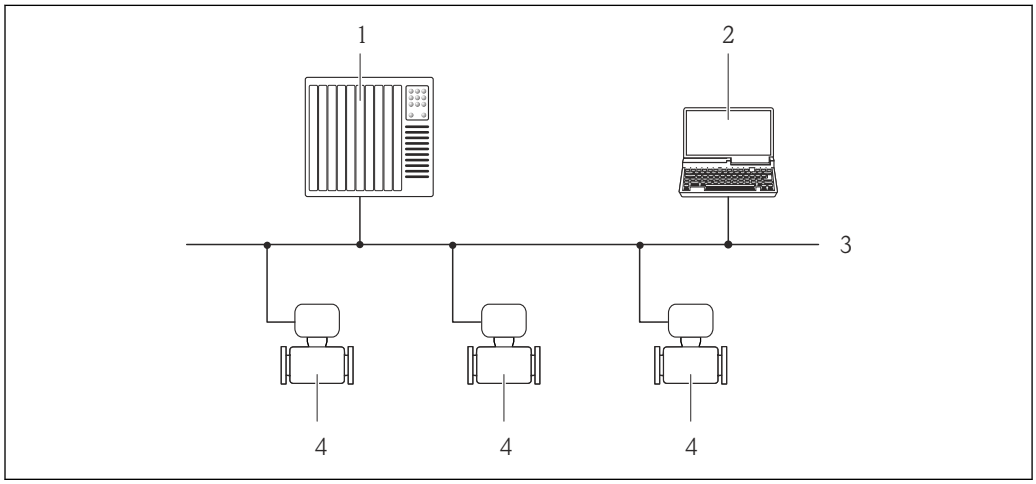
32 *Options for remote operation via HART protocol*

1 *Control system (e.g. PLC)*
2 *Field Communicator 475*
3 *Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
4 *Commubox FXA195 (USB)*
5 *Field Xpert SFX350 or SFX370*
6 *Field Xpert SMT70*
7 *VIATOR Bluetooth modem with connecting cable*
8 *Transmitter*

Via PROFIBUS DP network

This communication interface is available in device versions with PROFIBUS DP.

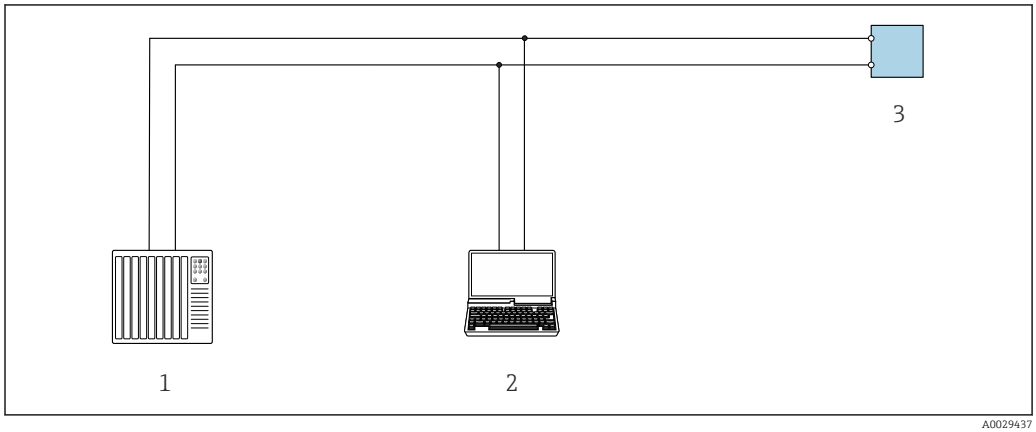


33 *Options for remote operation via PROFIBUS DP network*

1 Automation system
2 Computer with PROFIBUS network card
3 PROFIBUS DP network
4 Measuring device

Via Modbus RS485 protocol

This communication interface is available in device versions with a Modbus-RS485 output.



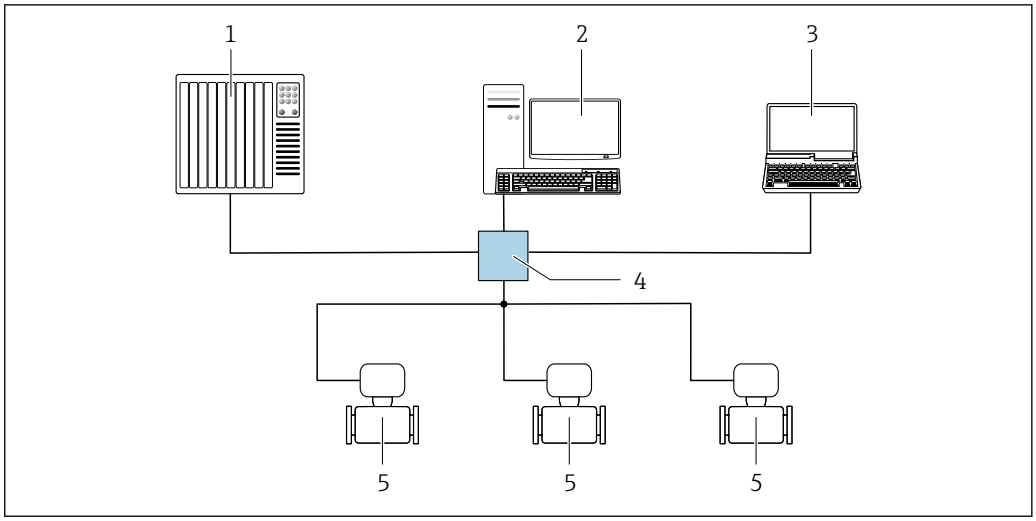
34 *Options for remote operation via Modbus-RS485 protocol (active)*

1 Control system (e.g. PLC)
2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP" or Modbus DTM
3 Transmitter

Via EtherNet/IP network

This communication interface is available in device versions with EtherNet/IP.

Star topology



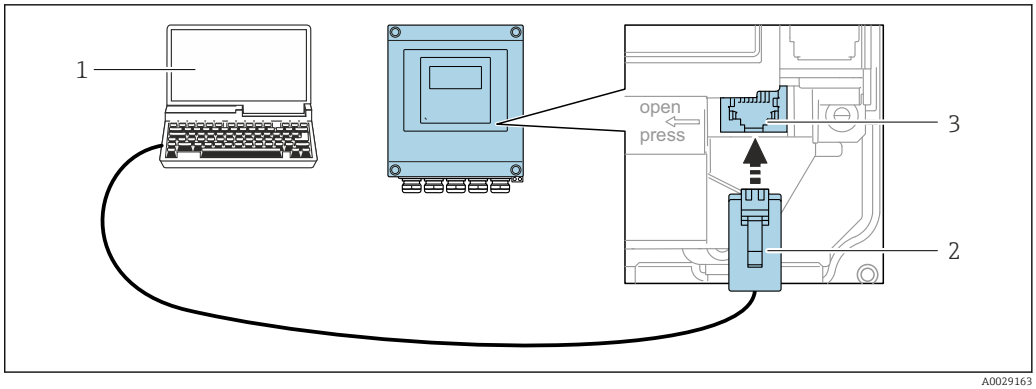
35 *Options for remote operation via EtherNet/IP network: star topology*

1 *Automation system, e.g. "RSLogix" (Rockwell Automation)*
2 *Workstation for measuring device operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)*
3 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"*
4 *Ethernet switch*
5 *Measuring device*

Service interface

Via service interface (CDI-RJ45)

This communication interface is present in the following device version:
- Order code for "Output", option **H**: 4 to 20 mA HART, pulse/frequency output, switch output
- Order code for "Output", option **I**: 4 to 20 mA HART, 2 x pulse/frequency/switch output, status input
- Order code for "Output", option **J**: 4 to 20 mA HART, certified pulse output, switch output; status input
- Order code for "Output", option **L**: PROFIBUS DP
- Order code for "Output", option **M**: Modbus RS485
- Order code for "Output", option **O**: Modbus RS485, 4 to 20 mA, 2 x pulse/frequency/switch output
- Order code for "Output", option **P**: Modbus RS485, 4 to 20 mA, certified pulse output, pulse/frequency/switch output
- Order code for "Output", option **N**: EtherNet/IP

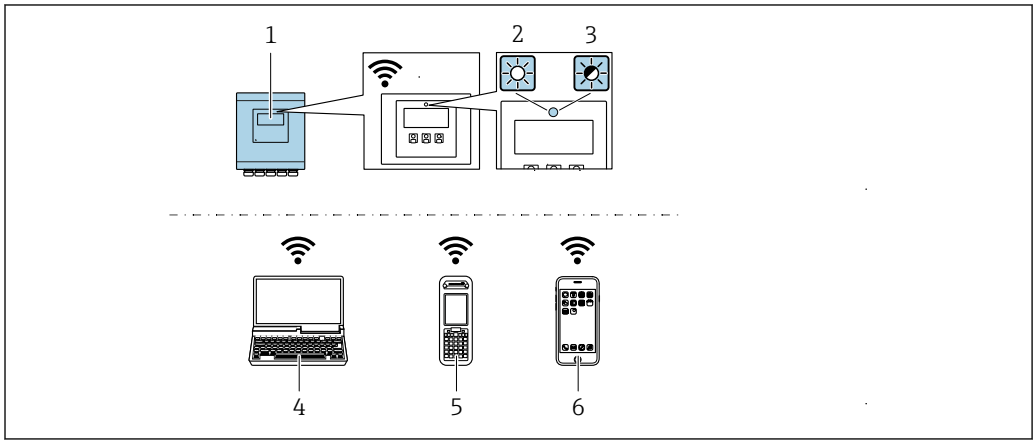


36 *Connection via service interface (CDI-RJ45)*

1 *Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with "FieldCare", "DeviceCare" operating tool with COM DTM "CDI Communication TCP/IP" or Modbus DTM*
2 *Standard Ethernet connecting cable with RJ45 plug*
3 *Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server*

Via WLAN interface

The optional WLAN interface is available on the following device version:
Order code for "Display", option BA "WLAN":
4-line, illuminated, graphic display; touch control + WLAN



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1 *Transmitter with integrated WLAN antenna*
2 *LED lit constantly: WLAN reception is enabled on measuring device*
3 *LED flashing: WLAN connection established between operating unit and measuring device*
4 *Computer with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare)*
5 *Mobile handheld terminal with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or operating tool (e.g. FieldCare, DeviceCare)*
6 *Smart phone or tablet (e.g. Field Xpert SMT70)*

Function	WLAN: IEEE 802.11 b/g (2.4 GHz) ▪ Access point with DHCP server (default setting) ▪ Network
Encryption	WPA2-PSK AES-128 (in accordance with IEEE 802.11i)
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antenna	Internal antenna
Range	Typically 10 m (32 ft)

Supported operating tools

Different operating tools can be used for local or remote access to the measuring device. Depending on the operating tool used, access is possible with different operating units and via a variety of interfaces.

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with Web browser	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Ethernet-based fieldbus (EtherNet/IP)	Special Documentation for the device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 105

Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 105
Device Xpert	Field Xpert SFX 100/350/370	Fieldbus protocol HART	Operating Instructions BA01202S Device description files: Use update function of handheld terminal

Other operating tools based on FDT technology with a device driver such as DTM/iDTM or DD/EDD can be used for device operation. These operating tools are available from the individual manufacturers. Integration into the following operating tools, among others, is supported:

- FactoryTalk AssetCentre (FTAC) from Rockwell Automation → www.rockwellautomation.com
- Process Device Manager (PDM) from Siemens → www.siemens.com
- Asset Management Solutions (AMS) from Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 from Emerson → www.emersonprocess.com
- Field Device Manager (FDM) from Honeywell → www.honeywellprocess.com
- FieldMate from Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The related device description files are available: www.endress.com → Downloads

Web server

Thanks to the integrated Web server, the device can be operated and configured via a Web browser and via a service interface (CDI-RJ45) or via a WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, device status information is also displayed, allowing users to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

A device that has a WLAN interface (can be ordered optionally) is required for the WLAN connection: order code for "Display", option BA "WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

Supported functions
Data exchange between the operating unit (such as a notebook for example) and the measuring device:
- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Flash firmware version for device firmware upgrade, for instance
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package → 🖹 103)

Web server special documentation → 🖹 106

HistoROM data management

The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient.

Additional information on the data storage concept

There are different types of data storage units in which device data are stored and used by the device:

	HistoROM backup	T-DAT	S-DAT

Available data	▪ Event logbook such as diagnostic events for example
	▪ Device firmware package
	▪ Driver for system integration for exporting via Web server, e.g:
	  ▪ GSD for PROFIBUS DP
	  ▪ EDS for EtherNet/IP
		▪ Measured value logging ("Extended HistoROM" order option)
		▪ Current parameter data record (used by firmware at run time)
		▪ Peakhold indicator (min/max values)
		▪ Totalizer values
			▪ Sensor data: nominal diameter etc.
			▪ Serial number
			▪ Calibration data
			▪ Device configuration (e.g. SW options, fixed I/O or multi I/O)

Storage location	Fixed on the user interface board in the connection compartment	Attachable to the user interface board in the connection compartment	In the sensor plug in the transmitter neck part

Data backup

Automatic
- The most important device data (sensor and transmitter) are automatically saved in the DAT modules
- If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
- If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors

Data transmission

Manual
- Transfer of a device configuration to another device using the export function of the specific operating tool, e.g. with FieldCare, DeviceCare or Web server: to duplicate the configuration or to store in an archive (e.g. for backup purposes)
- Transmission of the drivers for system integration via Web server, e.g.:
  - GSD for PROFIBUS DP
  - EDS for EtherNet/IP

Event list

Automatic
- Chronological display of up to 20 event messages in the events list
- If the **Extended HistoROM** application package (order option) is enabled: up to 100 event messages are displayed in the events list along with a time stamp, plain text description and remedial measures
- The events list can be exported and displayed via a variety of interfaces and operating tools e.g. DeviceCare, FieldCare or Web server

Data logging

Manual
If the **Extended HistoROM** application package (order option) is enabled:
- Record up to 1 000 measured values via 1 to 4 channels
- User configurable recording interval
- Record up to 250 measured values via each of the 4 memory channels
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

Certificates and approvals

Current certificates and approvals for the product are available via the Product Configurator at www.endress.com.

1. Select the product using the filters and search field.
2. Open the product page.

The **Configuration** button opens the Product Configurator.

CE mark

The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

UKCA marking

The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark.

Contact address Endress+Hauser UK:
Endress+Hauser Ltd.
Floats Road
Manchester M23 9NF
United Kingdom
www.uk.endress.com

RCM mark

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex approval

The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Control Drawing" document. Reference is made to this document on the nameplate.

Drinking water approval

- ACS
- KTW/W270
- NSF 61
- WRAS BS 6920

HART certification

HART interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:
- Certified according to HART 7
- The device can also be operated with certified devices of other manufacturers (interoperability)

PROFIBUS conformity

PROFIBUS interface

The measuring device is registered with PI (PROFIBUS and PROFINET International). It meets all the requirements of PROFIBUS PA Profile 3.02 specifications and can also be operated with certified devices of other manufacturers (interoperability).

Modbus RS485 certification

The measuring device meets all the requirements of the MODBUS/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.

EtherNet/IP certification

The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications:
- Certified in accordance with the ODVA Conformance Test
- EtherNet/IP Performance Test
- EtherNet/IP PlugFest compliance
- The device can also be operated with certified devices of other manufacturers (interoperability)

Radio approval

The measuring device has radio approval.

For detailed information regarding radio approval, see the Special Documentation → 106

Measuring instrument approval

The measuring device is (optionally) approved as a cold water meter (MI-001) for volume measurement in service subject to legal metrological control in accordance with the European Measuring Instruments Directive 2014/32/EU (MID).

The measuring device is qualified to OIML R49: 2013.

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326-3-2
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- ANSI/ISA-61010-1 (82.02.01)
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- CAN/CSA-C22.2 No. 61010-1-12
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
  Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
  Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
  Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
  Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
  Self-monitoring and diagnosis of field devices
- NAMUR NE 131
  Requirements for field devices for standard applications

Ordering information

Detailed ordering information is available for your nearest sales organization www.addresses.endress.com or in the Product Configurator under www.endress.com :

1. Click Corporate
2. Select the country
3. Click Products
4. Select the product using the filters and search field
5. Open the product page

The Configuration button to the right of the product image opens the Product Configurator.

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Cleaning

Package	Description
Electrode cleaning circuit (ECC)	The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite (Fe_3O_4) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to avoid build-up of very conductive matter and thin layers (typical of magnetite).

Diagnostics functions

Package	Description
Extended HistoROM	Comprises extended functions concerning the event log and the activation of the measured value memory. Event log: Memory volume is extended from 20 message entries (standard version) to up to 100 entries. Data logging (line recorder): ▪ Memory capacity for up to 1000 measured values is activated. ▪ 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. ▪ Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**Heartbeat Verification** Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment". ▪ Functional testing in the installed state without interrupting the process. ▪ Traceable verification results on request, including a report. ▪ Simple testing process via local operation or other operating interfaces. ▪ Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications. ▪ Extension of calibration intervals according to operator's risk assessment. **Heartbeat Monitoring** Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to: ▪ Draw conclusions - using these data and other information - about the impact process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the process or product quality, e.g. gas pockets.

Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Device-specific accessories

For the transmitter

Accessories	Description
Promag 400 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output/input ▪ Display/operation ▪ Housing ▪ Software For details, see Installation Instructions EA00104D

Display guard	Is used to protect the display against impact or scoring, for example from sand in desert areas. Order number: 71228792 Installation Instructions EA01093D
Connecting cable for remote version	Coil current and electrode cables, various lengths, reinforced cables available on request.
Ground cable	Set, consisting of two ground cables for potential equalization.
Post mounting kit	Post mounting kit for transmitter.
Compact → Remote conversion kit	For converting a compact device version to a remote device version.
Conversion kit Promag 50/53 → Promag 400	For converting a Promag with transmitter 50/53 to a Promag 400.

For the sensor

Accessory	Description
Ground disks	Are used to ground the medium in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. Technical Information TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. Technical Information TI405C/07
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. ▪ Technical Information TI00429F ▪ Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. Operating Instructions BA00061S
Fieldgate FXA42	Is used to transmit the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices ▪ Technical Information TI01297S ▪ Operating Instructions BA01778S ▪ Product page: www.endress.com/fxa42

Field Xpert SMT70	The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle. ▪ Technical Information TI01342S ▪ Operating Instructions BA01709S ▪ Product page: www.endress.com/smt70
Field Xpert SMT77	The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. ▪ Technical Information TI01418S ▪ Operating Instructions BA01923S ▪ Product page: www.endress.com/smt77

Service-specific accessories

Accessory	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Choice of measuring devices with industrial requirements ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. ▪ Graphic illustration of the calculation results ▪ Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. Applicator is available: ▪ Via the Internet: https://portal.endress.com/webapp/applicator ▪ As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle. W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, see: www.endress.com/lifecyclemanagement
FieldCare	FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. Innovation brochure IN01047S
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress +Hauser Common Data Interface) and the USB port of a computer or laptop. Technical Information TI00405C

System components

Accessories	Description
Memograph M graphic data manager	The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick. ▪ Technical Information TI00133R ▪ Operating Instructions BA00247R

Supplementary documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

Standard documentation

Brief Operating Instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline Promag W	KA01266D

Transmitter Brief Operating Instructions

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Proline 400	KA01263D	KA01420D	KA01419D	KA01418D

Operating Instructions

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Promag W 400	BA01063D	BA01234D	BA01231D	BA01214D

Description of device parameters

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Promag 400	GP01043D	GP01044D	GP01045D	GP01046D

Supplementary device-dependent documentation

Special Documentation

Content	Documentation code
Display modules A309/A310	SD01793D
Information on Custody Transfer Measurement	SD02038D
Information on Custody Transfer Measurement	SD02561D

Content	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Web server	SD01811D	SD01813D	SD01812D	SD01814D
Heartbeat Verification + Monitoring	SD01847D	SD02569D	SD02568D	SD02570D

Installation Instructions

Content	Comment
Installation instructions for spare part sets and accessories	Documentation code: specified for each individual accessory → 🖹 103.

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HART®
Registered trademark of the FieldComm Group, Austin, USA

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

EtherNet/IP™
Trademark of ODVA, Inc.

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Endress+Hauser

People for Process Automation

PRESSURE TRANSMITTER

Spec Sheet Endress+Hauser

Item: Pressure Transmitter

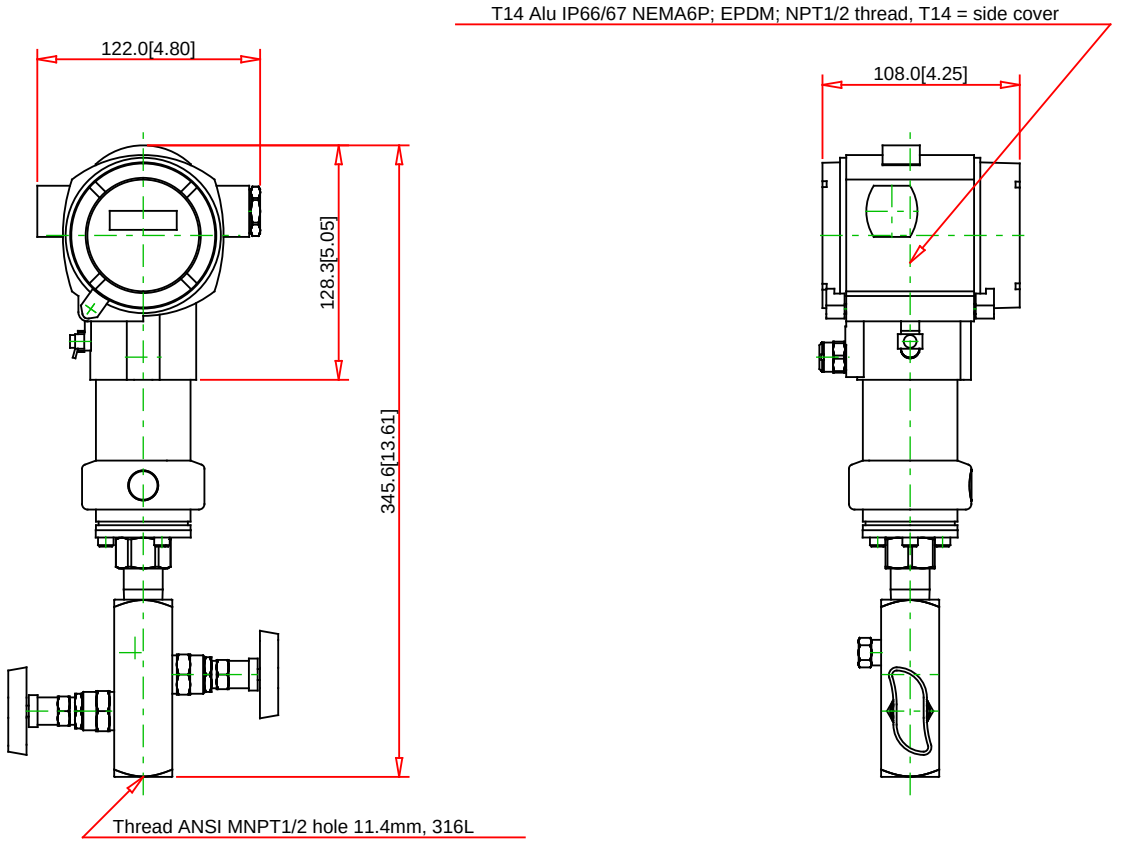
Product Data		
General information		
Measuring task	Pressure / Level	
General explosion-protection information	Information about currently available Ex versions (ATEX, FM, CSA, TIIS, IECEx, NEPSI, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is availabe upon request.	
Identification		
Nameplate material	Stainless steel	
Manufacturer name	Endress+Hauser	
Vendor	Endress+Hauser	
Product device / transmitter		
Product type	Pressure transmitter with capacitive measuring cell and ceramic process isolating diaphragm	
Product name	Cerabar S PMC71	
Order code	PMC71-7HDD0/0	
Extended order code	PMC71-VBC1S6RDA4ALSN2Z1	
Function and system design		
Measuring principle	Process pressure measurement	
Input characteristics		
Measurement channels		
Measured variable	Absolute / gauge pressure	
Measuring range		
Value application dependent	no	
Upper range-limit	4.0	MPa
abs/gauge pressure	Gauge	
Lower range-limit (EU)	-1.0	bar
Upper range-limit (EU)	40.0	bar
Lower range-limit (US)	-15.0	psi
Upper range-limit (US)	600.0	psi
Measuring span min. (EU)	0.4	bar
Measuring span min. (US)	6.0	psi
Output characteristics		
Analog Output		
Output type	Analog Output	
Signal type	4-20 mA	

Lower range value of signal	4.0	mA
Upper range value of signal	20.0	mA
Output configurable		
Lower range value of signal configurable	3.8	mA
Upper range value of signal configurable	20.5	mA
Signal on alarm		
Signal on alarm available	yes	
Signal on alarm configurable	yes	
Lower value	3.6	mA
Upper value	23.0	mA
Communication interface		
HART Communication Interface		
System Integration		
Type of protocol	HART	
Power supply		
Power input circuit		
Supply mode	2 wire	
Electrical connection	Screw terminal	
Voltage type	DC voltage	
Supply voltage DC min.	11.5	V
Supply voltage DC max.	45.0	V
Accuracy		
Measured value resolution	1.0	µA
Operating conditions		
Environment		
Ambient temperature °C min.	-20.0	°C
Ambient temperature °F min.	-4.0	°F
Ambient temperature °C max.	70.0	°C
Ambient temperature °F max.	158.0	°F
Storage temperature °C min.	-40.0	°C
Storage temperature °F min.	-40.0	°F
Storage temperature °C max.	85.0	°C
Storage temperature °F max.	185.0	°F
Vibrational resistance	3 to 25 Hz: ±1.6 mm (0.063 in); 25 to 100 Hz: 4 g	
Process conditions		
Process temperature in °C min.	-25.0	°C
Process temperature in °F min.	-13.0	°F
Process temperature in °C max.	125.0	°C
Process temperature in °F max.	257.0	°F
Proof pressure max.	6.0	MPa
Proof pressure max.(EU)	60.0	bar
Proof pressure max.(US)	900.0	psi
Mechanical construction		
Connection housing / head		
Housing type	Transmitter housing	
Housing type Endress+Hauser	T14	

Degree of protection, NEMA	NEMA Type 6P Enclosure	
Degree of protection, Europe	IP66/67	
Material housing	Die-cast aluminium	
Breadth	152.0	mm
Depth	111.0	mm
Height	129.0	mm
Coating	Powder protective coating on polyester base	
Cover		
Material cover sealing	EPDM	
Cable entry signal line		
Threaded cable entry	NPT 1/2	
Process connection		
Type of connection	Thread	
Reference Standard for connection	ASME	
Nominal diameter	MNPT 1/2 hole 11.4mm	
Material process connection based on EN/DIN	1.4404 / 1.4435	
Material process connection based on AISI	316L	
Material gasket	FKM	
Pressure meter		
Process isolating diaphragm design	Internal	
Material process isolating diaphragm	Al2O3 (Aluminium-oxide-ceramic)	
Manifold		
Design	Block&Bleed	
Material manifold	316L	
Process connection		
Type of connection	FNPT	
Nominal diameter based on ASME	1/2"	
Material process connection	PTFE	
Reference Standard for connection	IEC 61518-A	
Operability		
Display on device	With display	
Operating software	Handheld terminal Field Communicator 375 / FieldCare	
Operating element	Button (inside)	
Local operation	yes	
Remote operation	yes	
Display element		
Display type	LCD graphic display with bargraph	
Number of lines	4	
Certificate and approvals device / transmitter		
Approval for general usage	CE mark	
Quality certificate	Inspection certificate	
Pressure test approval	Pressure test, internal procedure	
Pressure test approval	CRN approval	
Pressure test approval	CRN approval	

Ex certificates C/US	
Approval type	CSA C/US
Ignition protection type	XP
Ex designation	yes
Class	Class I
Division	Division 1
Group	Group B-D
Ex certificates C/US 2	
Approval type	CSA C/US
Ignition protection type	Ex d
Ex designation	yes
Calibration	
Calibration performed	yes
Calibration type	Sensor range: psi
Comments	

Tag: PIT -301-1



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Order Code :
PMC71-VBC1S6RDA4A+N2Z1

Product Description :
Cerabar S PMC71

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Endress+Hauser

People for Process Automation

TEMPERATURE TRANSMITTER

Spec Sheet Endress+Hauser

Item: Temperature Transmitter

Product Data		
General information		
Measuring task	Temperature / resistance / voltage	
General explosion-protection information	Information about currently available Ex versions (ATEX, FM, CSA, TIIS, IECEx, NEPSI, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is availabe upon request.	
Identification		
Nameplate material	Metal	
Manufacturer name	Endress+Hauser	
Vendor	Endress+Hauser	
Product device / transmitter		
Nameplate material	Metal	
Product name	iTEMP® TMT162	
Order code	TMT162-10NK0/101	
Extended order code	TMT162-G21231DKANAZ1	
Input characteristics		
Measurement channels		
Measured variable	Temperature	
Measuring range		
Lower range-limit (EU)	-200.0	°C
Upper range-limit (EU)	850.0	°C
Lower range-limit (US)	-328.0	°F
Upper range-limit (US)	1,562.0	°F
Measuring span min. (EU)	10.0	K
Measuring span min. (US)	18.0	°F
Signal inputs		
Temperature input RTD 1		
Number	1	
RTD type	Pt100	
Connection type	3 wire	
Reference standard for temperature sensor	IEC 751 (a=0.00385)	
Input configurable		
Lower range value of signal configurable	0.00000	°C
Upper range value of signal configurable	100.00000	°C
Output characteristics		
Analog Output		
Number	1	

Output type	Analog Output	
Signal type	4-20 mA	
Lower range value of signal	3.8	mA
Upper range value of signal	20.5	mA
Signal on alarm		
Signal on alarm available	yes	
Signal on alarm configurable	yes	
Lower value	3.6	mA
Upper value	21.5	mA
Communication interface		
HART Communication Interface		
System Integration		
Type of protocol	HART	
Power supply		
Power input circuit		
Supply mode	2 wire	
Electrical connection	Screw terminal	
Power consumption max.	0.9	W
Operating conditions		
Environment		
Electrical safety protection	OVP	
Environment transmitter		
Ambient temperature °C min.	-40.0	°C
Ambient temperature °F min.	-40.0	°F
Ambient temperature °C max.	80.0	°C
Ambient temperature °F max.	176.0	°F
Storage temperature °C min.	-40.0	°C
Storage temperature °F min.	-40.0	°F
Storage temperature °C max.	80.0	°C
Storage temperature °F max.	176.0	°F
Climate class	Class C	
Mechanical construction		
Housing device / transmitter		
Housing type	Transmitter housing	
Housing design	Field housing	
Mounting style	Mounting bracket, wall / pipe 2", L-shape	
Material mounting parts	304	
Degree of protection, NEMA	NEMA Type 4X Enclosure	
Degree of protection, Europe	IP67	
Material housing	Aluminum	
Coating	Powder coating	
Cable entry signal line		
Threaded cable entry	NPT 1/2 internal thread	
Cable entry sensor		
Threaded cable entry	NPT 1/2 internal thread	
Operability		

Display element	
Number of lines	2
Background lighting	yes
Certificate and approvals device / transmitter	
Approval for general usage	CE mark
Approval for general usage	UL approval
Functional safety	
Safety integrity level	SIL 2
Ex certificates C/US	
Approval type	CSA
Ignition protection type	XP
Ignition protection type	NI
Ignition protection type	DIP
Ex designation	yes
Class	Class I
Class	Class II
Class	Class III
Division	Division 1
Division	Division 2
Group	Group A-G
Comments	

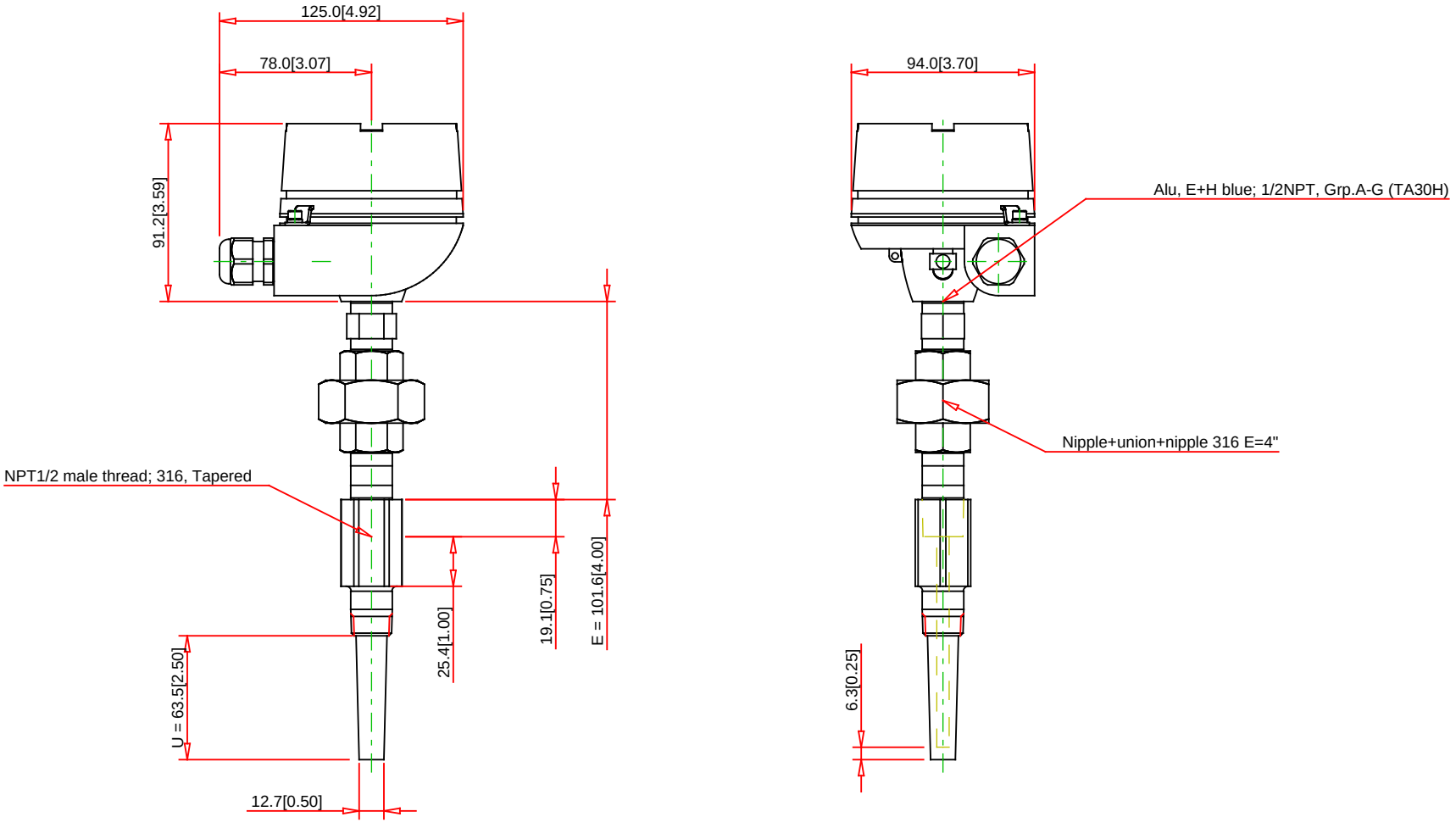
Spec Sheet Endress+Hauser

Item: Temperature Transmitter RTD

Product Data		
General information		
Measuring task	Continuous Temperature	
General explosion-protection information	Information about currently available Ex versions (ATEX, FM, CSA, TIIS, IECEx, NEPSI, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is availabe upon request.	
Identification		
Nameplate material	Metal	
Manufacturer name	Endress+Hauser	
Vendor	Endress+Hauser	
Product device / transmitter		
Product name	T13	
Order code	T13-G3A11A4C53KBA	
Extended order code	T13-G3A11A4C53KBAA	
Function and system design		
Measuring principle	RTD	
Input characteristics		
Measurement channels		
Measured variable	Temperature	
Measuring range		
Lower range-limit	-50.0	°C
Upper range-limit	200.0	°C
Signal inputs		
Temperature input RTD 1		
Terminals signal line		
Type of terminal	Terminal block	
Mechanical construction		
Connection housing / head		
Housing design	Connection head	
Housing type Endress+Hauser	TA30H	
Material housing	Aluminum	
Color	E+H blue	
Cable entry signal line		
Threaded cable entry	NPT 1/2	
Neck		
Extension type	Nippel+Union+Nippel	
Length	4.0	inch

Material extension based on AISI	316	
Material nipple based on AISI	316	
Process connection		
Type of connection	External thread.	
Nominal diameter	NPT 1/2	
Material process connection based on AISI	316	
Thermowell		
Design	Tapered	
Installation length	2.5	inch
Insert		
Sensing element		
Number	1	
RTD type	Pt100	
Temperature sensor accuracy class	Class A	
RTD measuring circuit type	3 wire	
Operability		
Display on device	Without display	
Certificate and approvals device / transmitter		
Quality certificate	Sensor calibration certificate	
Pressure test approval	Internal hydrostatic pressure test	
Ex certificates C/US		
Approval type	CSA	
Ignition protection type	XP	
Ignition protection type	NI	
Ignition protection type	DIP	
Ex designation	yes	
Class	Class I	
Class	Class II	
Class	Class III	
Division	Division 1	
Division	Division 2	
Group	Group A-G	
Calibration		
Calibration type	0°C + 2 Points variable, 1xRTD	
Comments		

Power input circuit		
Voltage type	DC voltage	
Supply voltage DC max.	24.0	V
Voltage type	AC voltage	
Supply voltage AC min.	100.0	V
Supply voltage AC max.	240.0	V
Accuracy		
Accuracy	0.5	%
Operating conditions		
Installation		
Inlet run (x DN)	5.0	x DN
Outlet run (x DN)	2.0	x DN
Installation instructions		
Partially filled pipes	Special requirements for partially filled pipes may be necessary	
Down pipes	Special requirements in down pipes may be necessary	
Environment		
Ambient temperature °C min.	-10.0	°C
Ambient temperature °F min.	14.0	°F
Ambient temperature °C max.	60.0	°C
Ambient temperature °F max.	140.0	°F
Vibrational resistance	Acceleration up to 2 g by analogy with IEC 600 68-2-6	
Electromagnetic compatibility	To EN 61326/A1 and NAMUR recommendation NE 21	
Process conditions		
Process temperature in °C min.	0.0	°C
Process temperature in °F min.	32.0	°F
Process temperature in °C max.	80.0	°C
Process temperature in °F max.	176.0	°F
Medium conductivity min.	5.0	µS/cm
Flow min. (EU)	110.0	m3/h
Flow max. (EU)	3,300.0	m3/h
Flow min. (US)	500.0	USga/m
Flow max. (US)	15,000.0	USga/m
Low flow cut-off	yes	
Mechanical construction		
Connection housing / head		
Housing type	Transmitter housing, compact	
Material housing	Aluminum, coated	
Cable entry signal line		
Threaded cable entry	NPT 1/2	
Process connection		
Type of connection	Flange	
Reference Standard for connection	ASME B16.5	
Nominal diameter based on EN/DIN	DN 350	



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Order Code :
T13-G3A11A4C53KBA+A

Product Description :
RTD Assembly T13, TW type XP US Style

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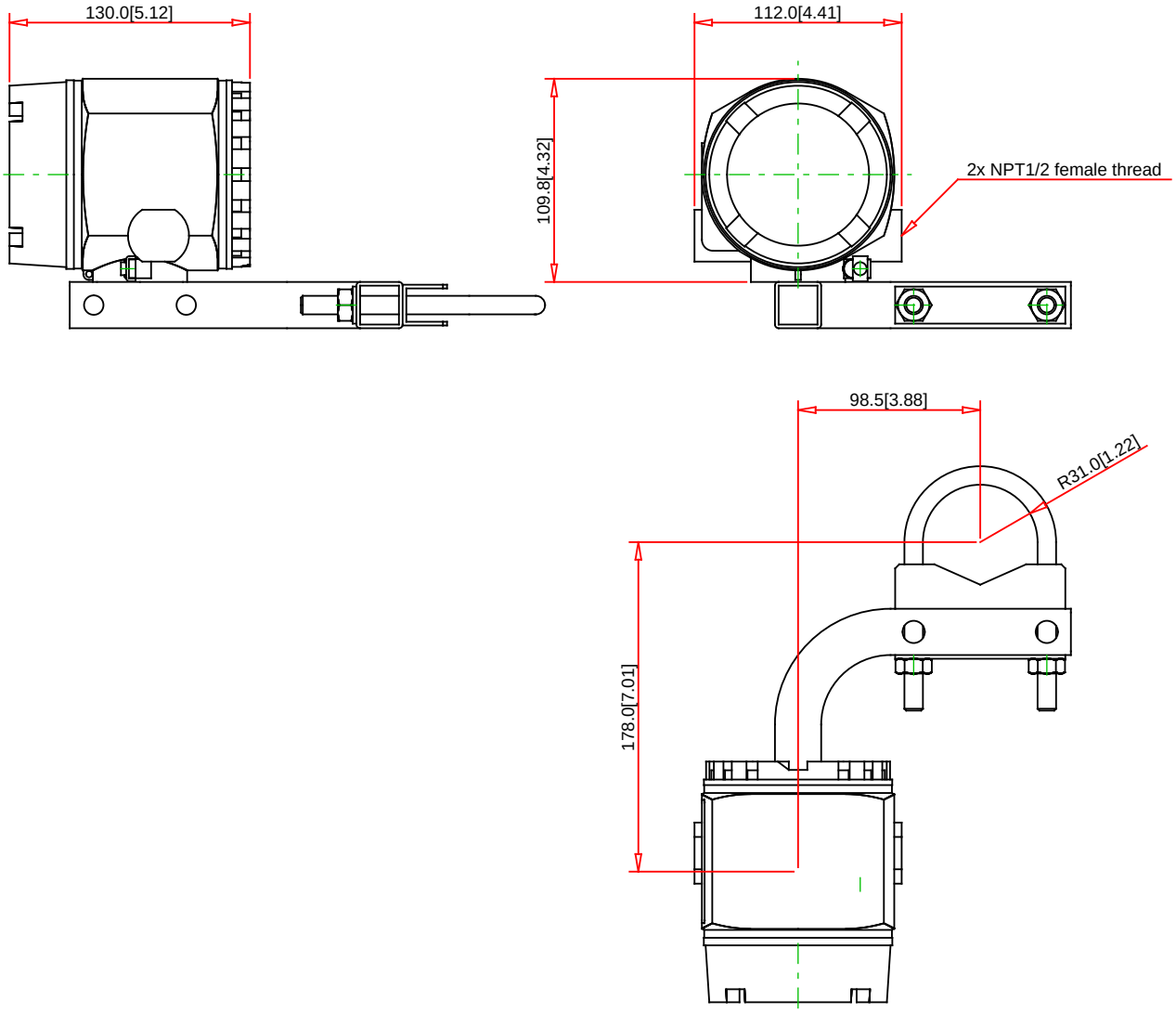
People for Process Automation

Tag: TIT-001



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Order Code :
TMT162-G21231DKA+Z1

Product Description :
TMT162, field transmitter

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Endress+Hauser

People for Process Automation

FLOW TRANSMITTER

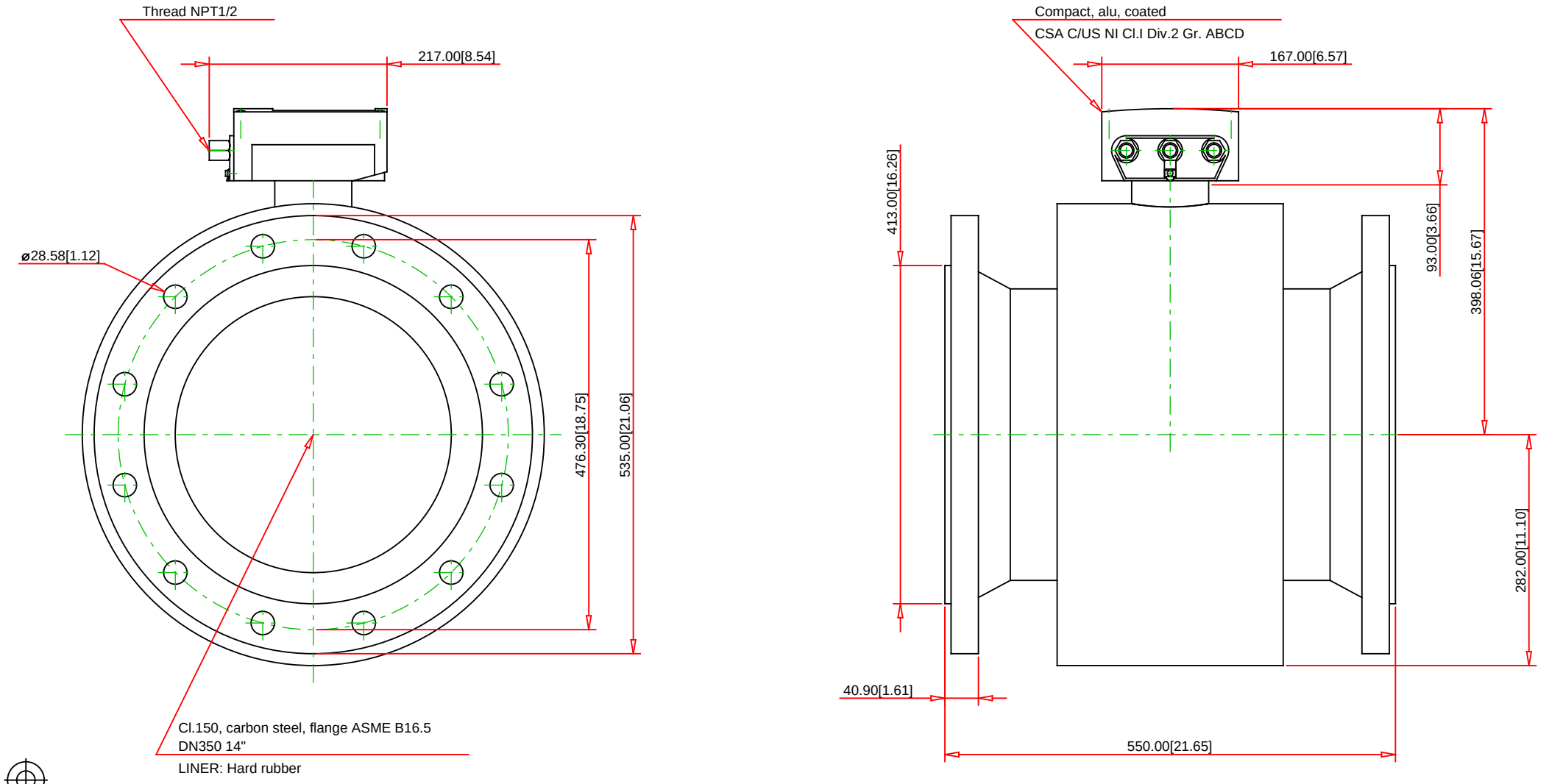
Spec Sheet Endress+Hauser

Item Name: Flow Transmitter

Product Data		
General information		
Measuring task	Flow (Volume)	
General explosion-protection information	Information about currently available Ex versions (ATEX, FM, CSA, TIIS, IECEx, NEPSI, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is availabe upon request.	
Identification		
Nameplate material	Stainless steel	
Manufacturer name	Endress+Hauser	
Vendor	Endress+Hauser	
Product device / transmitter		
Product name	Proline Promag W 400	
Order code	5W4C3F-MNP0/101	
Extended order code	5W4C3F-C6ELHA0DHA1K0ADADHECZ1	
Function and system design		
Measuring principle	Electromagnetic	
Adjustment	Output 1	
Adjustment	Display; Totalizer	
Device Software Functional Packages	ECC electrode cleaning circuit	
Input characteristics		
Measurement channels		
Measured variable	Flow	
Measuring range		
Lower range-limit	0.01	m/s
Upper range-limit	10.0	m/s
Output characteristics		
Analog Output		
Number	1	
Output type	Analog Output	
Pulse/frequency output		
Number	1	
Output type	Pulse/Frequency Output	
Communication interface		
HART Communication Interface		
System Integration		
Type of protocol	HART	
Power supply		

Nominal diameter based on ASME	14"	
Nominal pressure	Class 150	
Material process connection	Carbon steel	
Flowmeter (Electromagnetic)		
Material electrodes based on EN/DIN	1.4435	
Material electrodes based on AISI	316L	
Material lining	Hard rubber	
Inline device length in mm	550.0	mm
Inline device length in inch	21.65	inch
Certificate and approvals device / transmitter		
Approval for general usage	CE mark	
Ex certificates C/US		
Approval type	CSA C/US	
Ignition protection type	NI	
Ex designation	yes	
Class	Class I	
Division	Division 2	
Group	Group A-D	
Calibration		
Calibration performed	yes	
Calibration type	Standard	
Comments		

Due to a transition phase from DIN 2501 / EN 1092-1 (2001) to EN 1092-1 (2013) for DN 350 - DN 2400 you may still receive flanges according to the old standard. Additional details and dimensions are available in the Operating Instructions (BA)



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Order Code :
5W4C3F-C6ELHA0DHA1K0A+DADHECZ1

Product Description :
Promag W 400, 5W4C3F, DN350 14"

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Endress+Hauser

People for Process Automation

LEVEL TRANSMITTER

Spec Sheet Endress+Hauser

Item: Level Transmitter

Product Data		
General information		
Measuring task	Continuous Level	
General explosion-protection information	Information about currently available Ex versions (ATEX, FM, CSA, TIIS, IECEx, NEPSI, etc.) can be supplied by your E+H Sales Center on request. All explosion protection data are given in a separate documentation which is availabe upon request.	
Identification		
Nameplate material	Stainless steel	
Manufacturer name	Endress+Hauser	
Vendor	Endress+Hauser	
Product device / transmitter		
Product type	Level transmitter for continuous and non-contact level measurement	
Product name	Micropilot FMR62B	
Order code	FMR62B-H478/0	
Extended order code	FMR62B-C1BADBHBGAAAAGJPJAPBZ1	
Function and system design		
Measuring principle	Radar measurement	
Input characteristics		
Measurement channels		
Measured variable	Level	
Measuring range		
Upper range-limit (EU)	50.0	m
Upper range-limit (US)	164.0	ft
Output characteristics		
Analog Output		
Output type	Analog Output	
Signal type	4-20 mA	
Lower range value of signal	4.0	mA
Upper range value of signal	20.0	mA
Communication interface		
HART Communication Interface (output)		
System Integration		
Type of protocol	HART	
Other Communication Interfaces		
Interface name	Bluetooth	
Power supply		

Power input circuit		
Supply mode	2 wire	
Operating conditions		
Environment		
Ambient temperature °C min.	-20.0	°C
Ambient temperature °F min.	-4.0	°F
Ambient temperature °C max.	60.0	°C
Ambient temperature °F max.	140.0	°F
Storage temperature °C min.	-40.0	°C
Storage temperature °F min.	-40.0	°F
Storage temperature °C max.	85.0	°C
Storage temperature °F max.	185.0	°F
Climate class	DIN EN 60068-2-38 (test Z/AD)	
Vibrational resistance	DIN EN 60068-2-64 / IEC 60068-2-64 for 5 to 2 000 Hz: 1.5 (m/s2)2/Hz	
Electromagnetic compatibility	EN 61326- series and NAMUR recommendation EMC (NE21)	
Process conditions		
Process temperature in °C min.	-20.0	°C
Process temperature in °F min.	-4.0	°F
Process temperature in °C max.	150.0	°C
Process temperature in °F max.	302.0	°F
Process pressure in bar min.	-1.0	bar
Process pressure in bar max.	16.0	bar
Process pressure in psi min.	-14.5	psi
Process pressure in psi max.	232.0	psi
Mechanical construction		
Connection housing / head		
Housing type	Transmitter housing	
Housing design	Single compartment	
Degree of protection, NEMA	NEMA Type 4X/6P Enclosure	
Degree of protection, Europe	IP66/68	
Material housing	Aluminum, coated	
Additional equipment	Weather protection cover	
Cable entry power supply		
Threaded cable entry	NPT 1/2	
Cable entry signal line		
Threaded cable entry	NPT 1/2	
Process connection		
Type of connection	Flange	
Design sealing surface	RF	
Reference Standard for connection	ASME B16.5	
Nominal diameter based on ASME	NPS 4"	
Nominal pressure	Class 150	
Material process connection based on AISI	316/316L (dual rated)	
Material gasket	FFKM Kalrez	

Antenna		
Antenna diameter in mm	50.0	mm
Antenna diameter in inch	2.0	inch
Antenna shape	Drip-off antenna	
Material wetted part	PTFE	
Operability		
Display on device	With display	
Display element		
Display type	LCD display	
Certificate and approvals device / transmitter		
Approval for general usage	CE mark	
Quality certificate	Inspection certificate 3.1 EN10204	
Material test certificate	3.1 Material (wetted parts) approval (EN 10204)	
Ex certificates C/US		
Approval type	CSA C/US	
Ignition protection type	XP	
Ex designation	yes	
Class	Class I	
Division	Division 1	
Group	Group A-D	
Ex certificates C/US 2		
Approval type	CSA C/US	
Ex designation	yes	
Class	Class II	
Class	Class III	
Division	Division 1	
Group	Group E-G	
Ex certificates C/US 3		
Approval type	CSA C/US	
Ignition protection type	IS	
Ex designation	yes	
Class	Class I	
Class	Class II	
Class	Class III	
Division	Division 1	
Group	Group A-G	
Ex certificates C/US 4		
Approval type	CSA C/US	
Ignition protection type	Ex ia	
Class	Class I	
Division	Division 2	
Group	Group A-D	
Ex certificates C/US 5		
Approval type	CSA C/US	
Ignition protection type	AEx/Ex db	

Equipment protection level	Ga/Gb
Zone	Zone 0/1
Ex designation	yes
Gas group	IIC
Temperature class	T6
Class	Class I

Ex certificates C/US 6

Approval type	CSA C/US
Ignition protection type	AEx/Ex ia
Equipment protection level	Ga
Zone	Zone 0
Ex designation	yes
Gas group	IIC
Temperature class	T6
Class	Class I

Comments

J6 Series

PRESSURE AND VACUUM SWITCHES

FEATURES

- Gasketed, Die Cast Aluminum Enclosure with Epoxy Coating
- SPDT Switch Output
- Adjustable Deadband Option
- Sealed, Isolated Metal Bellows Sensors
- Adjustable Pressure Ranges: 30 "Hg Vac to 6000 psi (-1 to 414 bar)

ISO 9001 CERTIFIED COMPANY

OVERVIEW

The J6 is a reliable, sensitive pressure switch, originally designed for instrument air applications in process plants. Its compact design and combination of set-point sensitivity and narrow or optional adjustable deadband, offers cost-saving solutions for a variety of applications.

The J6 is ideally suited for a wide range of industrial processes such as alarm/shutdown and low/high service pressures. OEMs also utilize the J6 in machinery and equipment for threshold protection.

FEATURES

- UL listed and cUL certified
- Optional ATEX or GOST intrinsic safety compliance
- Designed to meet Enclosure Type 4X
- SPDT switch output
- Adjustable deadband option for precise on-off control
- Brass or welded stainless steel bellows sensors
- External manual reset option

SPECIFICATIONS

AMBIENT TEMPERATURE LIMITS	-40° to 160°F (-40 to 71°C); set point typically shifts less than 1% of range for a 50°F (28°C) ambient temperature change
SET POINT REPEATABILITY	Models S126B-S164B, 126-364, 680: ± 1% of adjustable range; models 610-614: ± 1.5% of adjustable range
SHOCK	Set point repeats after 15 G, 10 millisecond duration
VIBRATION	Set point repeats after 2.5 G, 5-500 Hz
ENCLOSURE	Die cast aluminum, epoxy powder coated, gasketed; captive cover screws
ENCLOSURE CLASSIFICATION	Designed to meet Enclosure Type 4X requirements
SWITCH OUTPUT	One SPDT; switch may be wired "normally open" or "normally closed"
ELECTRICAL RATING	15 A 125/250/480 VAC resistive. Electrical switches have limited DC capabilities. Consult factory for additional information.
WEIGHT	Approx. 1 lb., 8 oz. (0.68 kg.)
ELECTRICAL CONNECTION	1/2" NPT (female)
PRESSURE CONNECTION	All models 1/4" NPT (female) except models S126B-S164B: 1/2" NPT (female)

APPROVALS

UE declarations and third-party issued Agency certifications are available for download at www.ueonline.com/prod_approval.

UNITED STATES AND CANADA
UL Listed,
UL 508, file #E42272
cUL Certified
CSA C22.2 No. 14, file #42272
Canadian Registration Number (CRN): Refer to www.ueonline.com/certifications for list of approved models

EUROPEAN UNION
ATEX Directive (94/9/EC)
II 1 G EEx ia IIC T6 **(OPTIONAL - Code M405)**
Tamb = -50°C to +60°C
UL International DEMKO A/S (N.B.# 0539)
Certificate #DEMKO 03 ATEX 0335063
EN 50014, 50020 & 50284

Low Voltage Directive (LVD) (73/23/EC & 93/68/EEC)
Compliant to LVD
Products rated lower than 50 VAC and 75 VDC are outside of the scope of the LVD
The Low Voltage Directive does not apply to products for use in hazardous locations

Pressure Equipment Directive (PED) (97/23/EC)
Compliant to PED
Products rated below 7.5 psi are outside the scope of PED

RUSSIA
Gosgortechnadzor Permit **(OPTIONAL - Code M406)**
OExia IIC T6
Tamb. = -50°C to +60°C
NANIO CCVE Certification Center
Certificate ROSS US.GB05.Bo2933
GOST R 51330.0, 51330.1, 51330.10 & 51330.14

PRESSURE MODEL CHART

Model	Adjustable Set Point Range Low end of range on fall; High end of range on rise		Deadband		Over Range Pressure*		Proof Pressure**	
	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar
Welded 316L stainless steel bellows and 1/2" NPT (female) pressure connection								
S126B	30 "Hg Vac to 0 psi	-1 to 0	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	3	0,2	5	0,3
S134B	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	20	1,4	25	1,7
S136B	0 to 50" wc	0 to 124,5 mbar	3 to 6 "wc	7,5 to 14,9 mbar	50 "wc	124,5 mbar	5	0,3
S142B	0 to 18	0 to 1,2	4 to 7 "wc	10 to 17,4 mbar	18	1,2	25	1,7
S148B	0 to 40	0 to 2,8	0.1 to 0.4	6,9 to 27,6 mbar	40	2,8	40	2,8
S152B	0 to 50	0 to 3,4	0.1 to 0.5	6,9 to 34,5 mbar	50	3,4	75	5,2
S156B	3 to 100	0,2 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	100	6,9	125	8,6
S160B	50 to 180	3,4 to 12,4	0.3 to 1	20,7 to 68,9 mbar	180	12,4	180	12,4
S164B	0 to 200	0 to 13,8	0.3 to 2	20,7 to 137,9 mbar	200	13,8	200	13,8
Welded 316L stainless steel bellows and 1/4" NPT (female) pressure connection (Model 680 not recommended for rapid or high cycling pressure changes)								
354	0 to 50	0 to 3,4	1.5 to 2.5	0,1 to 0,2	50	3,4	75	5,2
356	0 to 100	0 to 6,9	2 to 4	0,1 to 0,3	100	6,9	150	10,3
358	0 to 200	0 to 13,8	3 to 5	0,2 to 0,3	200	13,8	250	17,2
360	0 to 250	0 to 17,2	3 to 5	0,2 to 0,3	250	17,2	330	22,8
362	0 to 350	0 to 24,1	2 to 8	0,1 to 0,6	350	24,1	430	29,6
364	0 to 500	0 to 34,5	3 to 9	0,2 to 0,62	500	34,5	575	39,6
680	100 to 1700	6,9 to 117,2	9 to 23	0,6 to 1,6	1700	117,2	2500	172,4
303 stainless steel piston with Buna N O-ring and 303 stainless steel 1/4" NPT (female) pressure connection (not recommended for gas service since drying of the O-ring can allow bleeding of the medium into the atmosphere)								
610	75 to 1000	5,2 to 68,9	30 to 150	2,1 to 10,3	1000	68,9	10,000	689,5
612	125 to 3000	8,6 to 206,8	40 to 250	2,8 to 17,2	3000	206,8	10,000	689,5
614	500 to 6000	34,5 to 413,7	50 to 400	3,4 to 27,6	6000	413,7	10,000	689,5

* **Over Range Pressure**: The maximum pressure that may be applied continuously without causing damage and maintaining set point repeatability.
** **Proof Pressure**: The maximum pressure to which a pressure sensor may be occasionally subjected, which causes no permanent damage. The unit may require calibration (e.g., start-up, testing).

Model	Adjustable Set Point Range Low end of range on fall; High end of range on rise		Deadband		Over Range Pressure*		Proof Pressure**	
	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar (unless noted)	psi (unless noted)	bar
Brass bellows with nickel-plated brass 1/4" NPT (female) pressure connection†; Models 126 and 134 have zinc-plated steel spring exposed to media								
126	30 "Hg Vac to 0 psi	-1 to 0	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	3	0,2	5	0,3
134	30 "Hg Vac to 20 psi	-1 to 1,4	0.2 to 0.8 "Hg	6,8 to 27,1 mbar	20	1,4	25	1,7
136	0 to 50" wc	0 to 124,5 mbar	3 to 6 "wc	7,5 to 14,9 mbar	50 "wc	124,5 mbar	5	0,3
142	0 to 18	0 to 1,2	4 to 7 "wc	10 to 17,4 mbar	18	1,2	25	1,7
148	0 to 40	0 to 2,8	0.1 to 0.4	6,9 to 27,6 mbar	40	2,8	40	2,8
152	0 to 50	0 to 3,4	0.1 to 0.5	6,9 to 34,5 mbar	50	3,4	75	5,2
156	3 to 100	0,2 to 6,9	0.2 to 0.8	13,8 to 55,2 mbar	100	6,9	125	8,6
160	50 to 180	3,4 to 12,4	0.3 to 1	20,7 to 68,9 mbar	180	12,4	180	12,4
Phosphor bronze bellows with nickel-plated brass 1/4" NPT (female) pressure connection; Model 218 has 300 series stainless steel spring exposed to media								
218	30 "Hg Vac to 0 psi	-1 to 0	1 to 2 "Hg	33,9 to 67,7 mbar	0	0	30	2,1
222	0 to 20	0 to 1,4	0.5 to 1	34,5 to 68,9 mbar	20	1,4	30	2,1
224	0 to 30	0 to 2,1	0.5 to 1	34,5 to 68,9 mbar	30	2,1	45	3,1
226	0 to 50	0 to 3,4	0.7 to 1.3	48,3 to 89,6 mbar	50	3,4	75	5,2
230	0 to 100	0 to 6,9	1 to 2	68,9 mbar to 0,1 bar	100	6,9	110	7,6
258	0 to 50	0 to 3,4	1.5 to 2.5	0,1 to 0,2	50	3,4	75	5,2
266	0 to 100	0 to 6,9	2 to 5	0,1 to 0,3	100	6,9	150	10,3
270	0 to 200	0 to 13,8	3 to 5	0,2 to 0,3	200	13,8	250	17,2
272	0 to 250	0 to 17,2	3 to 5	0,2 to 0,3	250	17,2	330	22,8
274	0 to 300	0 to 20,7	4 to 6	0,3 to 0,4	300	20,7	350	24,1

†Several of these models were previously offered with adjustable deadband as J6D. Specify option code 1520 if adjustable deadband is required.

J6 Series

HOW TO ORDER

BUILDING A PART NUMBER

Select a **Type**

Refer to the "Type" section below.

Determine type number based on switch output, enclosure, adjustment and reference.

Fill in the type portion of your part number with the corresponding number.

Select a **Model**

Refer to the "Model Charts".

Determine model based on adjustable range, deadband and proof pressure.

Fill in the model portion of your part number with the corresponding number.

Select an **Option**

Refer to the "Options" section.

Determine option number based on switch output, optional materials or other product enhancements.

Fill in the option portion of your part number with the corresponding number.

Leave "option" portion blank if no options are needed. *FOR MULTIPLE OPTIONS:* Call United Electric Controls.

TYPE	DESCRIPTION
Pressure	**Type J6 -** One SPDT output; epoxy coated enclosure; internal adjustment with no reference dial

SWITCH OPTIONS*

0140	Gold contacts, 1 A 125 VAC resistive
0500	Close deadband, 5 A 125/250 VAC resistive
1070	10 A 125 VDC resistive; deadband and minimum set point will increase
1520	Adjustable deadband, 15 A 125/250/277 VAC resistive. Adjustment wheel changes rise setting only - if adjustment on fall setting is required, use primary adjustment. NOT AVAILABLE ON MODELS 258-274, 354-364, 610-614, 680. NOTE: Must select this option for models previously listed as J6D.
1530	External manual reset, 15 A125/250/480 VAC resistive, latches on rising pressure only
2000	20 A 125/250/480 VAC resistive

SENSOR AND OTHER OPTIONS

M201	Factory set one switch; specify increasing or decreasing pressure and set point
M277	Range indicated on nameplate in kPa or MPa factory selected
M278	Range indicated on nameplate in Kg/cm^2
M405	Intrinsic safety compliance for European Union per ATEX standards
M406	Instrinsic safety compliance for Russia per Gosgortechnadzor standards
M444	Paper ID tag
M446	Stainless steel ID tag & wire attachment
M540	Viton® construction (deadband and low end of range may increase); wetted parts include Viton® O-ring and standard connection material. AVAILABLE ON MODELS 610-614 ONLY
M550	Oxygen service cleaning; alcohol cleaning to remove residue from the process connection
M913	1/4" NPT (female) 316L stainless steel pressure connection. AVAILABLE MODELS S126B-S164B
M914	1/2" NPT (female) 316L stainless steel pressure connection. AVAILABLE MODELS 354-364

***** *All switches have limited DC capabilities. Consult factory for details.*

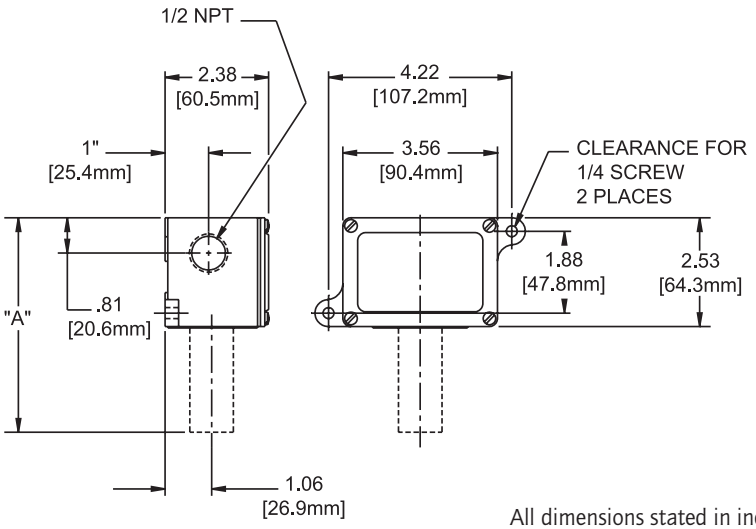
Viton® is a registered trademark of E.I. duPont de Nemours and Company

DIMENSIONAL DRAWINGS

Dimensional drawings for all models may be found at www.ueonline.com

Internal Set Point Adjustment

Types J6

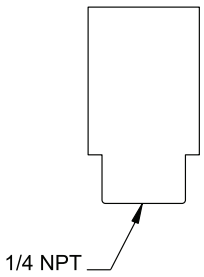


Dimension A			
Models	**Inches**	**mm**	**NPT**
126-160	5.06	128.5	1/4
S126B-S164B	5.47	138.9	1/2
218-230	4.31	109.5	1/4
258-274	4.75	120.7	1/4
354-364	4.78	121.4	1/4
610-614	5.72	145.3	1/4
680	4.97	126.2	1/4

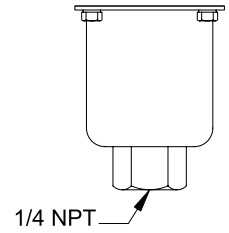
All dimensions stated in inches (millimeters)

Pressure Sensors

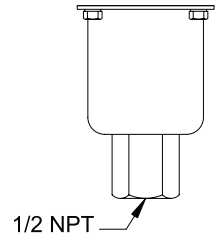
Models 218-230



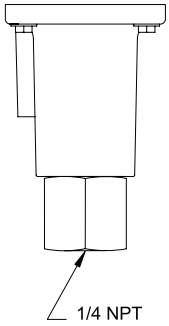
Models 126-160



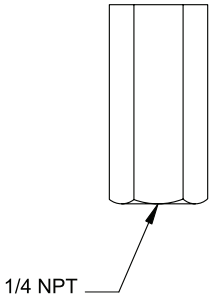
Models S126B-S164B



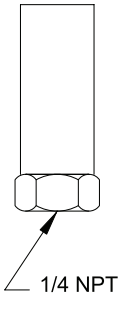
Models 610-614



Models 258-274



Models 354-364, 680



RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. When applicable, orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF SELLER'S LIABILITY

SELLER'S LIABILITY TO BUYER FOR ANY LOSS OR CLAIM, INCLUDING LIABILITY INCURRED IN CONNECTION WITH (I) BREACH OF ANY WARRANTY WHATSOEVER, EXPRESSED OR IMPLIED, (II) A BREACH OF CONTRACT, (III) A NEGLIGENT ACT OR ACTS (OR NEGLIGENT FAILURE TO ACT) COMMITTED BY SELLER, OR (IV) AN ACT FOR WHICH STRICT LIABILITY WILL BE INPUTTED TO SELLER, IS LIMITED TO THE "LIMITED WARRANTY" OF REPAIR AND/OR REPLACEMENT AS SO STATED IN OUR WARRANTY OF PRODUCT. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL OR OTHER DAMAGES OF A LIKE GENERAL NATURE, INCLUDING, WITHOUT LIMITATION, LOSS OF PROFITS OR PRODUCTION, OR LOSS OR EXPENSES OF ANY NATURE INCURRED BY THE BUYER OR ANY THIRD PARTY.

UE specifications subject to change without notice.

Be sure to visit www.ueonline.com for the latest information.

FOR A LIST OF OUR INTERNATIONAL AND DOMESTIC REGIONAL SALES OFFICES PLEASE VISIT OUR WEBPAGE WWW.UEONLINE.COM

UNITED ELECTRIC CONTROLS
180 Dexter Avenue, P.O. Box 9143
Watertown, MA 02471-9143 USA
Telephone: 617 926-1000 Fax: 617 926-2568
http://www.ueonline.com

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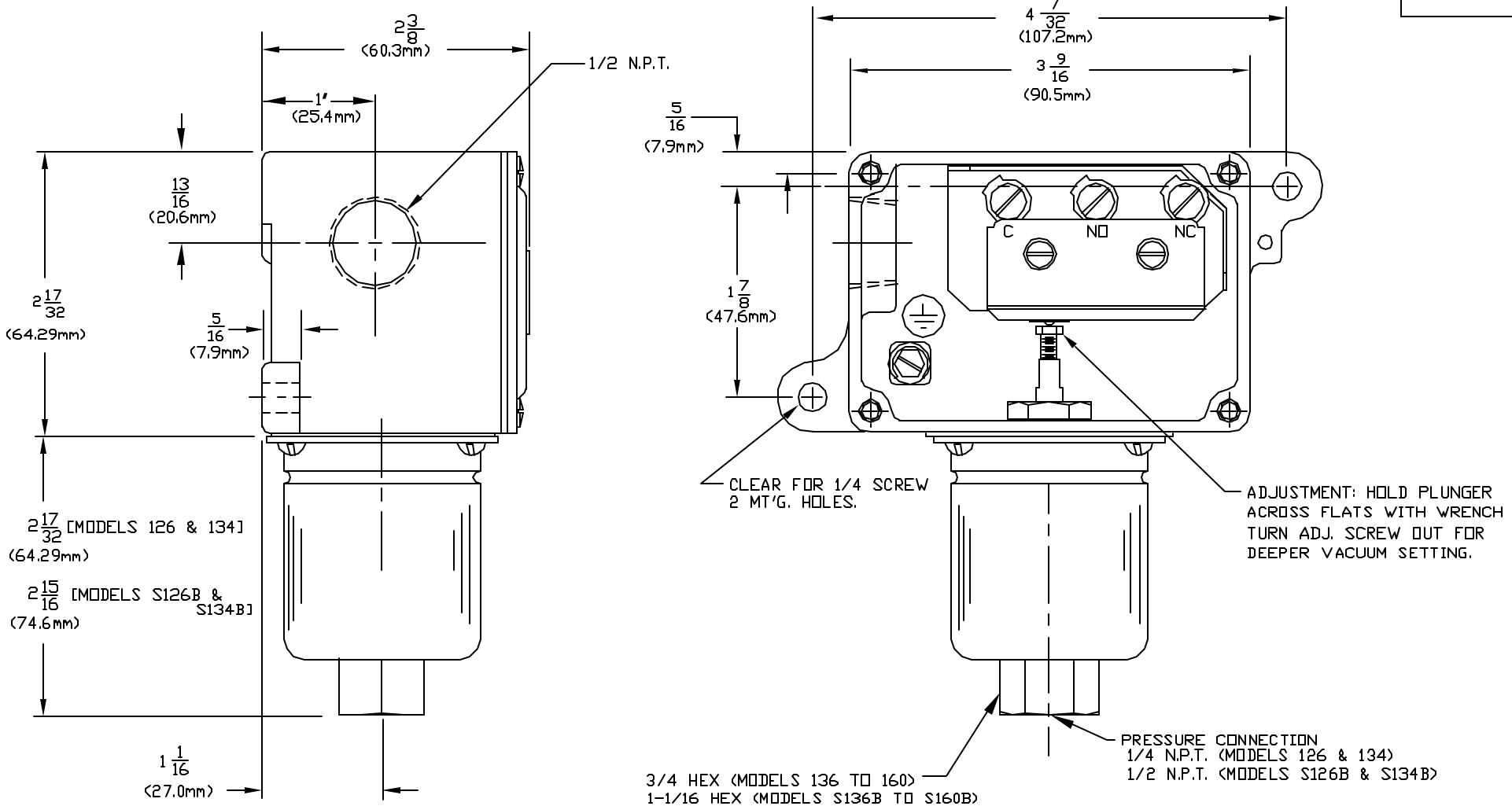
A-4488



COVER REMOVED IN FRONT VIEW

R	REDRAWN, NO CHANGE. ECN#C5688	7/5/96	PLW	L.K.
SYM	DESCRIPTION	DATE	DWN	APPD

REVISIONS

ORIGINAL DATE	4-7-54
DRWN	GLENN V. REIS
CHKD	A.B.
APPD	A.B.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ±1/64 2 PLACE DEC 3 PLACE DEC ANGLES ±.010 ±.005 ±1/2° DO NOT SCALE THIS DRAWING

TITLE

TYPE J6
MODELS:
126 & 134
S126B & S134B

SCALE 3/4:1

UNITED ELECTRIC CONTROLS COMPANY
WATERTOWN * MASSACHUSETTS

DF001
REV. B

DWG NO
A-4488

Data Sheet

1008S 63 mm & 100 mm Stainless Steel Pressure Gauge

Tags:
20-PI-304-1/2/3/4
20-PI-303-1/2/3/4

FEATURES

- Power*Flex*™ movement provides superior resistance to shock, vibration and pulsation
- ***PLUS!***™ Performance patented dampening technology provides liquid fill performance in a dry gauge
- All welded stainless steel construction
- Ventable fill plug
- MSL Helium leak tested to $1x10^{-6}$ scc/s
- Ammonia and refrigerant versions available

TYPICAL USES

- Pumps and compressors
- Hydraulics and pneumatic
- Specialized OEM equipment
- Food and beverage
- Ammonia and refrigeration

1008S/SL
63, 100 mm dial size

SPECIFICATIONS

Accuracy:	Dry: ±1.6% of span Liquid: ±2% of span
Size:	63, 100 mm
Ranges:	Vacuum, compound to 15,000 psi
Process Connection Location:	Lower, Lower Back, Top, 3 o'clock, 9 o'clock
Process Connection Size:	⅛ NPT Male, ¼ NPT Male
Movement:	304 Stainless steel
Window Material:	Polycarbonate
Dial:	Black figures on white background, aluminum
Pointer:	Black, aluminum
Weather Protection:	IP65 (Plug closed), IP54 (Plug vented) NEMA 4X (Plug closed)
Dampening:	Liquid fill and ***PLUS!***™ Performance
Mounting:	U-clamp, Back Flange and Front Flange
Approvals:	CRN, RoHS, PED, CE/UKCA

WETTED COMPONENTS

Bourdon Tube	Process Connection Material
316 SS	316 Stainless steel

NON-WETTED COMPONENTS

Case	Ring
304 SS	304 Stainless steel crimped

KEY BENEFITS

- **Accessory kits for easy panel mounting**
- **True Zero™ reduces reading errors "zero box" instead of conventional dial pins**

MIN/MAX TEMPERATURE LIMITS

Version	Ambient	Process	Storage
Dry	-40 °F to 200 °F (-40 °C to 93 °C)	-40 °F to 250 °F (-40 °C to 121 °C)	-40 °F to 250 °F (-40 °C to 121 °C)
PLUS!™	-40 °F to 150 °F (-40 °C to 66 °C)	-40 °F to 200 °F (-40 °C to 93 °C)	-40 °F to 150 °F (-40 °C to 66 °C)
Glycerin Fill	20 °F to 150 °F (-7 °C to 66 °C)	20 °F to 200 °F (-7 °C to 66 °C)	0 °F to 150 °F (-18 °C to 66 °C)
Silicone Fill	-40 °F to 150 °F (-40 °C to 66 °C)	-40 °F to 200 °F (-40 °C to 93 °C)	-40 °F to 150 °F (-40 °C to 66 °C)
Halocarbon® Fill	-40 °F to 150 °F (-40 °C to 66 °C)	-40 °F to 200 °F (-40 °C to 93 °C)	-40 °F to 150 °F (-40 °C to 66 °C)

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ASHCROFT®
Trust the shield.®

1008S 63 mm & 100 mm Stainless Steel Pressure Gauge

ORDERING CODE Example:	63	S	L	02	L	XC4	100#
Dial Size/Model Code							
631008 - 63 mm (2½″) 304 Stainless steel case	63						
101008 - 100 mm (4″) 304 Stainless steel case							
System							
S - 316 Stainless steel tube/316 stainless steel process connection		S					
Case Fill							
Blank - Dry liquid fillable							
L - Liquid filled case (glycerin standard)			L				
Process Connection Size							
01 - ⅛ NPT Male							
02 - ¼ NPT Male				02			
04 - ½ NPT Male							
RW - SAE 4 7/16″- 20 straight thread with washer and O-ring							
KJ - ¼″ Straight JIS, BSP							
KA - ¼″ Tapered JIS, BSP							
13 - G ¼″ DIN							
JP - ¼″ Tubing							
JQ - 6mm Tubing (N/A with throttle plug, N/A ranges above 6000 psi)							
JR - ⅜″ Tubing (N/A with throttle plug, N/A on ranges above 6000 psi)							
Process Connection Location							
L - Lower					L		
B - Lower back							
D - Side (3 o'clock)							
E - Side (9 o'clock)							
T - Top							
Options (If choosing an option(s) must include an "X")						X__	
LL - ***PLUS!***™ Performance							
NZ - ***PLUS!***™ Performance silicone free							
GV - Silicone case fill (add to glycerine filled case)							
GX - Halocarbon® case fill (add to glycerine filled case)							
TU - Throttle plug 0.013″ orriface (STD. on all liquid filled and XLL gauges 30 psi to 1000 psi)							
TS - Throttle screw (STD. with liquid filled and XLL gauges 1500 psi and above)							
6B - Cleaned for oxygen service (for liquid filled Halocarbon® XGX required; N/A on ranges greater than 10,000 psi							
NH - Stainless steel tag wired to case							
FF - Front flange							
UC - U-clamp							
FW - Back flange mounting							
C3 - Material certification, call factory for availability							
C4 - Traceable calibration certificate						C4	
SM - All stainless steel movement							
YW - 316L Stainless steel case and ring							
Ranges (See range table on page 3 for all standard ranges)							
Single Scale							
100# - 100 psi							100#

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ASHCROFT®
Trust the shield.®

1008S 63 mm & 100 mm Stainless Steel Pressure Gauge

SINGLE SCALE

	psi	bar	kPa	Mpa	kg/cm2
Vacuum	30IMV	N1BR	N100KP	N0.1MP	N1KG
	-	N1/0.6BR	N100/60KP	N0.1/0.6MP	N1/0.6KG
Compound	30IMV&15#	-	-	-	-
	-	N1/1.5BR	N100/150KP	N0.1/15MP	N1/1.5KG
	30IMV&30#	-	-	-	-
		N1/3BR	N100/300KP	N0.1/3MP	N1/3KG
	30IMV&60#	-	-	-	-
	-	N1/5BR	N100/&500KP	N0.1/5MP	N1/5KG
		-	-	-	-
Positive Pressure	30IMV&100#				
		N1/9BR	N100/900KP	N0.1/9MP	N1/9KG
	15#	1BR	100KP	0.1MP	1KG
	-	1.6BR	160KP	0.16MP	1.6KG
	30#	-	-	-	-
	-	2.5BR	250KP	0.25MP	2.5KG
	60#	4BR	400KP	0.4MP	4KG
	-	6BR	600KP	0.6MP	6KG
	100#	-	-	-	-
		10BR	1000KP	1MP	10KG
	160#	-	-	-	-
	200#	-	-	-	-
	-	16BR	1600KP	1.6MP	16KG
	300#	-	-	-	-
	-	25BR	2500KP	2.5MP	25KG
	400#	-	-	-	-
	600#	40BR	4000KP	4MP	40KG
	800#	-	-	-	-
	-	60BR	6000KP	6MP	60KG
	1000#	-	-	-	-
	1500#	100BR	10,000KP	10MP	100KG
	2000#	-	-	-	-
	-	160BR	16,000KP	16MP	160KG
	3000#	-	-	-	-
	-	250BR	25,000KP	25MP	250KG
	4000#	-	-	-	-
	5000#	-	-	-	-
	6000#	400BR	40,000KP	40MP	400KG
	-	600BR	60,000KP	60MP	600KG
	8000#	-	-	-	-
	10,000#	-	-	-	-
	15,000#	1000BR	100,000KP	100MP	1,000KG

NOTES

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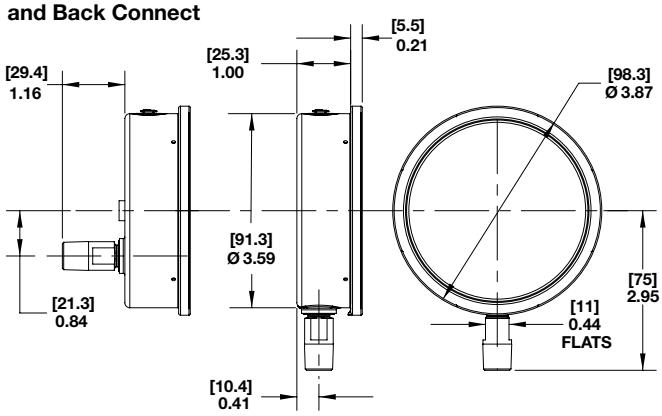
1008S 63 mm & 100 mm Stainless Steel Pressure Gauge

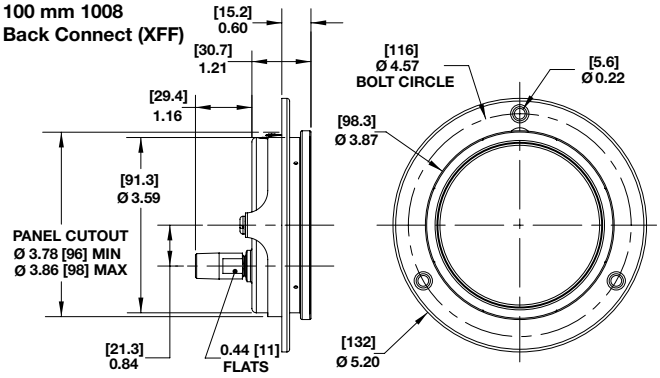
DIMENSIONS in [ ] are millimeters

For reference only, consult Ashcroft for specific dimensional drawings

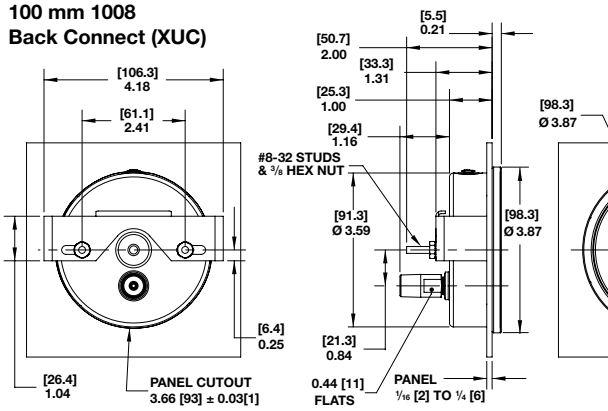
100 mm 1008 Lower and Back Connect



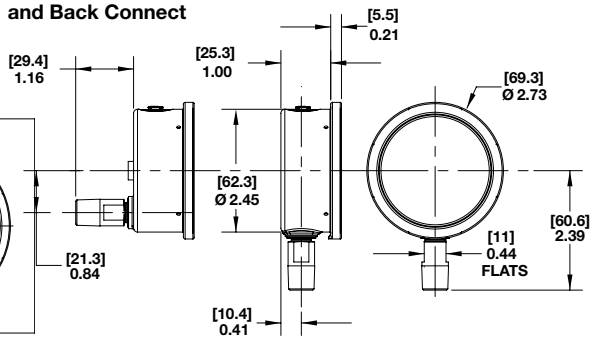
100 mm 1008 Back Connect (XFF)



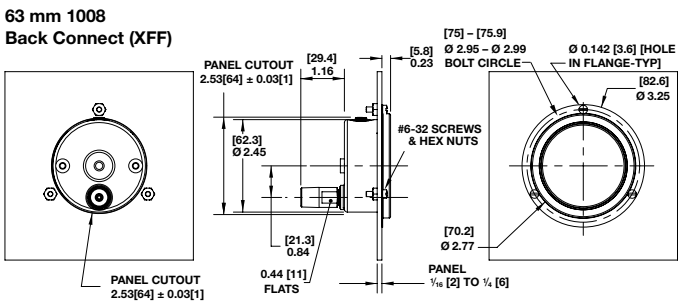
100 mm 1008 Back Connect (XUC)



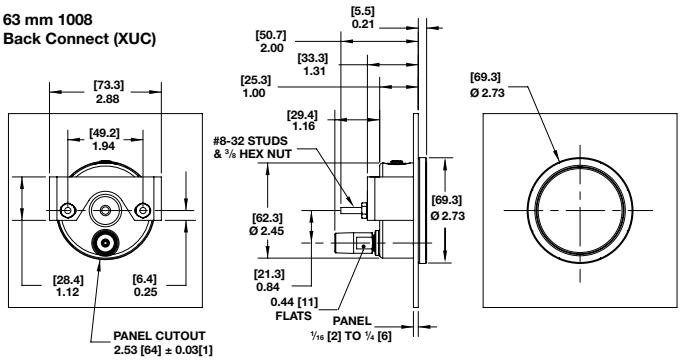
63 mm 1008 Lower and Back Connect



63 mm 1008 Back Connect (XFF)



63 mm 1008 Back Connect (XUC)



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MJK Float Switch 7030

2.71

MERCURY FREE WITH HIGHLY FLEXIBLE BREAKFREE CABLE

General - flexible breakfree cable

The exceptional reliability of the MJK Float Switch 7030 makes it very suitable for many highly automated systems to provide additional protection against control system failures, preventing pumps from running dry, etc.

MJK uses only up-to-date, environmentally friendly materials in the Float Switch 7030. The extra durability of the potted switching components - strong multi-fiber flexible cable and rugged polypropylene enclosure - allows the Float Switch 7030 to deliver reliable results where other float switches fail.

5 YEAR WARRANTY

Features

- Environmental friendly - no mercury
- Unmatched rugged construction for durability
- Reliable electromechanical contact system - guaranteed for up to 20 million operations
- Unique counterweight system
- UL approved 250 VAC/16 A switch
- 12, 20, 30,5 or 46m oil resistant PVC cable and polypropylene cable bracket
- SPDT relay allowing normally open or normally closed configurations - selected based on how it is wired.

Applications

- Waste water pumping stations
- Sewage treatment plants
- Drinking water reservoirs.

Functions

A hermetically sealed microswitch is activated by a moving counterweight when the float changes its position in the fluid. The changeover hysteresis can be adjusted by means of a counterweight placed on the cable. The counterweight also ensures that Float Switch 7030 is always correctly positioned and makes the bend of the cable less sharp.

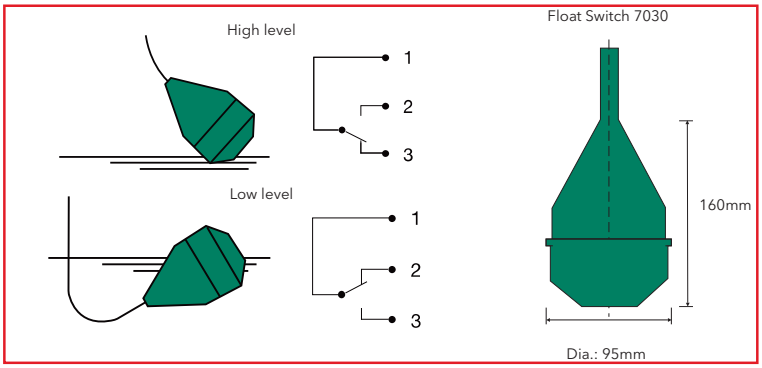
mjk
a xylem brand

Datasheet

EN 2.71 Float Switch 7030 datasheet 2005

MJK Float Switch 7030 - with flexible cable

Connections and Dimensions



Specifications

Float Switch 7030 - with flexible cable	
Output signal	Mechanical contact system (microswitch), change-over switch (SPDT)
Max. load	AC: 250V / 16A. Voltage Max. 250V AC DC: 220V / 0,5A. 24V / 16A
Temperature	- 20 … + 60 °C /- 5 to + 150 °F
Materials	Body: Polypropylene Bending relief: Oil resistant PVC Cable: Oil resistant PVC
Cable	3 x 1 mm2 (AWG 17), dia. 8 mm (1/3in)
Cable lengths	12, 20, 30,5, 46m /39, 65, 100, 150ft.
Enclosure	IP 68 / NEMA 6P
Approvals	CE approvals: EN61000-6-1, EN61000-6-3, EN61000-6-4 2007, EN61000-6-2 2005. Switch UL U83 161 3 (16A 125VAC).

Order Numbers

Float Switch 7030 - with flexible cable	
202810	Float switch 7030 with 12m/39ft. cable
202811	Float switch 7030 with 20m/65ft cable
202811-100	Float Switch 7030 with 30,5m/100ft cable
202811-150	Float Switch 7030 with 46m/150ft cable
Float Switch 7030 - with flexible cable - incl. counter weight	
202814	Float switch 7030 incl. 560917 With 12m/39ft cabel
202814-65	Float switch 7030 incl. 560917 With 20m/65ft cabel
202814-100	Float switch 7030 incl. 560917 With 30,5m/100ft cabel
Float Switch 7030 - with flexible cable - acessories	
560914	Plastic Mounting Bracket for Expert™ Transmitter, Cable Ø6-10mm
560917	Counter weight f. level switch 400 gr.

MJK Float Switch 7030

2.71

MERCURY FREE WITH STANDARD CABLE

General - standard cable

The MJK Float Switch 7030 with standard cable is the ideal choice for most level control applications, such as wastewater pumping stations and ground water or drainage pumping. When the liquid level reaches the MJK Float Switch 7030, the float tilts, activating the internal micro switch, which starts or stops a pump or triggers an alarm device.

MJK Float Switch 7030 hangs immersed in the liquid. This prevents cables from tangling when several regulators are used. MJK Float Switch 7030 level regulators last several times longer than most standard level regulators. This ensures reliable operation and a low degree of maintenance - thereby keeping service costs down to a minimum over a lifecycle.

Environmentally friendly

The MJK Float Switch 7030 contains no harmful or toxic materials such as lead or mercury and does not require use of any adhesives.

Features

- Environmental friendly - no mercury
- Reliable electromechanical contact system
- 13, 20, and 30m oil resistant PVC cable and polypropylene cable bracket
- SPDT relay allowing normally open or normally closed configurations - selected based on how it is wired.

Applications

- Waste water pumping stations
- Sewage treatment plants
- Drinking water reservoirs.

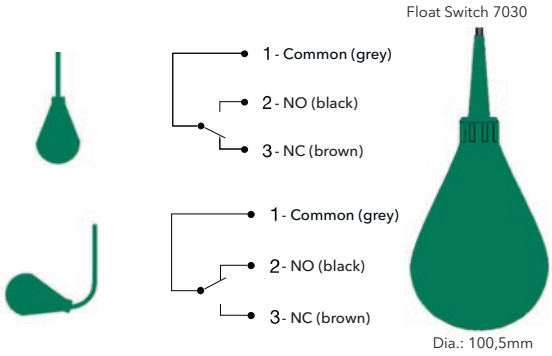
Functions

In a two-pump station, generally, four level regulators are used.
One is positioned at the stop level, one at each pump's start level, and the fourth regulator is used to trigger a high-level alarm.

mjk
a xylem brand

MJK Float Switch 7030 - with standard cable

Connections and Dimensions



Specifications

Float Switch 7030 - with standard cable	
Output system	Mechanical contact system (microswitch), change-over switch (SPDT)
Max. load	AC: 250 V/10 A resistive load AC: 250 V/10 A resistinductive load at cosϕ = 0.5 DC: 24 V/ 10mA min., 6 A max.
Temperature	0... + 60 °C /- 32 to + 140 °F
Materials	Body: Polypropylene Bending relief: EPDM rubber Cable: Special compound PVC & NBR/PVC
Cable	3 x 0,75 mm2 (AWG 21), dia. 6 mm (0.236 in)
Cabel length	13, 20 og 30m/43, 65, 98ft
Enclosure	IP 68 / NEMA 6P
Approvals	CE, CSA, SEMKO, NEMKO, DEMKO

Order Numbers

Float Switch 7030 - with standard cable	
202800	Float switch 7030 with 13m/42ft. cable
202802	Float switch 7030 with 20m/65ft. cable
202803	Float switch 7030 with 30m/100ft. cable

MJK Automation
Blokken 9
DK-3460 Birkerød
Denmark

Tel. +45 45 56 06 56
www.mjk.com

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Appendix D

Installation and Maintenance Manual

ZeeWeed* 500EV
Immersed Hollow-Fiber Ultrafiltration Technology

SAMPLE ONLY

[Project Number]-WTS-OM-SYS-EN41-MA-100 | Rev. A

CE

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Document information

Signatories

Role	Company	Name	Job Title	Date
Author				
Checked				
Approved				

Revision status

Rev.	Date	Description	Initials
		New document.	

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NOTICE

This manual must be retained with the ZeeWeed membrane system for future reference.

If the product or system is sold or transferred to another owner, or if the existing owner relocates and leaves the product or system behind, ensure that this manual and related documents are supplied to the new owner.

Veolia
veoliawatertech.com

Preface

About this manual

This Installation, Operation, & Maintenance Manual (“Manual”), includes warnings and guidance required to safely install, operate, and maintain the Veolia ZeeWeed membrane system. Before installing, operating, and maintaining the ZeeWeed membrane system, the owner and its employees, contractors and agents (collectively, the “Owner”) must read and fully understand the IOM Manual and any supplemental supporting materials and additions/modifications of the Manual that were provided separately.

If the Owner does not fully understand the information provided in the Manual, or if the Owner perceives there to be ambiguities or uncertainties with any part of the installation, operation, or maintenance of the ZeeWeed membrane system, do not proceed with installation, operation, or maintenance until you have contacted Veolia for additional information and clarification.

Contact information can be found in *1.2.2 Contacting Veolia*.

FAILURE TO READ AND FULLY UNDERSTAND THE MANUAL AND TO SEEK ADDITIONAL INFORMATION FROM VEOLIA WHEN QUESTIONS OR UNCERTAINTIES ARE PERCEIVED TO ARISE BEFORE INSTALLATION, OPERATION, AND MAINTENANCE COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH, BROKEN OR DAMAGED PARTS/EQUIPMENT, AND/OR WATER QUALITY ISSUES AND RESULTING HARM.

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Deviations or modifications of this Manual suggested by Veolia field personnel or other employees do not supersede the Manual unless stated in writing by Veolia.

If owners are interested in requesting and purchasing professional installation, operation, maintenance, inspection and training services for its products, contact their Veolia representative.

This Manual applies generally to all ZeeWeed membrane systems and, as a result, could contain instructions, statements and information about installations, uses, operations or other features that may not apply to the supplied ZeeWeed membrane system. To purchase a customized package applicable to your product, contact Veolia.

Proprietary information

This Manual discloses information in which Veolia has proprietary rights and is disclosed in confidence.

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Disclaimer

This Manual may include original manufacturer's literature. This Manual and literature should provide complete and accurate information to meet your operating and/or service requirements based on the information available at the time of publication. However, Veolia assumes no responsibility for the technical content of the original manufacturer's literature.

The information in this Manual and literature may not cover all operating details or variations, or provide for all conditions in connection with installation, operation, and maintenance. If questions arise that are not answered specifically in this Manual, contact the Veolia Service Department.

Veolia reserves the right to make engineering refinements that may not be reflected in this Manual. The material in this Manual and literature is for informational purposes and is subject to change without notice.

This Manual is not intended to modify, amend or otherwise change the terms and conditions pursuant to which the ZeeWeed membrane system was purchased, nor be construed as containing or otherwise giving rise to express or implies warranties, each of which are hereby disclaimed. Refer to the warranty information in the contract pursuant to which the Veolia product was purchased.

Service information

It is recommended that owners complete the following fields upon receiving the system. This information will be helpful when requesting service and support.

System provider information

System provider:	
Contact:	
Phone:	
Fax:	
Email:	

System information

Installation date:	
Model number*:	
Serial number*:	

** Model and serial number information can be found on the nameplate located on the system's electrical panel.*

Refer to the *Declaration of Conformity* for additional information, such as the full address of the manufacturer and his authorized representative, and the designation of the machinery.

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1.1 Safety and note statements

Throughout this manual, statements are included in the text to highlight safety hazards, notices, and general notes. All personnel must acknowledge these when working on plant or equipment. Examples of these types of statements are:

DANGER	
ISO symbol	**{Hazard}** {Statement that warns of a specific danger or radiation hazard that may present the threat of death.}

WARNING	
ISO symbol	**{Hazard}** {Statement that warns of a potential hazard that could cause serious injury.}

CAUTION	
ISO symbol	**{Hazard}** {Statement that warns of a potential hazard or calls attention to an unsafe practice that presents a lesser threat of injury.}

NOTICE	
ISO symbol	{Statement that warns of a hazard to equipment or a hazard that does not present a danger to personnel.}

NOTE: *{Statement that highlights important information about the plant, about equipment use, or procedural advice.}*

TIP: *{Statement that highlights a way to make a procedure easier to perform.}*

1.2 Service and support

This section provides information regarding the various support services offered by Veolia. All service bulletins associated with this system are to be inserted at the end of this section.

1.2.1 Available services

Veolia delivers a comprehensive range of services beyond system design and installation. Contact the Service Department to inquire about the following services:

- InSight remote monitoring support and data analysis
- site visits and component audits
- training programs
- 24/7 technical support
- additional operator training
- emergency call-out support
- OEM components and consumable products inventory
- Operation & Maintenance agreements
- plant commissioning, optimization, and upgrades
- system controls support
- component calibration and preventive maintenance planning.

1.2.1.1 InSight* remote monitoring

InSight is an automated service that captures and stores plant data in the cloud. This data is then transformed into meaningful information, providing the knowledge needed to optimize plant processes. With InSight, operators and selected personnel from Veolia can assess trends and detect problems quickly, allowing them to take action to avoid operational interruptions.

Available in a variety of ways (web, mobile, email), the information provided by InSight makes it easier to monitor the plant and follow Veolia best practices. InSight users can review historical and current plant performance, helping them to ensure maximum membrane life and asset utilization. Additionally, the automated data collection feature reduces the tedious work of entering and reporting operator-collected data, including data required for membrane or stack warranties.

It tracks cleans, production, gives guidance on time for membrane replacement and much more. Digital files (likely through Scada) are recommended if InSight is not used.

Contact Veolia for additional information regarding InSight.

1.2.1.2 Site visits

Veolia service professionals are on-hand for both emergency service calls (call-outs) and planned service visits. Areas of plant operation that they can assist with include instrument calibration, preventive maintenance planning, process monitoring, and programming modifications. Contact the service department and ask them to develop a service plan tailored to this system.

Emergency call-outs are invoiced based on the field services labor rate sheet, which can be obtained by contacting Veolia.

1.2.1.3 Training

Customized training packages are available. Contact Veolia for more information.

1.2.2 Contacting Veolia

When calling to request technical assistance, have the following information ready:

- [system or stack] model and serial number
- system details, P&ID, PFD, and so on
- the date when the system was installed
- a detailed description of the issue

- recently completed Daily Logsheets and a list of current performance parameters (example: flowrates, pressure readings, pH levels)
- the date when a chemical clean was last performed (if applicable).

Upon subscribing to Veolia 24/7 technical support service and activating the customer account, use the project number assigned to the site to help Veolia identify the system. Provide this project number when contacting the technical support team, who can be reached by phone or email:

PHONE (TOLL-FREE WITHIN NORTH AMERICA): 1-866-271-5425

PHONE (WORLDWIDE): 1-905-469-7723

EMAIL: **technicalsupport@veolia.com**

NOTE: *When contacting Veolia after hours service, there will be a fee associated with the support provided if the account is not active.*

Contact the regional lifecycle sales manager for additional information about the 24/7 technical support service and other services provided by Veolia.

For inventory inquiries and purchases, contact Veolia inside sales department, who can be reached by either phone or email:

PHONE (AMERICAS): 1-866-271-5425.

EMAIL: **vtc.vwts.namparts.wts.all@veolia.com**

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2 Safety

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2.1 About this section

This section serves as a guide to Veolia's commitment to maintaining a safe and healthy work environment.

This section includes:

- safety information specific to the equipment, including how to work safely with or around the equipment.

It is the responsibility of the operator to follow their company policy regarding rules and regulations and ensure they comply with the current health and safety legislation and regulations applicable to the country of work.

This manual does not supersede safety information in the manufacturer's instructions (where provided) for specific components.

2.1.1 Create a site safety plan

The measures and procedures outlined in this section do not address every safety consideration and do not take the place of a properly designed and implemented facility safety program. It is the responsibility of the site to establish appropriate health and safety practices and ensure they are implemented. This includes a site safety plan that incorporates (but is not limited to) emergency procedures; first-aid requirements; accident reporting; traffic management; contractor and co-activity management; inspections and audits; weather hazards; lone worker procedures; alcohol and drugs policy; harassment at work; and mental health and wellbeing.

2.1.2 Perform a risk assessment

The manual cannot cover all possible hazards. Its purpose is to highlight the most common and significant dangers. Perform an overall task- and site-specific safety risk assessment (according to local guidelines) before starting work. This must be done for the entire system and may include (but is not limited to) Personal Protective Equipment (PPE), personal and site safety, and high-risk hazards, and must also consider the site requirements (as they may be more restrictive).

DANGER	
	Not to be Serviced by Users Only qualified and certified personnel shall perform work on the ZeeWeed membrane system.
	Personnel Training and Certification Each employee must possess and maintain all required certifications and valid training relevant to their specific tasks, work environment, site location, and local regulations. This includes, but is not limited to, certifications for confined space work, working at heights, lockout/tagout procedures, and region-specific safety training.

WARNING	
	Read the manual The operator must read and fully understand all instructions in this manual before using this system. Failure to follow safety guidelines or instructions could result in severe personal injury or death, broken or damaged parts/equipment, and/or water quality issues and resulting harm.

CAUTION	
	Transportation Hazards Veolia typically works with transportation carriers who understand the equipment and how to secure it properly. If transportation is required, work with Veolia to develop a procedure for transport.

2.2 Cautions specific to this system

All operators must read and understand the information outlined below before attempting any of the tasks or procedures discussed in these sections.

2.2.1 Storage and handling requirements for ZeeWeed membranes

NOTICE	
	Failure to adhere to the information outlined in this section may result in damage to the system.

Ensure that the following precautions are followed while storing or moving the membranes:

- Membranes that are placed in storage must be kept in the following conditions:
  - moist at all times
  - ambient temperature between 5 to 35ºC (41 to 95ºF)
  - protected from freezing temperatures.
- Do not allow membrane fibers to come in contact with sharp objects, become entangled with equipment or tools, or be pulled tightly.
- If the system has been preserved (example: for shipment or shutdown), any shipping preservatives must be flushed from the system before startup.
- Membranes must be immersed in a biocidal solution before storage, shipping, or system shutdowns longer than 72 hours.

- Membranes that are to be returned to Veolia must be cleaned, sanitized, and preserved before shipment. Contact Veolia for instructions before returning membranes.

For information on storing membranes, see *4.11.3 Storing ZeeWeed membranes*.

2.2.2 Ensuring ZeeWeed membrane integrity during operation

NOTICE

Failure to adhere to the information outlined in this section may result in damage to the system.

Observe the following precautions during operation to reduce the risk of membrane damage or premature wear:

- The use of unapproved chemicals on ZeeWeed membranes will render the warranty null and void and will leave the customer solely responsible for any damage incurred as a result. Contact Veolia before using any chemicals not outlined in this manual.
- To avoid damaging the membranes, all prescreening measures must be in operation at all times. ***Do not bypass prescreening processes under any circumstances***.
- Compressed air used to test membrane integrity must be clean, dry, and free of oil. ***Do not exceed the maximum recommended pressure.***
- Do not clean the membranes with a high-pressure water stream (example: pressure washer, firehose).
- At all times, ensure that debris is prevented from entering the membrane tanks. If work that may produce debris (example: grinding) must be performed near a tank, ensure that the tank and membranes are protected before starting work (by sealing or covering the tank, or taking additional precautions as needed).

2.2.3 Fall protection

It is illegal to use railings as fall protection anchors, for both arrest and restraint, unless they are engineered for that purpose. The standard railings supplied by Veolia with membrane tanks must not be used as anchors.

NOTE: *If a travel restraint frame is supplied, it is to be used for fall restraint only, not fall arrest.*

There are two types of fall protection systems that offer protection from falling into stainless steel membrane tanks: The Temporary Transportable Railing (TRR), and the Travel Restraint Anchor (TRA).

2.2.3.1 Temporary Relocatable Railing (TRR)

WARNING	
	Fall Hazard Do not use TRRs as anchorage for travel restraint and fall arrest systems, as they are not designed for that purpose.

The Temporary Relocatable Railing (TRR) provides passive protection from falling into a ZeeWeed membrane tank, when the tank covers are removed during cassette installation and removal operations.

The TRRs are 6061-T6 aluminum weldments, with top and midrails located at the same heights as the tank's fixed railings. The TRR is attached to the fixed railings at four (4) positions, using quick-release detent pins. The pins engage holes located in the fixed railings, in line with the ends of the tank covers installed above each cassette bay. The TRR is intended to be installed on both ends of a bay before removing the tank covers, and removed after the covers are installed back in place. As only one cassette is normally serviced at any given time in a treatment plant, only one pair of railings is required for the entire plant. Each TRR weighs 25 lb, and is easily carried by a single person. No special training or additional fall protection equipment is necessary, although additional equipment may be used if considered necessary.

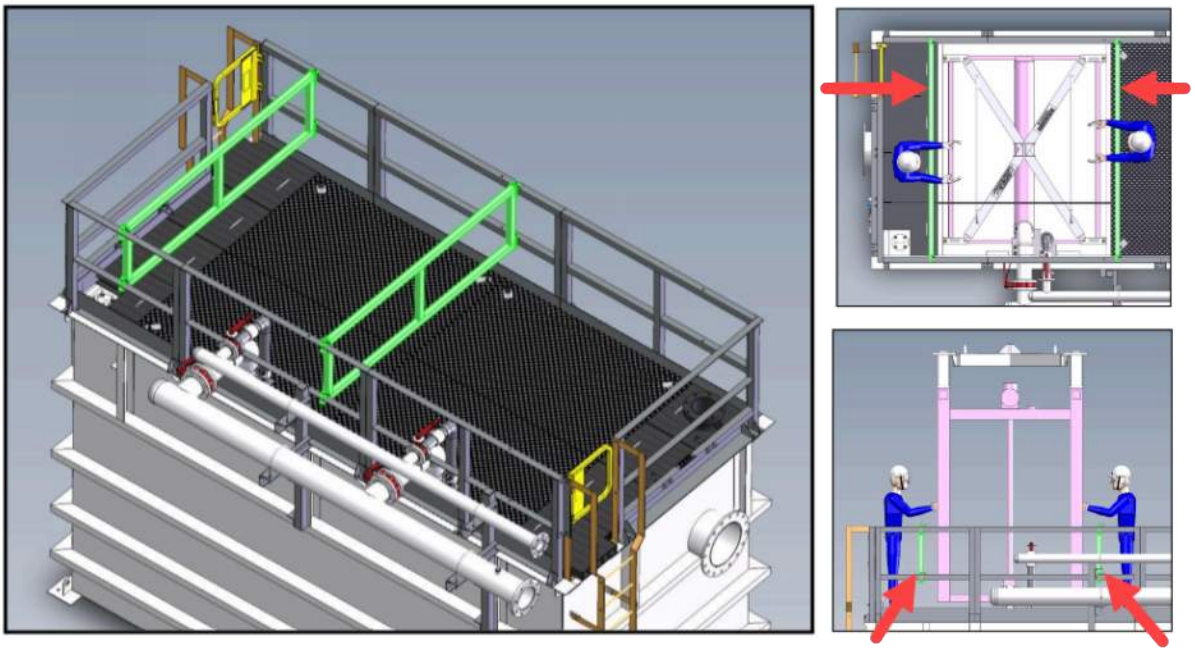

Figure 2.1 - TRR general arrangement (left); TRR with tank covers removed (top right); TRR with cassette removed from tank (bottom right)

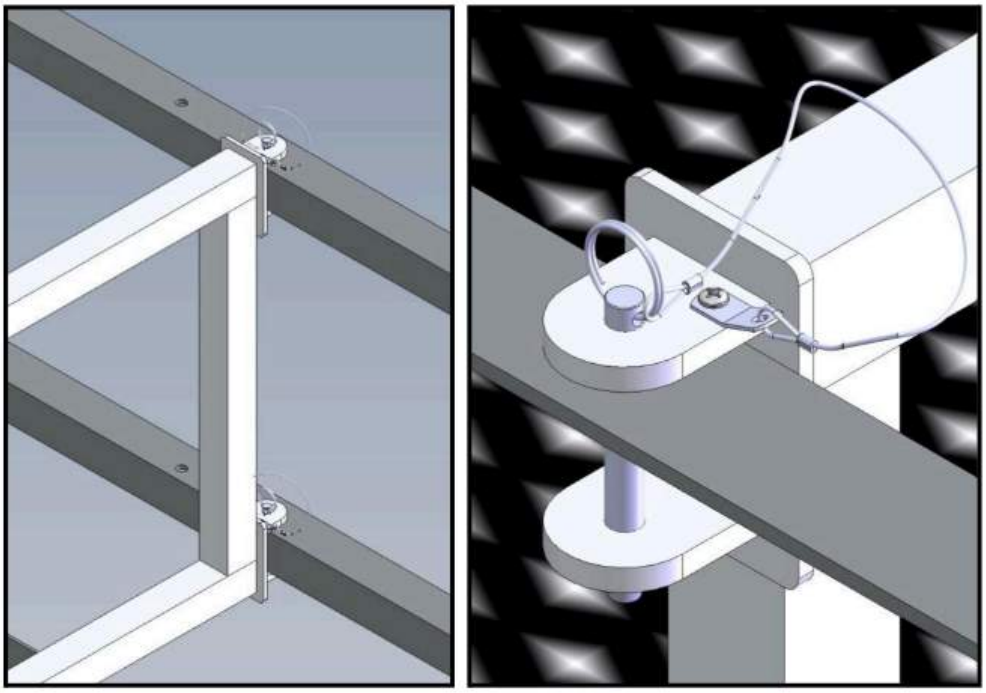

Figure 2.2 - TRR quick-release detent pins installed

The fixed railings installed on the longitudinal walls have double holes in the top rails and midrails, located inline with each cassette beam, *(see Figure*

2.3 - Holes in fixed railing for TRR quick-release detent pins). The TRR must be installed in the holes furthest from the cassette bay being serviced, *(see Figure 2.4 - Mount TRR in these holes to access this cassette bay (1)* and *Figure 2.5 - Mount TRR in these holes to access this cassette bay (2))*, to allow clearance to lift the cassette from the bay.

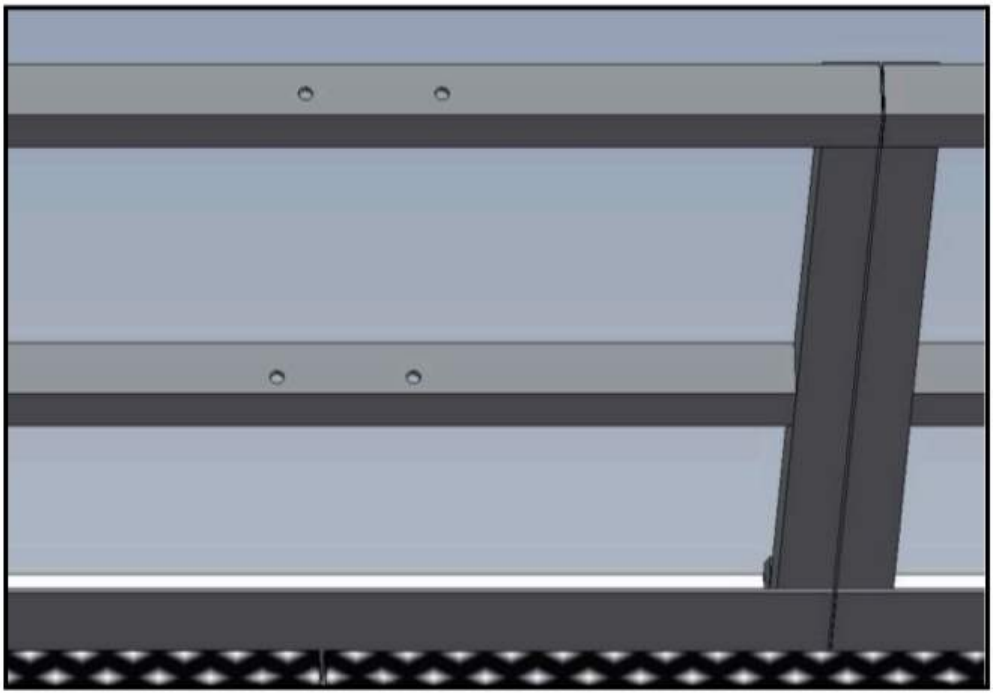

Figure 2.3 - Holes in fixed railing for TRR quick-release detent pins

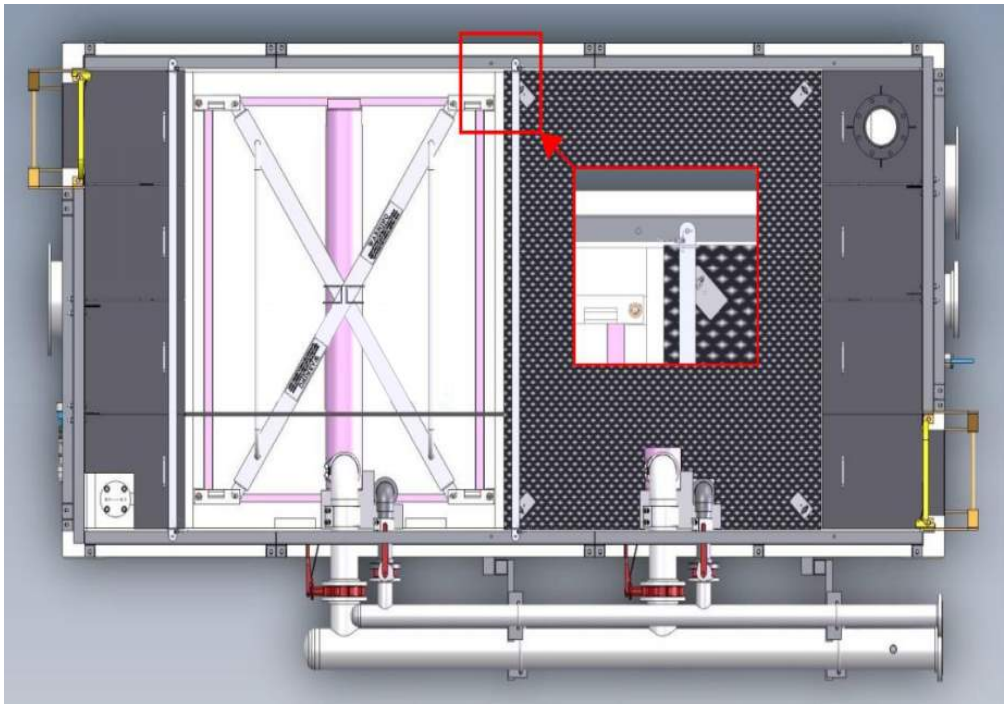

Figure 2.4 - Mount TRR in these holes to access this cassette bay (1)

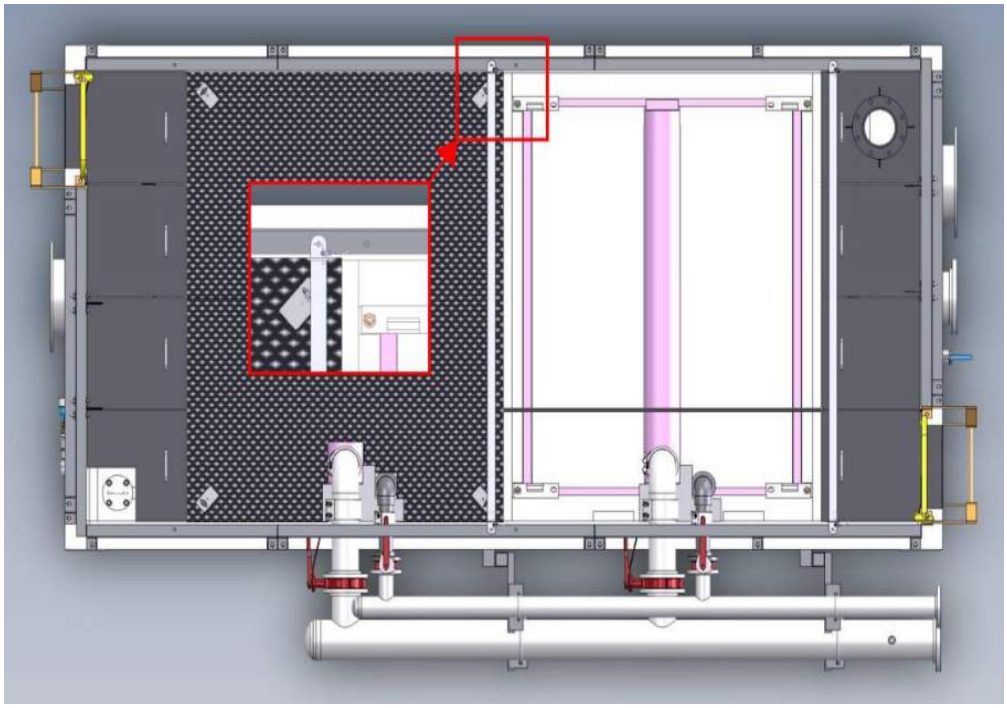

Figure 2.5 - Mount TRR in these holes to access this cassette bay (2)

2.2.3.2 Travel Restraint Anchor (TRA)

The Travel Restraint Anchor (TRA) is another fall protection system developed for stainless steel ZeeWeed membrane tanks. The TRA design provides a safe and convenient means of securing fixed-length travel restraint lanyards to purpose-designed anchor points, instead of using pipe and other structures. The anchors, consisting of commercial D-rings, are installed on the reinforced fixed railings located at each narrow end of the tank. One (1) person may secure their fixed-length lanyard to each anchor ring, allowing a maximum of two (2) people to work on each side of a cassette bay opening.

Each anchor meets the ANSI Z359.2 1,000 lb per person travel restraint load requirement. The D-ring installations are not rated to serve as anchors for fall arrest.

WARNING	
	Fall Hazard Do not secure more than one (1) authorized person to each D-ring. The TRA anchor mounting is designed to provide anchorage for one person per D-ring, for a maximum of two (2) people on each side of a cassette bay. Exceeding this limit could result in death or severe injury.
	Fall Hazard Do not use TRA anchors for fall arrest anchorage. The TRA anchor mounting is designed to provide anchorage for travel restraint, not fall arrest. Using the TRA for fall arrest anchorage could result in death or severe injury.

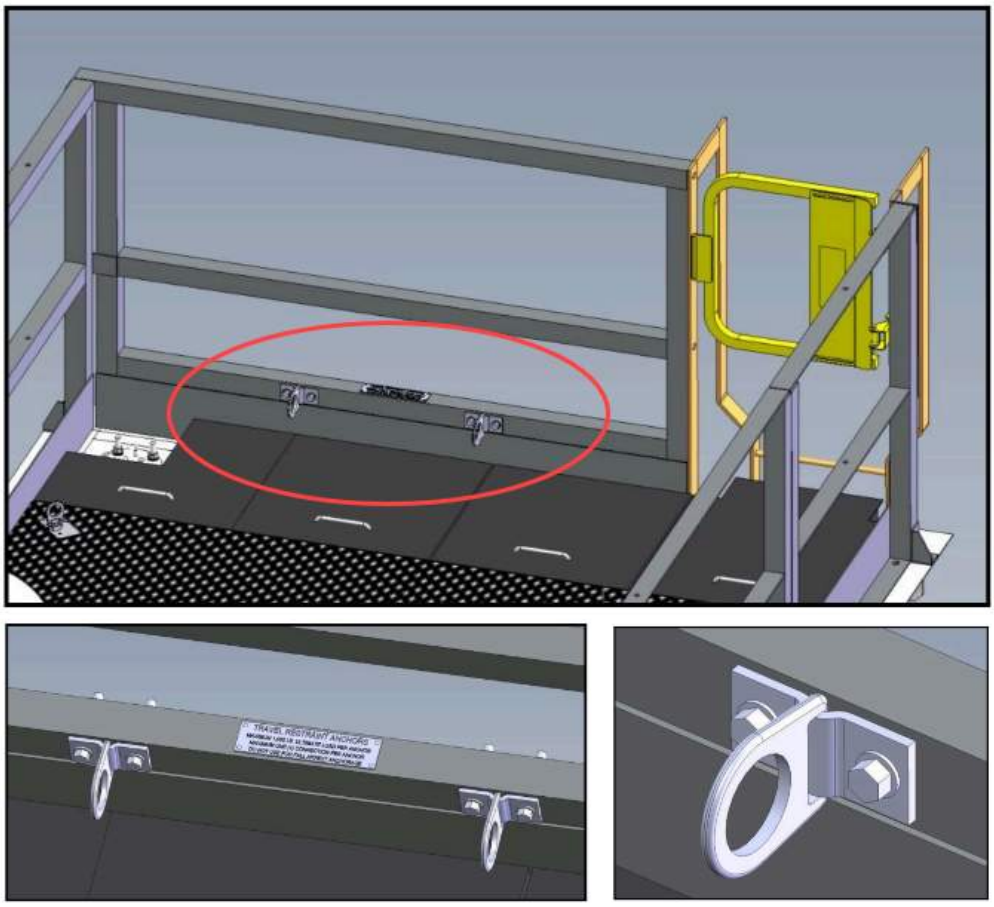

Figure 2.6 - TRA general arrangement (top); TRA anchors and instruction plate (bottom left); TRA D-ring anchor (bottom right)

Authorized persons must adjust the lengths of their tethers such that they can hold and guide the cassette by hand, while it's being lifted or lowered, but not so close they can step over the edge of the cassette bay opening in either a kneeling or standing position *(see Figure 2.7 - TRAs with fixed-length travel-restraint lanyards attached)*.

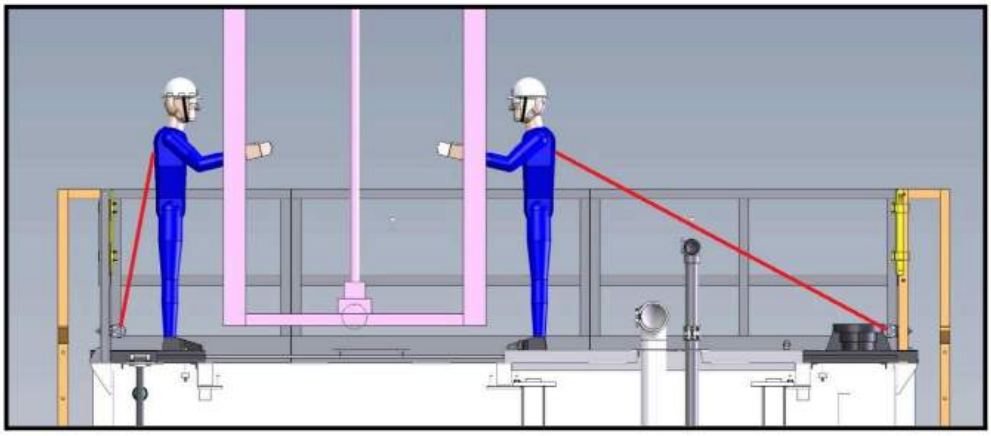

Figure 2.7 - TRAs with fixed-length travel-restraint lanyards attached

3 Overview and design

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3.1 About this section

This section provides an overview of the system and its design, including its primary components.

3.2 Design and theory of operation

This section provides a general description of the ZeeWeed membrane system, including its primary components, design, and theory of operation.

NOTICE	
	Operating this system in a manner that deviates substantively from the Veolia instructions and best practices may render the warranty null and void. If an alternate mode of operation (example: revised cleaning frequency) is being considered, contact Veolia to request warranty approval before making any changes *(see 1.2 Service and support)*.

3.2.1 Primary components

The main elements of the system are the membrane fiber, the membrane module, and the cassette.

3.2.1.1 Membrane fibers

The core of the ZeeWeed-based wastewater treatment is the Veolia proprietary ultrafiltration membrane. ZeeWeed 500 membranes are a polyvinylidene fluoride (PVDF) reinforced hollow-fiber with a nominal pore size of 0.04 microns. The small pore size is capable of producing a high-quality permeate by allowing the passage of water while physically blocking the passage of suspended solids, protozoa, bacteria, and most viruses *(see Figure 3.3 - ZeeWeed membrane fiber)*.

3.2.1.2 Membrane modules

Membrane fibers are arranged vertically between the membrane module's two headers.

Water is drawn through the fibers and into the module's permeate headers. From there, it exits each module via the permeate spigots.

The following table outlines the physical dimensions and operational requirements for the ZeeWeed membrane modules.

Figure 3.1 - ZeeWeed 500EV module

Table 3.1 - ZeeWeed 500EV module and membrane specifications

Parameter	500EV RX12	500EV TX12
Module Dimensions		
Width	861 mm (33.9 in)	861 mm (33.9 in)
Height	2,136 mm (84.1 in)	2,307 mm (90.8 in)
Depth	61 mm (2.4 in)	61 mm (2.4 in)
Membrane Properties		
Membrane surface area	42.7 m^2 (460 ft^2)	49.2 m^2 (535 ft^2)
Lifting weight	25.5 kg (56 lb)	29 kg (64 lb)
Material	PVDF	
Nominal pore size	0.04 µm	
Surface properties	Non-ionic and hydrophilic	

Parameter	500EV RX12	500EV TX12
Fiber diameter	2.2 mm	
Fiber tensile strength	> 600 N	
Flow path	Submerged, outside-in	
Operating Specifications[1]		
TMP range	-55 to 55 kPa (-8 to 7 psig)	
Typical aeration	2,631 Nm^3/h (1,560 scfm)	
Maximum operating temperature	40°C (104°F)	
Operating pH range	5.0 to 9.5	
Cleaning Specifications		
Backpulse type	Relax aeration (standard) Backpulse-capable (as required)	
Maximum cleaning temperature	40°C (104°F)	
Cleaning pH range	2.0 to 10.5 (< 30°C or < 86°F) 2.0 to 10.0 (30 to 40°C or 86 to 104°F)	
Maximum chlorine concentration	1,000 ppm	

Note 1: Cassettes can be populated with 32 to 64 modules. Normalized ADF flow for fully populated cassette at 150 m ASL, 20C wastewater temperature. Delivered value at modules will differ based on site conditions. Lower cassette populations will have a lower aeration rate.

3.2.1.3 Cassettes

Figure 3.2 - ZeeWeed 500EV cassette

Cassettes group the modules together into a filtration unit, and consist primarily of a reinforced frame, a permeate collection system, and an integrated aeration assembly. When installed, modules are connected in parallel into the top and bottom permeate collection system. The permeate is collected in a common top manifold that has an 8" vertical connection. The cassette is then linked to an external permeate header on the train using a hard pipe connection.

Each cassette comes equipped with a single 3" FNPT air connection. Air from this line enters a central pipe, and is then directed to the aerator assembly located at the base of the cassette.

The following table outlines the physical dimensions and operational requirements for the ZeeWeed cassette.

Table 3.2 - ZeeWeed 500EV cassette specifications

Parameter	16 Modules (R-16M)	56 Modules (R-56M)	64 Modules (T-64M)
Height	2512 mm (98.9 in)	2561 mm (100.8 in)	2735 mm (107.7 in)
Width	738 mm (29.1 in)	1743.5 mm (68.6 in)	1743.5 mm (68.6 in)
Length	1744 mm (68.7 in)	2136 mm (84.1 in)	2136 mm (84.1 in)
Application	LEAPmbr	LEAPmbr	LEAPmbr
Module version	RX12	RX12	TX12
Module population	8, 12, or 16	28, 36, 44, 48, 52, or 56	32, 40, 44, 56, or 64
Permeate connection	1 x 4" FNPT	1 x 6" SS pipe	1 x 8" SS pipe
Air connection	1 x 3" FNPT SS half coupling	1 x 3" FNPT SS half coupling	1 x 3" FNPT SS half coupling
Maximum shipping weight	759 kg (1674 lb)	2034 kg (4484 lb)	2410 kg (5313 lb)
Wet weight[1]	797 kg (1758 lb)	2190 kg (4828 lb)	2618 kg (5772 lb)
Lifting design weight[2]	2268 kg (5000 lb)	4546 kg (10,000 lb)	4546 kg (10,000 lb)

Note 1: Wet weight of a clean, fully populated cassette. Cassette support and lifting module can vary this weight, depending on design. An estimate is used based on several standard designs.

Note 2: Product lifting design weight assumes a fully populated cassette with high solids accumulation, standard lifting method, cassette support, and pipe connections. Alternative support and lifting methods could vary this value. Extreme operational conditions could increase this value. Follow proper service procedures when lifting.

3.2.2 Membrane bioreactor design parameters

The ZeeWeed membranes have been designed to process mixed liquor that meets the criteria outlined in the following table. These parameters must be observed during both the design and the operation of the system where the membranes are used. Failure to adhere to these requirements may render the warranty null and void.

Note that these criteria are developed for municipal wastewater treatment applications; criteria may vary and/or additional criteria may apply to industrial wastewater treatment applications. In addition, other parameters may apply depending on the required effluent quality (for example, if the permeate TN must be less than 10 mg/L, then the soluble TN in the mixed liquor must be less than 10 mg/L).

CAUTION

Equipment Hazard

If any inlet parameters are outside the design parameters listed in this section, inform Veolia immediately.

NOTICE

Failure to adhere to the information outlined in this section may result in damage to the system.

Table 3.3 - Acceptable mixed liquor characteristics for municipal applications

Parameter[1]	Acceptable Operating Range
MLSS concentration	≤ 12,000 mg/L[2]
Temperature	5 to 40ºC[4]
Soluble ammonia[3]	< 1 mg/L
Soluble BOD_5	< 5 mg/L

Parameter[1]	Acceptable Operating Range
Soluble COD	< 50 mg/L[5]
Dissolved oxygen	> 2.0 ppm[9]
pH	6.5 to 8.5
Total hardness (as CaCO3)	Not scaling
Alkalinity (as CaCO3)	50 to 300 mg/L
TTF[6]	< 200 seconds
Trash content[7] (material > 2 mm)	< 2 mg/L (material > 2 mm)
Colloidal TOC (cTOC)[8]	< 10 mg/L
Fats, oils and grease (FOG)	< 5 mg/L and no free oil

1. Refers to the mixed liquor in the ZeeWeed membrane tank(s).

2. In all cases, the MLSS concentration in the membrane tank(s) is recommended to be ≤ 12,000 mg/L for all operating conditions and durations. It is possible to operate up to 15,000 mg/L under a reduced flux approach.

3. May be measured in the permeate flow.

4. Aerobic MBR and the biological process functions best within this temperature range. Do not operate ZeeWeed membranes at temperatures ≥ 35°C for a prolonged period without review by Veolia.

5. Soluble COD in mixed liquor for industrial wastewater MBR systems may be higher.

6. As per the TTF procedure.

7. As per the sieve test procedure.

8. The difference between the TOC measured in the filtrate passing through a 1.5-µ filter paper and the TOC measured in the ZeeWeed membrane permeate.

9. Calibrate the dissolved oxygen (DO) meter once a week.

Performance specifications are unique to each MBR system and must be reviewed and approved by Veolia or by a third-party designer who has been authorized by Veolia to provide approval.

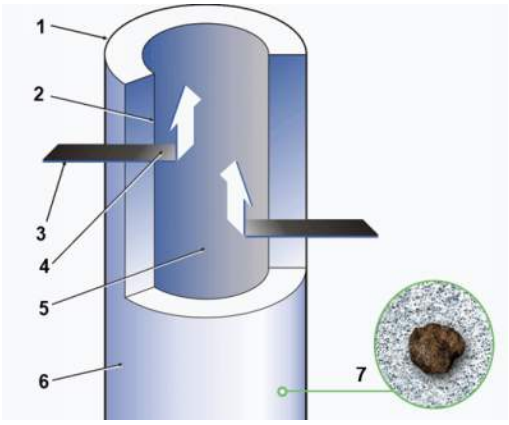
Control software, programming, and the control interface used to monitor MBR performance parameters have been provided by others and are not documented within this manual.

3.2.3 Theory of operation

Ultrafiltration (UF) is a process that filters particles on the basis of size. The ZeeWeed 500 can therefore easily remove particles that are larger than the membrane pore size without pretreatment.

The Membrane Bioreactor (MBR) process is a wastewater treatment technology that combines suspended-growth biological treatment with immersed membrane filtration. The ZeeWeed membranes act as the solid-liquid separation step in the process, in place of the secondary clarifiers and tertiary filters. The ZeeWeed membranes reject solid particles while passing permeate through the membrane fibers, producing a high quality permeate with very low suspended solids.

The ZeeWeed membrane filtration surface is a neutral, strong polymeric membrane cast on the outside surface of a porous support fiber. Each fiber can be divided into three parts: the membrane, the support braid (or reinforced structure), and the lumen.



1: Membrane
2: Support braid (reinforced structure)
3: Mixed liquor
4: UF quality permeate
5: Lumen
6: Hollow fiber
7: Closeup of membrane pore

Figure 3.3 - ZeeWeed membrane fiber

Periodic sessions of aeration without permeation (RELAX state) help to dislodge accumulated foulants from the membrane surface. When regular relax sequences prove insufficient to remove fouling, the membrane is

cleaned using a backpulse sequence, which involves pumping permeate back into the membrane fiber, forcing flow back out through the membrane to scour foulants from the surface.

During production, contaminants are rejected by the membrane and remain in the membrane tank while permeate is discharged. As these contaminants (sludge) become more concentrated, it will periodically become necessary for a portion of the tank's contents to be discharged to waste to prevent overconcentration. Unlike with a conventional bioreactor, however, in the ZeeWeed MBR process, sludge might be wasted less frequently and in smaller volumes.

3.3 Calculations

This section provides calculations used in various aspects of system operation and maintenance, such as evaluating performance data and determining chemical requirements.

Additional information may be provided by Veolia personnel during the initial startup period or as part of a regular maintenance service.

3.3.1 General dosing calculation for ZeeWeed

To determine the amount of chemical(s) required when dosing the subsystem, use the following calculation:

Calculate the flow rate of 49% alum solution to dose to 60 ppm in a 100 lpm stream.

1: Feedwater flowrate (Qf)

2: Chemical concentration in feedwater (Cf)

3: Chemical flowrate (Qc)

4: Chemical stock solution concentration (CC) and density (ρC)

Figure 3.4 - Dosing calculation diagram

Mixed liquor flow rate	Qf = 100 lpm
Chemical concentration in mixed liquor stream	Cf = 60 ppm (60 mg/L)
Stock solution concentration	Cc = 49% by weight
Stock solution density	rc = 1.34 kg/L

The mass flowrate of alum in the mixed liquor stream equals the mass flowrate of alum dosed.

In the equations below, Qf and Qc are in lpm, Cf is in mg/L, rc is in kg/L, and Cc is weight percent written as a decimal (example: 49% as 0.49).

$$Q_c = \frac{Q_f \times C_f}{\rho_c \times C_c \times 10^6}$$

EXAMPLE:

$$\frac{100 \times 60}{1.34 \times 0.49 \times 10^6} = 0.0091\, lpm$$

If the required nutrient concentration (nitrogen or phosphorus) in the mixed liquor stream (Cf) is given in mg/L (or ppm), then an extra calculation step must be included.

Calculate the chemical flowrate according to the general example above, and then divide this flowrate by the mass percent nitrogen or phosphorus in the chemical being used.

Table 3.4 - Mass percent nitrogen or phosphorus in chemical

Chemical	Mass Percent Nitrogen or Phosphorus in Pure Chemical
Ammonium chloride	26.1%
Urea	46.6%
Phosphoric acid	31.6%

3.3.2 Calculating ZeeWeed membrane permeability

To gauge the effectiveness of a clean, calculate the overall permeability of the membranes before versus after the clean has been performed.

Refer to the example below when calculating membrane permeability.

EXAMPLE: A system has a typical operating temperature of 68ºF (20ºC) (T1) and an actual (observed) operating temperature of 59ºF (15ºC) (T2). The permeate flowrate was recorded at 868 gpm (3,285.4 lpm) at a trans-membrane pressure of 6 psi (0.414 bar), while total membrane surface area equals 5,362.36 m^2 (57,720 ft^2), based on three cassettes of 52 modules, where each module contains 370 ft^2 of membranes.

1. Calculate the membrane area:

$$M = x \times y \times z$$

Symbol	Represented Value
M	Membrane area per train
x	modules per cassette
y	cassettes per train
z	surface area per module

$$52 \times 3 \times 370\,ft^2 = 57,720\,ft^2$$

$$52 \times 3 \times 34.37\,m^2 = 5,362.36\,m^2$$

2. Convert flowrate to flux at the observed temperature:

$$F_2 = \frac{x}{y} \times z$$

Symbol	Represented Value
F2	Observed flux at 59°F (15°C)
x	Flow
y	Membrane surface area per train
z	Time constant (1,440 mins/day or 60 mins/hour)

$$\frac{868\,gpm}{57{,}720\,ft^2} \times 60 \times 24 = 21.6\,gfd$$

$$\frac{3{,}285\ lpm}{5{,}362\ m^2} \times 60 = 36.8\ lmh$$

1. Correct the flux value from the observed temperature (59ºF (15ºC)) (T2) to the reference temperature (68ºF (20ºC)) (T1).

Table 3.5 - Water viscosity

Temp. (°F (°C))	Viscosity (cP)	Temp. (°F (°C))	Viscosity (cP)	Temp. (°F (°C))	Viscosity (cP)
34 (1)	1.7311	73 (23)	0.9356	113 (45)	0.5988
36 (2)	1.6736	75 (24)	0.9142	115 (46)	0.5884
37 (3)	1.6192	77 (25)	0.8935	117 (47)	0.5782
39 (4)	1.5677	79 (26)	0.8736	118 (48)	0.5683
41 (5)	1.5188	81 (27)	0.8544	120 (49)	0.5587
43 (6)	1.4723	82 (28)	0.8359	122 (50)	0.5494
45 (7)	1.4281	84 (29)	0.8180	124 (51)	0.5403
46 (8)	1.3860	86 (30)	0.8007	126 (52)	0.5315
48 (9)	1.3459	88 (31)	0.7840	127 (53)	0.5229
50 (10)	1.3077	90 (32)	0.7679	129 (54)	0.5145
52 (11)	1.2712	91 (33)	0.7523	131 (55)	0.5064
54 (12)	1.2362	93 (34)	0.7372	133 (56)	0.4984
55 (13)	1.2029	95 (35)	0.7225	135 (57)	0.4907
57 (14)	1.1709	97 (36)	0.7084	136 (58)	0.4832
59 (15)	1.1403	99 (37)	0.6946	138 (59)	0.4758
61 (16)	1.1109	100 (38)	0.6813	140 (60)	0.4687

Temp. (°F (°C))	Viscosity (cP)	Temp. (°F (°C))	Viscosity (cP)	Temp. (°F (°C))	Viscosity (cP)
63 (17)	1.0828	102 (39)	0.6685	142 (61)	0.4617
64 (18)	1.0558	104 (40)	0.6560	144 (62)	0.4549
66 (19)	1.0298	106 (41)	0.6438	145 (63)	0.4482
68 (20)	1.0049	108 (42)	0.6321	147 (64)	0.4418
70 (21)	0.9809	109 (43)	0.6207	149 (65)	0.4355
72 (22)	0.9578	111 (44)	0.6096		

$$F_1 = F_2 \times \frac{y}{x}$$

Symbol	Represented Value
F_1	Flux at reference temperature 68°F (20°C)
F_2	Observed flux at 59°F (15°C)
x	Viscosity at T_2
y	Viscosity at T_1

$$21.6\,gfd \times \frac{1.1404}{1.0049} = 24.5\,gfd$$

$$36.8\,lmh \times \frac{1.1404}{1.0049} = 41.8\,lmh$$

1. Using the recorded membrane pressure, convert the temperature-corrected flux to membrane permeability.

$$x = \frac{y}{z}$$

Symbol	Represented Value
x	Membrane permeability
y	Corrected flux
z	Membrane pressure

$$\frac{24.5\ gfd}{6\ psi} = 4.1\ gfd\ /\ 1\ psi$$

$$\frac{41.8\ lmh}{0.414\ bar} = 101.0\ lmh/bar$$

To accurately assess the effectiveness of a cleaning procedure, measure and record the membrane permeability immediately before and after each cleaning session is performed.

3.3.3 Analytical techniques for bioreactors

This section outlines procedures for measuring the various characteristics of bioreactor tank contents. For information regarding the operation and maintenance of meters, measurement kits, and other equipment mentioned below, refer to the manufacturers' instructions *(see B Appendix: Project documents)*.

Information in this section has been adapted from Standard Methods for Examination of Water & Wastewater 20th ed. (American Public Health Association Publications, 1998).

3.3.3.1 Dissolved oxygen

Measuring the dissolved oxygen (DO) level within the bioreactor will determine whether there is enough oxygen available within the tank to allow organisms to effectively break down pollutants in mixed liquor.

DO readings typically range from 1 to 14 mg/L, with readings above 9 mg/L being common for samples taken from near the bottom of the tank, where gases have a higher level of solubility.

Tanks with a DO level of below 1 mg/L may operate at reduced efficiency due to insufficient oxygen. This can be resolved by either increasing

aeration or decreasing mixed liquor flow into the tank until the DO level rises above 1 mg/L.

Collecting samples

The DO level can be measured using either a mounted or portable meter. If using a portable meter, a sample can be taken using one of the following methods:

IN-SITU (INSIDE THE BIOREACTOR): To obtain the most accurate reading, insert the probe directly into the bioreactor in an area of relatively high turbulence.

INLINE (AT THE SAMPLING VALVE): To take a reading using a sample, partially open the sample valve on the return line and collect a sample using a beaker. Return any biomass released during collection to the bioreactor.

CAUTION	
	Chemical Hazard Wear protective gloves and safety glasses when collecting from a sample valve, and do not allow the beaker to overflow.

GRAB SAMPLE (AT THE LAB BENCH): Testing a sample that has been taken directly from within the bioreactor tank requires a calibrated DO meter, a BOD bottle, and a magnetic stirrer. If the DO probe has a built-in stirrer, a magnetic stirrer is not required.

Measuring DO levels

The DO concentration can be read from the meter after allowing the probe to stabilize for one to two (1 to 2) minutes. If the in-situ method is being used, take the subsequent measurements from the same area in the bioreactor as the first.

Take multiple measurements and compare results. If the meter does not produce the same result (that is, if the second reading is not within 0.2 mg/L of the first) without calibration or adjustment, the meter has drifted during the test. Replace the probe membrane.

When maintaining the meter, always refer to the manufacturer's instructions *(see B Appendix: Project documents)*. As a general rule, replace the probe membrane approximately every three (3) weeks.

3.3.3.2 Biological oxygen uptake rate

The oxygen uptake rate (OUR) is the rate at which the biological population within the tank is consuming oxygen. The more active the bacteria, the higher the oxygen uptake rate.

Results of an OUR measurement are typically expressed as the amount of oxygen in mg consumed per liter of bioreactor contents per hour. Typical results will range between 10 to 60 mg oxygen per liter per hour. Various factors affect the OUR, including mixed liquor flowrate, solids concentration, aeration rate, nutrient levels, and temperature.

This measurement can be performed using either the grab sample or in-situ method, both of which are described below.

OUR grab sample method

The following equipment is required to perform this test:

- DO meter
- probe with oxygen-sensitive electrode
- BOD bottle sized to contain the DO probe
- magnetic stirrer
- stop watch or other timing device.

To measure the OUR within a bioreactor using the grab sample method, perform the following steps:

1. Calibrate the oxygen probe and meter according to the manufacturer's instructions.

   ***TIP:** The longer it takes to collect a sample and take a DO measurement, the less accurate the results will be.*

2. As quickly as possible, collect a 500 mL sample and transport it to the lab bench, and then measure the DO.
3. If the DO is greater than 4 mg/L, proceed to step 4. If not, increase the DO concentration before proceeding by shaking the sample in a partially filled container or by bubbling air through it for 3 to 5 minutes. Make sure the DO is greater than 4 mg/L before the OUR is measured.
4. Pour the sample into the BOD bottle containing the magnetic stirrer.
5. Insert the probe into the top of the BOD bottle to displace enough bioreactor contents to fill the bottle entirely and isolate the contents from the atmosphere. Make sure that no air bubbles are present in the top of the BOD bottle.
6. Turn on the magnetic stirrer and allow the sample to mix well before proceeding.
7. Measure the DO level, and then start the stop watch as soon as the meter registers (this provides the “time zero” DO level).
8. Continue to measure the DO level at least once every 15 to 30 seconds, depending on the rate of consumption. Record the data until the DO level is less than 1 mg/L.
9. Mark each reading on graph paper as DO (mg/L) versus time (minutes) and determine the slope of the line of best fit. This line is the oxygen consumption rate in mg per lpm. Multiply the result by 60 to obtain the OUR in mg per lph.

OUR in-situ method

The following equipment is required to perform this test:

- DO meter
- probe with oxygen-sensitive electrode
- stop watch or other timing device.

To measure the OUR within a bioreactor using the in-situ method, perform the following steps:

1. Calibrate the oxygen probe and meter according to the manufacturer's instructions.
2. Submerge the end of the probe in the bioreactor tank.

   TIP: *Ideally, the DO level within the tank should be 1 to 2 mg/L.*
3. If the DO level is below 2 mg/L, increase aeration until this level is achieved.
4. After the DO level has risen above 2 mg/L, turn off aeration.
5. Measure the DO level again, and then start the stop watch as soon as the meter registers (this provides the "time zero" DO level).
6. Continue to measure the DO level at least once every 15 to 30 seconds, depending on the rate of consumption. Record the data until the DO level is less than 1 mg/L.
7. Mark each reading on graph paper as DO (mg/L) versus time (minutes) and determine the slope of the line of best fit. This line is the oxygen consumption rate in mg per lpm. Multiply the result by 60 to obtain the OUR in mg per lph.

3.3.3.3 Total and volatile suspended solids

Analyzing the total suspended solids (TSS) and volatile suspended solids (VSS) will determine the amount of particulate material (that is non-dissolved solids) contained in a sample.

Using the TSS and VSS values, operators can estimate the microbial concentration within the membrane tank, which is necessary when establishing a schedule for wasting sludge.

Whereas the TSS test simply measures the total amount of suspended solids, the VSS test measures the amount of organic suspended solids. The difference between these values is the amount of inert (that is, non-organic) suspended solids in a sample.

Typical TSS values measured at various points throughout a system include the following:

RAW WASTEWATER FLOW: 100 to 500 mg/L.

PERMEATE FLOW: Below the minimum detection limit (less than 1 to 3 mg/L).

BIOREACTOR TANK: 8,000 to 10,000 mg/L (with a fully developed biomass population).

Before a TSS or VSS measurement can be taken, the sample must be filtered to separate suspended solids from dissolved solids. This is usually a simple process with mixed liquor or permeate samples, but can be quite complex for bioreactor samples containing more than 10,000 mg/L. In such cases, it is better to perform a total solids (TS) or volatile solids (VS) test instead of measuring TSS and VSS.

The following equipment is required to measure the TSS and VSS values in a sample:

***TIP:** The muffle furnace and crucibles are only required for the VS test. If only the TS analysis is being performed, any suitable container that can be accurately weighed may be used.*

- 25 mL ceramic crucibles (2)
- glass-fiber filter disks (GF/C) and filtration apparatus
- suction flask
- drying oven
- muffle furnace
- desiccator
- analytical balance.

To measure the TSS and VSS in a sample, perform the following steps:

1. Measure the TSS value by performing the following steps:
    a. Ignite the crucibles in the muffle furnace at 500 to 600ºC (932 to 1,112ºF) for 15 minutes, and then store them in the desiccator until cool.

b. Place a filter in each crucible.

c. Assemble the filtration apparatus.

d. Using a well-mixed sample, begin filtering until between 2.5 to 200 mg (0.007 oz) of dried residue has been produced. If filtration takes more than 10 minutes to complete, either increase the filter size or decrease the sample volume.

e. Weigh the crucible and record the weight (B in the calculation below).

f. Carefully remove the filter paper with residue from the filtration apparatus and transfer to one of the crucibles.

g. Dry the crucible and filter paper with residue for at least 1 hour in an oven heated to 103 to 105ºC (217.4 to 221ºF), and then cool in the desiccator to the temperature of the analytical balance, and weigh.

h. Repeat the cycle of drying, cooling, desiccating, and weighing until a constant weight is obtained, the weight loss is less than 4% of the previous weight, or a weight of 0.5 mg is obtained, whichever occurs first. (The resulting weight is A in the calculation below.)

i. Where A equals the combined weight of the crucible, filter, and dried residue (mg), while B equals the combined weight of the crucible and the filter (mg), calculate the TSS value as shown below. Repeat this procedure one (1) to two (2) times and determine the final TSS value by averaging the results.

$$TSS\ (mg/L) = \left(A - B\right) \times \frac{1{,}000}{x}$$

Symbol	Represented Value
A	Combined weight of the crucible, filter, and dried residue (mg)
B	Combined weight of the crucible and the filter (mg)
x	Sample volume (mL)

1. Measure the VSS by performing the following steps:
    a. Perform steps d to f in the TSS measurement procedure above using the crucible that was not used for the TSS measurement.
    b. Ignite the crucible and filter paper with residue within the furnace at a temperature of 500 to 600ºC (932 to 1,112ºF), and then cool in the desiccator to the temperature of the analytical balance, and weigh.
    c. Repeat the cycle of heating, cooling, desiccating, and weighing until a constant weight is obtained or until the weight loss is less than 4% of the previous weight, whichever occurs first. (The resulting weight is C in the calculation below.)
    d. Where A equals the combined weight of the crucible, filter, and dried residue (mg) before ignition, while C equals the combined weight (mg) after ignition, calculate the VSS value as shown below. Repeat this procedure one (1) to two (2) times and determine the final TSS value by averaging the results.

$$VSS\,(\mathrm{mg/L}) = \left(A - C\right) \times \frac{1{,}000}{x}$$

Symbol	Represented Value
A	Combined weight of the crucible, filter, and dried residue (mg) before ignition
C	Combined weight (mg) after ignition
x	Sample volume (mL)

1. After determining the TSS and VSS values, calculate the percentage of TSS that is VSS as follows:

$$\%\ VSS = average\ VSS \times \frac{100}{average\ TSS}$$

Symbol	Represented Value
x	% by weight (as decimal)
y	Density
z	Amount (kg) required per liter of solution

3.3.3.4 Total and volatile solids

When the solids content within the bioreactor is greater than 10,000 mg/L, it is much more practical to perform a TS or VS test than one for TSS and VSS. The results of this test can be used as a reasonable approximation of the TSS value.

***TIP:** A bioreactor's TS level will usually be within the 10,000 to 15,000 mg/L range after 3 to 4 months of operation.*

To measure the TS and VS in a sample, use the suspended solids procedure and calculations outlined in this manual, but without the use of filtration equipment or filter paper *(see 3.3.3.3 Total and volatile suspended solids)*. Instead, pour a liquid sample estimated to yield between 2.5 and 200 mg (0.007 oz) of dry residue into the crucible. The liquid portion of the sample will be evaporated during the drying (TS) or heating (VS) process.

3.3.3.5 Specific oxygen uptake rate

The bioreactor TSS or TS concentration is an approximate measure of the microbial population within the tank. Because this concentration can vary, the specific OUR is often calculated to determine the OUR per unit mass of bacteria.

To calculate the specific OUR, perform the following steps:

1. Measure the OUR within the bioreactor *(see 3.3.3.2 Biological oxygen uptake rate)*
2. Measure either the TSS or TS level within the bioreactor *(see 3.3.3.3*

Total and volatile suspended solids)

3. Using the following calculation, determine the specific OUR.

$$x = \frac{y}{z}$$

Symbol	Represented Value
x	Specific OUR (mg oxygen per g of TSS (or TS) per hour)
y	OUR (mg per L/hour)
z	TSS (or TS) g per L

3.3.3.6 pH

To ensure proper operation, pH levels within the bioreactor should remain between 6.8 and 7.5 and must be checked daily. The pH analysis can be performed with a pH meter and probe as described in the following procedure:

1. Calibrate the pH meter and probe as per the manufacturer's instructions *(see B Appendix: Project documents)*.
2. Collect a sample from the bioreactor and stir gently before inserting the pH probe.
3. Record the registered reading.

3.3.3.7 Chemical oxygen demand

Measuring the chemical oxygen demand (COD) of a sample will indicate the amount of organic material it contains.

The COD in mixed liquor entering the bioreactor represents the amount of food available to the organism contained there, while the COD in permeate represents the amount of non-biodegradable (recalcitrant) material in the permeate.

In the case of the bioreactor contents, only the soluble COD is measured and the sample must be filtered before analysis.

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4.1 About this section

This section explains how to receive, handle, and install the ZeeWeed membrane system, as well as how to prepare it for operation.

All operators must read and understand the information outlined in this section before attempting any of the tasks or procedures discussed in it.

CAUTION	
	General Hazard Do not make any modifications (example: wiring into the electrical cabinet) or incorporate additional tools to the system (example: piping, external mechanical devices, anything else that connects to the system) that are outside of system specifications without first consulting with Veolia.

4.2 Initial requirements

The following must be available before installation begins:

APPLICABLE DRAWINGS: The Piping and Instrumentation Diagram (P&ID), General Arrangement (GA), and Electrical drawings will be needed during installation *(see B Appendix: Project documents)*.

WATER: Water introduced into the system during installation must be free of particulates. Any debris allowed to enter tanks or piping must be removed immediately.

ELECTRICITY: Veolia is not responsible for supplying power to the [system or stack]. During installation, a qualified electrician must verify the following:

- All electrical connections meet local government and industry standards.
- All electrical cables have been properly fitted.
- All motors have been wired for proper rotation.

QUALIFIED PERSONNEL: A qualified electrician, pipefitter, and millwright/fitter are required on site when commissioning the system.

4.3 Shipping and handling requirements for ZeeWeed membranes

CAUTION	
	Chemical Hazard Membranes are preserved with glycerin (glycerol) and sodium bisulfite or metabisulfite, which may cause skin and eye irritation.
	Wear Appropriate PPE When handling membranes, wear appropriate PPE, which includes skin (gloves) and eye protection at a minimum.
	Slip/Fall Hazard Ensure any glycerin spills or leaks are cleaned immediately.

NOTICE	
	Failure to adhere to the information outlined in this section may result in damage to the system.

NOTE: *The "lifting modules" referred to in this manual may be called "lifting frames" or "lifting braces" in other documentation.*

4.3.1 Shipping membranes

Ensure that the following precautions are followed while moving the membranes:

- Control shipment temperatures in the range of 5 to 35°C (41° to 95°F) (setpoint 20°C or 68°F).

- Never expose the shipping crates housing the membrane cassettes or modules to excessive vibration or large bumps. When shipping membrane cassettes or modules by rail or truck, take care to ensure that air suspension cars or trailers are used.
- In most cases, membranes will be shipped in populated cassette form (modules are already installed) in cassettes. For membrane refurbishment, membranes may be sent in shipping frames.
- Membranes that are to be returned to Veolia must be cleaned, sanitized, and preserved before shipment. Contact Veolia for instructions before returning membranes.

After shipping, installation, and glycerin flush, an integrity check will be performed on the membranes to ensure no fibers were compromised during the handling process. To optimize performance, routine and pre-commissioning maintenance may be necessary to ensure the highest quality product prior to commissioning.

4.3.2 Handling factory-shipped membranes

Membrane cassettes are shipped in either a plywood or Cartonplast packing crate. The cassette itself is sealed in a plastic bag to retain moisture and prevent damage to the membranes due to drying.

Individual membrane modules/elements are shipped in a cardboard box within a crate. The module itself is sealed in a plastic bag to retain moisture. Do not stack shipping crates.

In the case of cassette refurbishment, modules may be shipped in shipping frames. The frame is sealed in a plastic bag to retain moisture. Each frame can contain up to 30 modules.

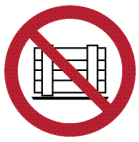
4.3.2.1 Unloading membranes

The Installer is responsible for the prompt and proper unloading of all membrane equipment and materials received into their custody.

- Dock level, off-loading facilities are recommended.
- The wooden shipping crates and shipping frames are designed to be lifted from the bottom using a forklift.

Note that extended forks and an appropriately sized lift are required for the ZW500 large cassettes and crated modules.

WARNING	
	Forklift Hazard It is recommended that an experienced/qualified forklift truck driver unloads the membranes from the carrier.
	General Hazard Cassettes are shipped on their sides and will require righting - follow all procedures carefully to prevent injury.
	General Hazard Do not stack shipping crates!

CAUTION	
	**Obstruction Hazard** Clear area of all obstacles and bystanders to avoid being struck by, struck against, or caught on the cassette.
	Overhead Load Hazard Only lift the cassette as needed to clear obstacles.
	Overexertion Hazard Use correct position and posture when lifting sides.

NOTICE	
	Damage incurred or observed during equipment off-loading needs to be immediately reported to a Veolia representative.

4.3.2.2 Confirming equipment and materials

- Perform a cross-check on the shipment using the packing slip to confirm the delivery of membrane equipment.

  NOTE: *Do not open membrane crates! Limit verification to external examination of crates.*

- Check the equipment delivery for content and any damage that may have occurred during shipping or unloading.
- Report any non-conformance immediately to a Veolia representative (in writing). Provide digital pictures of the damage.
- Refer to *4.3.2.3 Confirming handling indicators*.
- Once the equipment shipment has been checked, the document provided by Veolia (ref. Equipment Acceptance Certificate and Checklist) is completed and signed by the site organization's representatives.
- The Installer shall expeditiously replace all materials and equipment that are lost or damaged while in the custody of the Installer.
- Replacement materials and equipment of a type and quality equal to the original materials and equipment shall be acceptable to Veolia and to the Owner.

4.3.2.3 Confirming handling indicators

NOTICE

Experience has proven that these are simply precautionary measures, as Veolia is not aware of any damage that has resulted from exposure to high or cold temperatures.

Veolia includes a series of shipping indicators to protect the integrity of the membrane cassettes while they are being shipped, in addition to the external indicators inside the crate (affixed to one of the cassette legs). There are both warm and cold mark temperature indicators to monitor the membrane exposure to extreme temperatures.

Figure 4.1 - Outside temperature indicators

- On a cassette or shipping frame, the internal indicators will be in a plastic bag affixed to the cassette or shipping frame. For a crate of bagged and boxed modules, one of the top boxes will have the indicators inside and that box will have an “X” on it.

  NOTE: *There are duplicate indicators inside the crate affixed to the cassette. These indicators are for Veolia FSR use.*

- The Installer's representative should record the indicator condition of the external indicators.
- Tripped indicators mean that further inspection and testing are necessary during membrane installation and commissioning. At the time of discovery, the Installer must inform the Veolia representative of any triggered indicators. (A triggered indicator indicates ideal shipping conditions were not maintained. Both inside and outside indicators

should be cross checked. The Veolia representative will evaluate membranes prior to installation).

Table 4.1 - Temperature indicators

	Freeze Indicator	Heat Indicator
Indicator location	External	External
When to check	At time of receipt	At time of receipt
Indicator location	Internal	Internal
When to check	During installation	During installation

- As soon as any tripped indicators are identified, contact the Veolia representative and provide the following information:
  - maximum and minimum temperature of exposure and duration
  - number of tripped hot and cold indicators inside and outside of the crate
  - number of crates sent
  - shipping dates and crate inspection dates
  - responsible party for shipping, receiving, and storage
  - at what stage of the shipping process the temperature indicators were found tripped (example: ground/air/sea transportation, during transfer to installation).
- During membrane installation, the Veolia representative onsite will also inspect and record the status of all indicators.

Any crates with tripped indicators will be inspected when the membranes are installed. They will first be uncrated and inspected for:

- signs of sagging/warping plastic components (extreme heat)
- signs of cracking/brittle plastic components (extreme cold)
- lack of membrane fiber slack (high temperatures)

If any signs of damage to the plastic occur, these components will need to be replaced. If there is not sufficient membrane fiber slack, the slack will need to be adjusted.

As a final check to ensure no damage has occurred, the membranes will again be tested following installation. For the first test, the bubble test, the membranes will be completely submerged in water and will be pressurized with clean, low pressure air specific to the membrane type. An overwhelming number of leaks may indicate further damage. It is normal to have a small number of fiber repairs following installation.

For the second test, the membranes will be flushed of glycerin and flux tested on potable water. For the flux test, water is sucked through the membranes as in normal operation. The flows and TMPs (Trans Membrane Pressure) are recorded, and compared to the product design criteria for the specific project.

The FSR will document any concerns.

For information on long-term storage, see *4.11.3 Storing ZeeWeed membranes*.

4.4 Preventing membrane fiber drying

To prevent membrane fibers from drying, which can negatively impact membrane performance, wet down the cassette / modules at least every thirty (30) minutes while the cassette is out of the water. If the membranes are ***frequently, lightly misted*** (not sprayed with fire hoses or pressure washers) from the time they have been taken out of the water, they may be left exposed to the air for a maximum of 6 hours at a temperature between 5 to 35°C (41 to 95°F), after which the cassette must be returned to the membrane tank for 5 to 10 minutes to fully rewet and re-hydrate the membrane fibers. Put the cassette or module back into a tank full of potable water up to the top of the membranes, but do not submerge it completely; leave the permeate pipe out of the water.

If required by compliance regulations, the standard procedures for rinsing and disinfection may be used before membranes are put into operation. If the membranes have been wetted and it becomes impractical to immerse or repeatedly spray them during the time before they can be placed in the

membrane tank, the membranes must be cleaned, preserved in glycerin solution, and rebagged *(see 4.11 Shutting down the system and preserving ZeeWeed membranes)*.

4.5 Receiving the lifting module

WARNING	
	Forklift Safety Only qualified personnel shall operate a forklift.
	Equipment Hazard The hook used to connect the lifting module to the hoist (or crane) must meet the minimum width and bearing requirements for the type of lifting module supplied with this system. The hook's specifications must be verified by Veolia before the lifting module may be used.

Cassettes cannot be lifted by connecting chains, hooks or lifting straps directly to the cassette framework. Instead, the ZeeWeed lifting module must be used at all times. This applies when the cassette is first uncrated and installed, as well as when it must be removed from the tank for routine maintenance or repair.

***TIP:** The only exception to this rule is the cassette righting procedure, during which lifting straps may be used as outlined in this manual.*

Figure 4.2 - Example of lifting module with EV R cassette

To prepare for the cassette installation process, the lifting module must be unpackaged, inspected, and readied for use. To do this:

1. Using a forklift, move the packaged lifting module to its designated set-down area. The lifting module must be stored indoors on a flat, dry surface.
2. Remove all packaging, including any plastic wrap, crating and shipping straps.
3. Lower the hook of a properly rated hoist (or crane) and connect it to the lift-point located at the center of the lifting module *(see B Appendix: Project documents)*.

NOTICE	
	Do not allow any part of the lifting module to come into contact with carbon steel. Doing so will contaminate the lifting module, which may in turn contaminate the cassette.

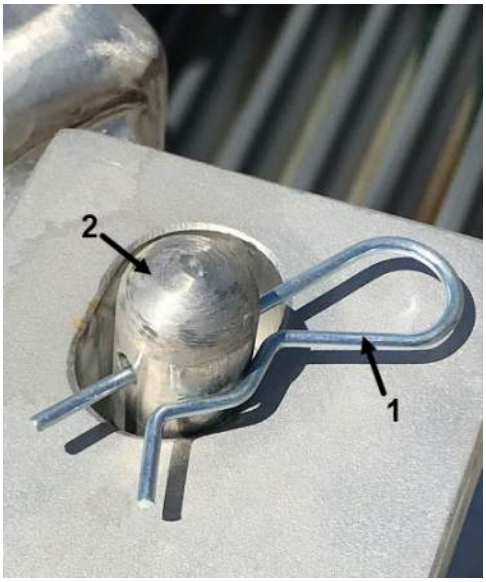
4. Raise the lifting module to a height that is comfortable and safe to work with.

5. Ensure that all four support pins are fitted with locking pins. The support pins are located at each corner of the module.

   TIP: *The diagram shown here is a general example. Refer to the GA drawings for specific illustrations of the lifting module provided with this system* *(see B Appendix: Project documents)**.*

6. Inspect the lifting module for any damage that may have occurred during shipping, such as dents, bent or broken parts, or chipped paint.

7. Slowly lower the lifting module until it sits level on the ground.



1: Locking pin

2: Support pin

Figure 4.3 - lifting module pin diagram

4.6 Preventing debris contamination

It is critical that debris capable of damaging the membranes (example: anything over 2 mm (1/16 in.) in size) be prevented from entering the membrane tank(s).

CAUTION	
	Equipment Hazard Do not bypass using the drum screen at the inlet to the bioreactor. This could result in damage to the membranes. See the specifications to determine if a drum screen is required *(see B Appendix: Project documents)*.

NOTICE	
	Damage to the membranes and/or associated equipment due to the introduction of destructive foreign materials into the membrane tanks may not be covered by the warranty.
	Failure to ensure that all prescreening measures remain functioning and in proper working order may render the warranty null and void. This includes weekly inspection of the fenced, open-top external aeration basin and the removal of any large-scale debris that may have entered the enclosure.

Possible contamination pathways include:

- mixed liquor laden with debris
- debris allowed to enter the tank during work performed nearby
- debris left within piping connected to the membrane tank
- residue from piping or process equipment
- debris resulting from damage to the tank or tank coating, not including damage due to the normal operation and maintenance of the system.

Examples of common materials that can cause damage include, but are not limited to:

- cable ties
- plastic turnings from drilling
- pieces of wire
- broken measuring tapes
- weld slag and metal debris from grinding
- twigs and leaves
- shells, sand, and fish.

As a general rule, seal, cover, or otherwise protect the interior of the membrane tank whenever work that may generate debris is being performed nearby.

Sand that remains in the mixed liquor after prescreening and that enters the membrane tank as a result will be defined as a destructive foreign material. The customer is responsible for ensuring that all prescreening measures remain functioning and in proper working order. The customer is also responsible for the removal of any sand that may accumulate within the membrane tank.

NOTICE

Sand is an abrasive substance. Failure to remove accumulated sand from within the membrane tank may result in membrane damage that will not be covered by the warranty.

4.7 Uncrating and installing ZeeWeed cassettes

NOTICE	
	The physical abuse, misuse, or improper installation or removal of membrane elements by non-Veolia personnel, including damage caused by operator error while handling membrane elements, may render the warranty null and void.
	The unauthorized alteration of equipment or parts provided by Veolia with the membrane modules may render the warranty null and void.

Two operators (at minimum) must be present to perform this procedure.

4.7.1 General precautions

CAUTION	
	General Hazard Failure to observe the following precautions may result in injury or damage to the system.

NOTICE	
	All piping and tanks must be installed, cleaned, and subjected to a wet test before membranes may be installed.

While performing the installation procedure, ensure that the following precautions are taken:

- The membranes must not be allowed to dry out.
- Avoid moving or working beneath a cassette while it is being lifted.

- Do not allow permeate connections to fill with water while the cassette is being lowered into the tank.
- Do not touch, pull, or otherwise handle membrane fibers during installation.

4.7.2 Preparing the site

The Membrane Pre-Installation Checklist must be completed and signed before cassettes can be uncrated and installed. If this checklist has not been provided by a Veolia representative by the time cassettes have arrived on site, request a copy by contacting Veolia *(see 1.2.2 Contacting Veolia)*.

The membrane tank must be cleaned thoroughly.

All loose-shipped parts required for the cassette installation must be located. Also, all permeate piping, air piping, and any tank internals and supports must be installed before the membranes can be installed.

The area where cassettes will be uncrated must be clearly designated and closed-off to all personnel who will not be taking part in this procedure.

4.7.3 Parts and equipment

WARNING

Training and Certification Required

Always use trained operators and inspected equipment.

- Forklift with extended forks, rated for cassette weight; required to move the crate
- Crane or hoist, slings, and lifting module; required to right the cassette and install the cassette in the tank; lifting hoist requirement for 64 element cassettes is 3,000 to 4,600 kg
- Two (2) sheets of 1-inch thick foam (90 x 90”)
- Four (4) 3/4" lifting safety hoist rings rated for 5,000 lb; material: 4140 aircraft quality carbon steel (recommended manufacturer is ACTEK,

part no. 46018), comes with eight (8) 3/4" diameter stainless steel flat washers and four (4) 3/4" diameter stainless steel hex nuts (included with shipment)

- Four (4) slings
- Four-point spreader bar AND two-point spreader bar
- Flathead screwdriver; to uncrate the cassette
- Camera; for documenting the condition of the cassette and indicators upon uncrating
- 1-1/8” socket; to attach cassette arms
- PVC glue and primer; to install necessary PVC elbows to cassette
- Anti-seize – use NSF grade only for drinking water applications (for example: White Knight)

4.7.3.1 Parts required

- Four (4) 3” x 3/4" stainless steel bolts
- Eight (8) 3/4" stainless steel nuts
- Four (4) 3/4" stainless steel Nord-Lock washers
- Four (4) hanger arms (two (2) left and two (2) right)
- ZeeWeed 500 lifting module (comes with hitch pins)
- Four (4) 3/4" stainless steel double split shaft collars

4.7.4 Safety during installation

WARNING

Refer to Manual

Failure to adhere to the following safety requirements may result in serious injury or death.

When uncrating and installing a cassette, always ensure:

- a minimum of two operators are present to perform the installation
- all lifting equipment is in proper working order and rated to carry the required weight
- operators are wearing an appropriate safety harness or similar fall-arrest equipment when working overtop of the membrane tank or in any other position where a fall from a significant height is possible
- all personnel are standing clear and remain within sight of the forklift operator while a cassette headpiece is being moved
- cassette headpieces are not lifted overtop areas where personnel are standing or may enter into.

To promote safety, use a dedicated staging area to right the cassette.

- Clear the staging area of any material and cordon it off to people who are not directly involved in this activity.
- Clearly mark and isolate the area such that access of unauthorized personnel shall be prevented. Consider using a perimeter fence, rope/chain barriers, pylons, or other signaling and blocking means.
- Ensure that the area for the uprighting operation is at least 7.5 m x 3 m (25 ft x 10 ft). This area does not include additional area required for a mobile crane.

4.7.5 Uncrating the cassettes

CAUTION

General Hazard

Two (2) workers are required to guide or lift the box sides.

NOTICE

ZeeWeed 500EV crates are not designed to be stacked on top of one another.

ZW500EV cassettes are always shipped with modules installed. The cassette is shipped on its side in a Cartonplast crate. The cassette itself is sealed in plastic to retain moisture and prevent membrane damage.

Damage such as punctures, water damage, or tripped indicators incurred during equipment off-loading needs to be reported to the site superintendent and Veolia immediately.

Figure 4.4 - Cartonplast crate

Uncrate the membranes with a Veolia representative present to monitor the process and verify the receiving tanks and piping have been satisfactorily prepared. Failure to do so may affect the membrane warranty.

Use a forklift to transport the cassette to a designated uncrating area. This requires a dry level surface, out of direct sunlight. Do not allow the cassettes to freeze *(see 2.2.1 Storage and handling requirements for ZeeWeed membranes)*

Do not uncreate membranes if any of the following activities are happening in the immediate vicinity:

- painting
- roofing
- tinwork
- pipe flushing
- grinding
- welding
- sandblasting
- drilling
- using any power tools that discharge debris (including carpentry)
- wiring and terminations
- or any other activity that could pose harm to the membranes.

To uncrate the cassettes:

1. Remove the top first, followed by the sides. Remember: At least two people are required to uncrate the cassette.
2. Cut and remove the outer straps of the crate packaging.
3. Remove the outer grey Cartonpast packaging material. Remove the top first, then all four sides.
4. The cassette comes packaged in a vacuum sealed bag. Once the cassette is uncrated AND if the cassette will soon be placed into the membrane tank with water, carefully remove the bag.
5. Cut and remove the inner straps.
6. Cut open the bag that seals the cassette at the top and then carefully roll down the bag to the base of the crate. DO NOT CUT IN THE INDICATED AREA (see image below, right) AS FIBERS CAN BE

DAMAGED.

7. Once rolled down, cut the bag at the base and discard it.

Figure 4.5 - Cassette in a vacuum-sealed bag (left); opening the sealed bag (right)

NOTICE	
	There is plastic wrap underneath the bag. The plastic wrap must stay intact for the righting of the cassette.
	If the membranes have spent time in storage, carefully check for any signs of mold on the fibers. If mold is present, immediately rebag the membranes contact Veolia for next steps.

4.7.6 Moving uncrated cassettes

NOTICE	
	If there is contact with the fibers, the integrity of the membranes may be compromised.

Once the cassette has been removed from the shipping crate, take care to avoid contact with the membrane fibers.

If there is contact with the fibers, the integrity of the membranes may be compromised. Advise onsite Veolia staff immediately so the fibers can be inspected, and repairs can be initiated before the cassette is installed.

If fiber damage is not reported to Veolia staff, it will take a lot of extra time and effort later to remove the cassette and make the repairs.

When lifting the cassette, lift it by the factory-supplied lifting points on the top of the cassette using the lifting module. If a lifting module is not available, a spreader bar is required. Do not simply attach ropes to the four hanger brackets and lift on the hanger brackets. The hanger brackets will not withstand the horizontal (inward) loads produced because the ropes are sloping inwards.

Cassettes are designed to be lifted vertically and lowered slowly in a smooth fashion. Do not swing or drop the cassettes.

Never tilt or drag an uncrated cassette. Treat the product with care.

If necessary, the uncrated and righted cassette can be moved on the wooden skid on which it was shipped, using a forklift.

Take extreme caution to avoid wind, environmental and safety risks that may be present while moving the cassette in this manner.

4.7.7 Inspecting the cassette (inspection 1 of 2)

With the cassette uncrated but still on its side *(see Figure 4.6 - Example of aeration plug fitted in the center (circled in red))*, inspect the aeration piping and connections to ensure:

- aerators are properly in place
- any blanks aerators have plugs in the saddle
- all saddles are securely clipped to the cassette frame.

Figure 4.6 - Example of aeration plug fitted in the center (circled in red)

4.7.8 Righting the cassette

NOTICE	
	If a crane is being used in place of a hoist, place it at an appropriate distance to prevent collision with the cassette during lifting.

After the cassette has been inspected and the aeration assembly has been prepared, the cassette is ready to be righted.

Before beginning the righting procedure, remove all crating material from the staging area and ensure that there is a clean, flat surface for the righted cassette to be set down upon.

It is recommended that an overhead hoist be used for this procedure. However, if a hoist is not available, a mobile crane or similar device may also be used, so long as it is fully rated to support the cassette's weight.

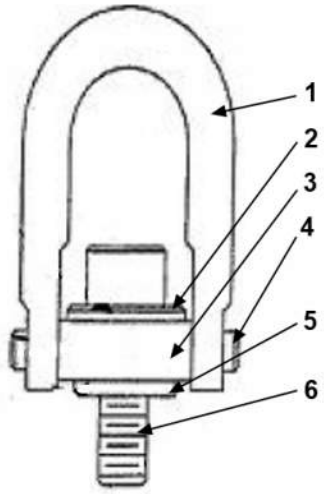
4.7.8.1 Attaching hoist rings

NOTICE

Hoist rings are made of carbon steel. To avoid contaminating the stainless-steel cassette frame, ensure that stainless-steel flat washers and hex nut are used.

While installing the hoist rings, ensure:

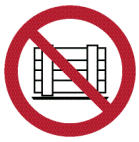
- the hoist ring bolt, shoulder pins, and bail are free of cracks or signs of wear
- the hoist ring bolts are tightened to 100 ft-lb (136 Nm)
- the bushing of the hoist ring is sitting flush against the frame
- the hoist is free to swivel and pivot in every direction
- the shoulder pins are secure.



1: Bail
2: Washer
3: Body
4: Shoulder pin
5: Bushing
6: Bolt thread

Figure 4.7 - Hoist ring assembly

4.7.8.2 Removing the skid

WARNING	
	**Do Not Obstruct the Area** Ensure that all personnel have been cleared from the immediate area before beginning the lift.

NOTICE	
	Ensure that the hoist rings do not touch or press against the cassette frame.
	Use slings made of a fabric capable of supporting the cassette's full weight. Using chains may cause damage to the cassette.
	If a crane is being used in place of a hoist, place it at an appropriate distance to prevent collision with the cassette during lifting.

After the hoist rings have been attached, the skid must be removed in preparation for righting the cassette.

To remove the skid:

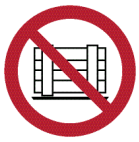
1. Place one of the foam sheets on the ground in the area where the cassette will be righted. Ideally, this will be directly next to where the cassette currently sits upon the skid.
2. Attach the lifting assembly to the hoist rings. If possible, use a four-point lift frame and spreader bar. If this is not possible, use slings that have been arranged according to the following requirements:
    - Connect a fabric sling (1.2 m (4 ft) long) to each hoist ring, and a properly rated cable (6 m (20 ft) long) to each sling.

- When taut, the slings must be at a minimum 60º angle to the cassette if a spreader bar is used, or at 75º for a single-point lift.

Figure 4.8 - Lifting cassette without a four-point lift frame and spreader bar

3. After attaching the lifting assembly, slowly lift the cassette until it is high enough that it can be moved without touching the skid underneath (not more than 5 cm (2 in.) above the skid).
4. Carefully move the cassette over to the foam sheet, and then gently lower it onto the sheet.
5. Remove the skid and the remains of the vacuum-sealed bag.
6. Ensure that any spills or debris have been thoroughly cleaned.
7. Disconnect the lifting assembly, and then remove the two hoist rings attached to the bottom side of the cassette (that is, the side that will be placed on the ground when the cassette is righted).

4.7.8.3 Lifting cassettes during righting

WARNING	
	**Do Not Obstruct the Area** Ensure that all personnel have been cleared from the immediate area before beginning the lift.

NOTICE	
	The lifting assembly must be equipped with a two-point spreader bar.
	If a crane is being used in place of a hoist, place it at an appropriate distance to prevent collision with the cassette during lifting.
	At all times during the lift, keep the hoist (or crane) aligned directly overtop the hoist rings. Failure to do so could result in the cassette swinging violently when it leaves the ground. Do not attempt to stop the cassette if it begins to swing.

After the skid has been removed and the work area cleared of spills and debris, right the cassette by performing the following steps:

1. Place the second foam sheet on the ground next to the cassette.
2. Attach the lifting assembly to the two hoist rings.
3. Carefully begin lifting the cassette. As it is raised, the cassette will begin to tilt. As the cassette tilts, move the hoist (or crane) horizontally to keep it above the hoist rings.

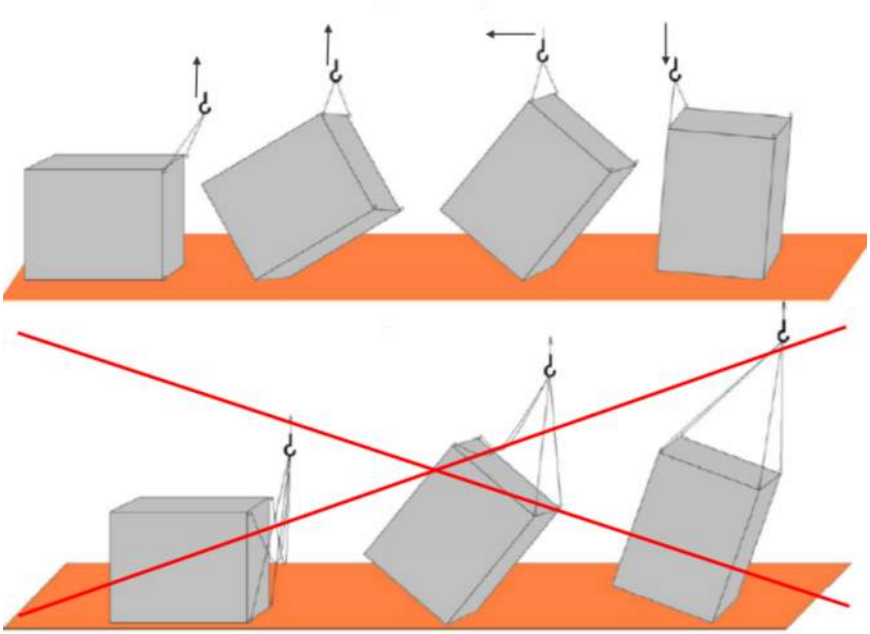


Figure 4.9 - Proper righting procedure

4. Lift the cassette until it pivots onto its side, then lower it until it rests in the upright position and fully atop the second foam sheet.
5. After the cassette sits firmly upon the ground, disconnect the lifting assembly, and then remove the hoist rings.

4.7.9 Installing cassette hanger arms (if supplied by Veolia)

The cassette hanger arms allow the cassette to be moved using the lifting module, and support the cassette after it is installed in the tank. These arms can be installed only after the cassette has been righted.

Figure 4.10 - Examples of cassette hanger arms attached

NOTICE

A torque of 104 ft-lb (141 Nm) must be applied to all 3/4" (19 mm) Nord-Lock nuts used to fasten the cassette arms in place.

There are two left-side arms and two right-side arms. When installing them, ensure that the correct arm is attached to the correct side of the cassette *(see B Appendix: Project documents)*.

Hanger arms are installed on the four corners of the cassette. When installed correctly, each arm must be identical to the one installed on the opposite (diagonal) corner, and must be the opposite type compared to those installed on the two adjacent corners.

When identifying the two types of arms, note the position of the open end of the arm and the position of the small tab at the bottom of the arm.

There are two different types of slots found on the top of each hanger arm. The slot that is nearest the center of the cassette when the arm is installed is for connecting the cassette lifting module. This slot is circled in red at the top of the image to the right.

If the hanger arm has been installed correctly, the other slot will sit on top of the support beam when the cassette is installed in the tank. This slot is elongated parallel to the beam, and is circled in blue at the bottom of the image to the right.

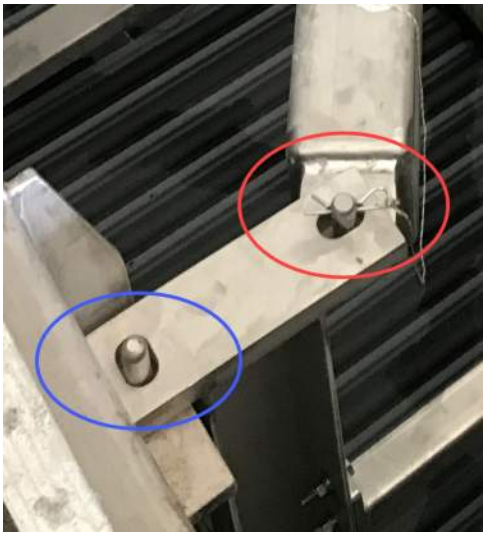


Figure 4.11 - Hanger arm slots (top view)

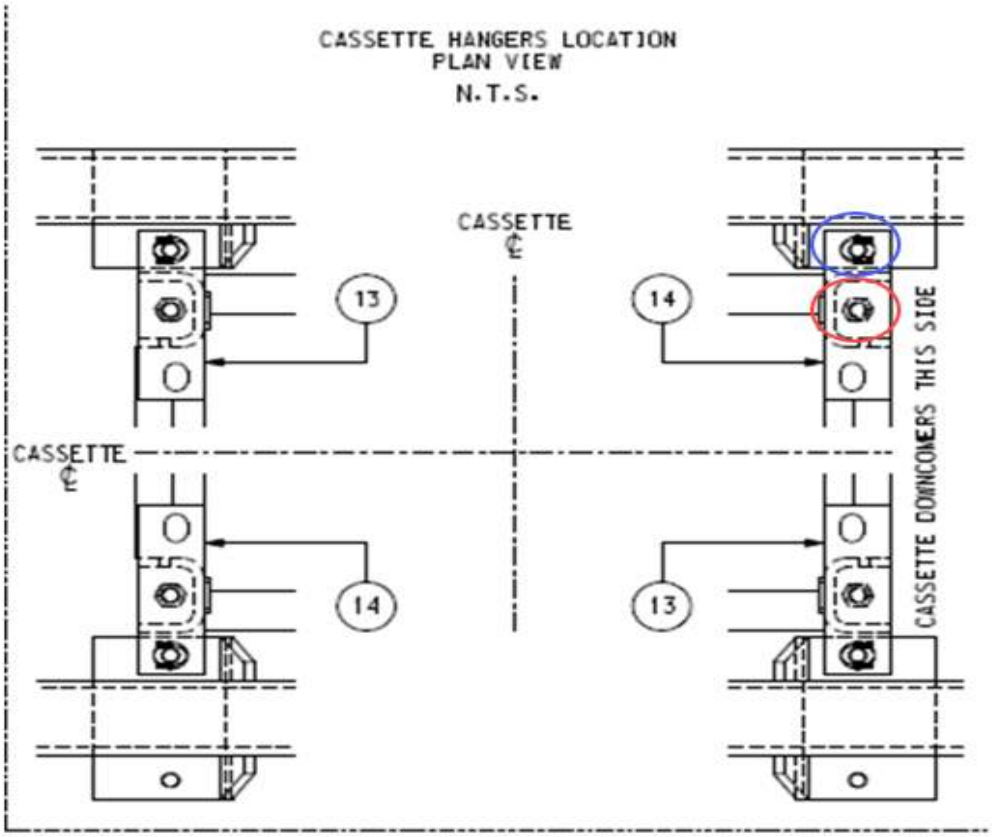


Figure 4.12 - Cassette hanger location

4.7.10 Using membrane tank covers (if supplied by Veolia)

ZeeWeed tanks may be covered by either fiberglass reinforced plastic (FRP), or aluminum or stainless steel covers. These covers must be supported by the Veolia-supplied cassette support beams (unless a "beamless" design is used).

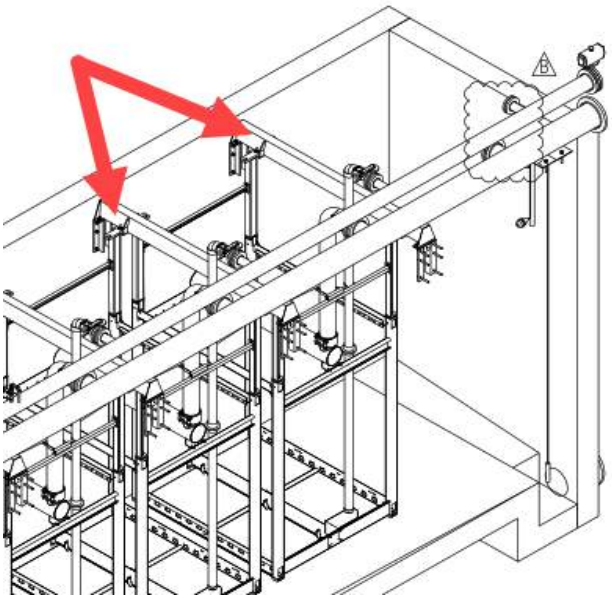


Figure 4.13 - Veolia-supplied cassette support beams for one-row design

Figure 4.14 - Veolia-supplied cassette support beams for two-row design

Figure 4.15 - Example of membrane tank covers

Cassettes can only be placed on covers that have been designed to support the maximum weight of a cassette. This can be accomplished with:

- specific panels, or a permanent structure that covers part of the tank, designed to support a cassette
- the use of removable load-bearing devices used only when cassettes are being serviced.

NOTICE	
	Verify that a structural analysis has been performed to confirm covers and load-bearing devices will support the maximum weight of a cassette.

In addition, membrane tank cover panels require features to prevent adjoining covers from moving during maintenance *(see Figure 4.16 - Tank cover underside with permanent tabs (left) and grating with screw-down clips to prevent sliding (right))*.

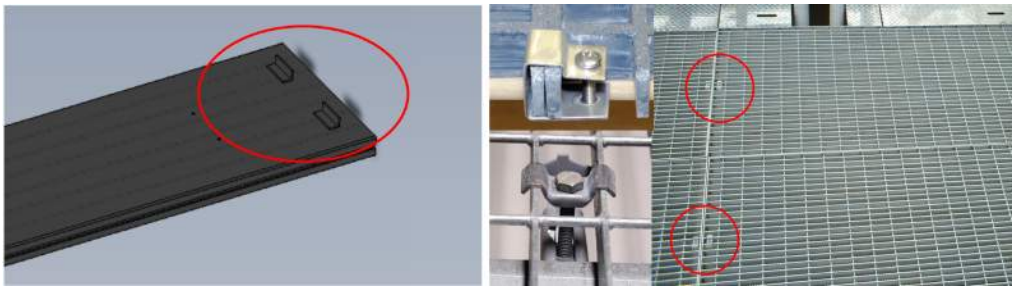


Figure 4.16 - Tank cover underside with permanent tabs (left) and grating with screw-down clips to prevent sliding (right)

If needed, review the *ZeeWeed Tank Cover Design Guide (E000001-WTS-ME-SYS-EN22-SG-017)* to ensure safety requirements are met. This document is available from Veolia.

4.7.11 Removing the plastic wrap

Cassettes are shipped with a plastic wrap beneath the sealed cassette bag. This wrap must be removed carefully so that the membrane fibers are not damaged.

To remove the wrap, make a cut close to the corner of the cassette frame, away from the membranes.

To avoid contaminating the stainless-steel frame, do not allow the blade to touch the cassette frame while the cut is being made. Discard the wrap after it has been removed.

Figure 4.17 - Cutting the plastic wrap

4.7.12 Inspecting cassettes after righting

After the cassette has been righted, confirm the following:

- Check the entire cassette for loose or missing nuts and bolts. Torque specifications are noted in the technical drawings *(see B Appendix: Project documents)*.

- Inspect all welded joints for rust spots.
- Record the serial numbers of each membrane module on the membrane map (provided separately). Also, if multiple cassettes will be installed within the same membrane tank, record the position within the tank where each cassette will be installed.
- If the cassette has blanks, ensure the empty aerators have plugs installed into the aerator saddle.
- Inspect all of the installed LEAP aerators to ensure that any blanking plugs are removed from the saddle.

4.7.13 Assembling aeration piping

Some parts of the cassette aeration spool may be assembled before the cassette is installed within the membrane tank. After the cassette is in place, connect the preassembled piping.

The technical drawings provide a detailed illustration of the piping assembly *(see B Appendix: Project documents)*. After the piping has been assembled, set it aside in a safe area where it will be protected from damage or contamination until it can be installed.

4.7.14 Leveling cassettes

Leveling of the ZeeWeed cassette is achieved by leveling the beams and/or brackets.

Before installing the cassette, follow the beam leveling instructions per the membrane tank General Arrangement drawing. If required, use shims *(see Figure 4.19 - Using shims when leveling)*. If fine leveling is required, use a 3/4” 316 stainless steel flat washer on the pins at each corner to raise the cassette.

***NOTE:** The image below is a typical drawing. For Bill of Material and torque specifications, refer to the project-specific General Arrangement drawing for the membrane tank.*

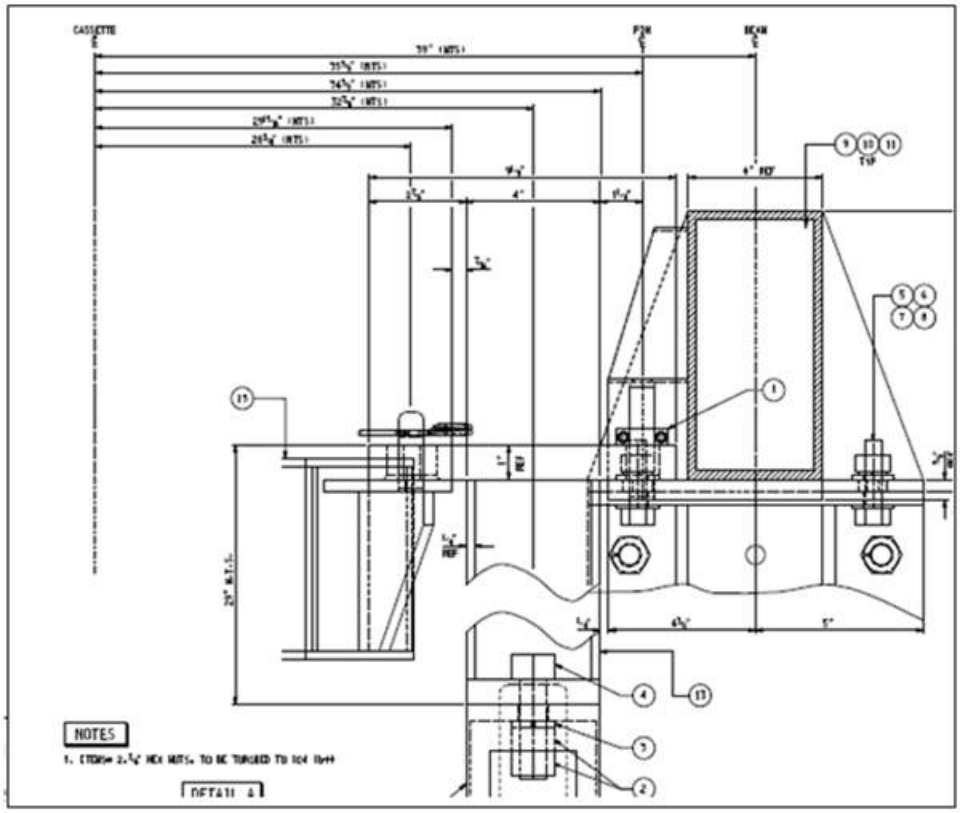


Figure 4.18 - Typical General Arrangement drawing

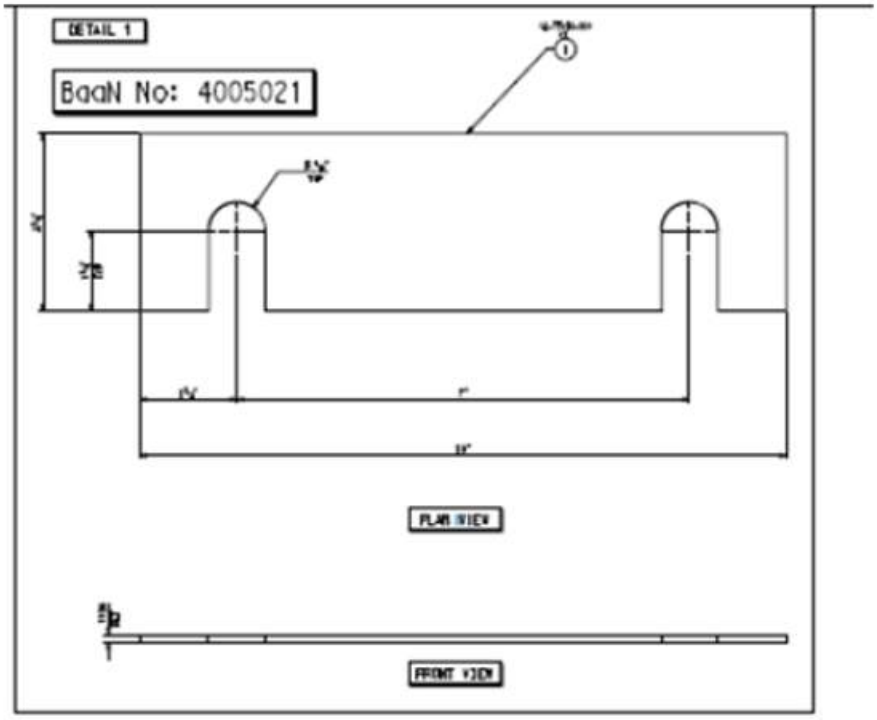


Figure 4.19 - Using shims when leveling

If the design has adjustable leveling pins at the cassette corners, the cassettes must be individually leveled to a tolerance of ± 1/8 in. per cassette within a train. All cassettes across adjoining trains must be within ± 1/4 in. level tolerance of one another.

Before installing the cassette, use a laser level to ensure the required tolerances are achieved. Cassettes that are not properly leveled may exhibit more rapid fouling as air distribution may be affected.

NOTE: *The image below is a typical drawing. For Leveling Pin Bill of Material and torque specifications, refer to the project-specific General Arrangement drawings.*

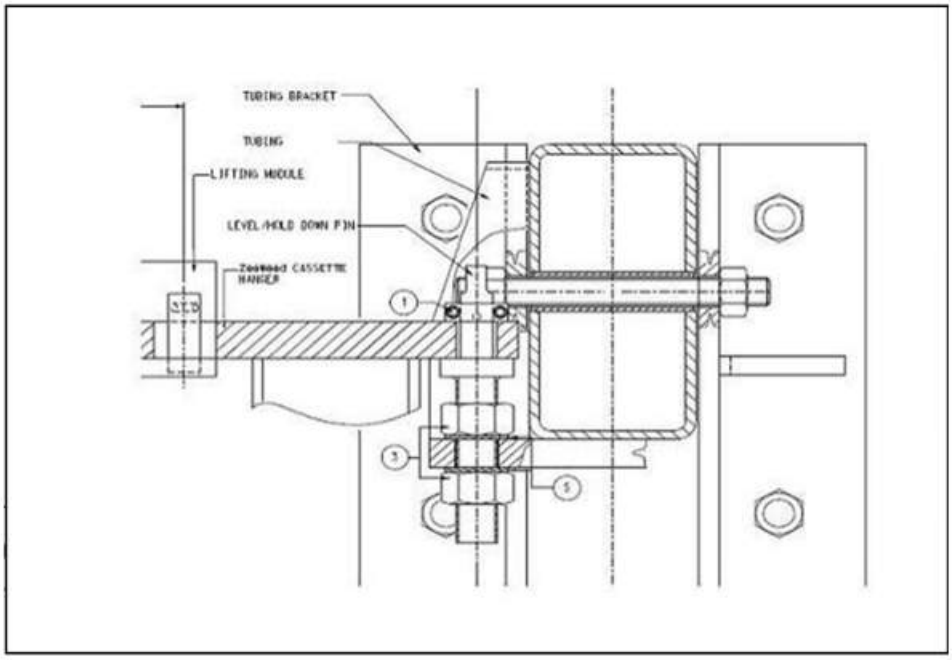


Figure 4.20 - Using a leveling pin

4.7.15 Installing cassettes in the membrane tank

When ready to install a cassette within the membrane tank, do so by performing the procedures outlined in the following sections.

These procedures apply to both the initial installation process as well as whenever a cassette is being returned to the membrane tank following routine inspection or repair.

4.7.15.1 Connecting the lifting module to the cassette (if supplied by Veolia)

WARNING	
	Equipment Hazard Use the lifting module supplied by Veolia at all times when lifting cassettes. ***Do not use chains or fabric straps to lift cassettes unless specifically instructed otherwise by Veolia.***

NOTICE	
	There must be enough potable water in the membrane tank so that no fibers will be exposed to air once the cassette is installed.
	While lifting the cassette, guide the cassette by the stainless steel supports ONLY. Never touch the membranes!

Before using the lifting module, inspect it for any obvious signs of wear or damage, including:

- worn or deformed parts
- cracked welds
- extensive rusting or other corrosion that appears significant enough to possibly compromise the structural integrity of the lifting module.

When using a lifting module, ensure that the following dangerous activities are avoided:

- Do not exceed the rated load capacity of the lifting module, nor use it to lift anything other than the cassettes it was designed for.
- Do not lift the cassette higher than necessary, and do not leave the suspended cassette unattended.
- Do not remove the warning or identification labels from the lifting module.
- Do not attempt to operate a damaged or malfunctioning lifting module.

After the cassette has been fully inspected, the cassette can be installed in the membrane tank. **Remember to ensure that there is enough water in the tank so no fibers will be exposed.**

1. Use the crane to move the lifting module overtop of the cassette.

Figure 4.21 - Crane moving lifting module

2. Slide the pins at the four corners into the hanger arm slotted hole facing the inside of the cassette.
3. Once the pins are through the slotted holes, depending on the cassette version, either pass a hitch pin through the lifting module pins or use a split ring collar to secure the lifting module to the cassette.
4. Use the hoist and lifting module to carefully lift the cassette and install it onto the leveling pins inside the membrane tank.

   Ensure a constant tension is maintained as any slack on the crane hoist will result in the lifting module falling out of the slots.

Figure 4.22 - Installing the cassette onto the leveling pins inside the membrane tank

NOTICE

The hitch pins or split ring collars are not designed to support the weight of the lifting modules.

4.7.16 Locking cassettes in place

After the cassette has been lowered into place onto the pins, a shaft collar is fitted to each pin, four in total. The collar has to be torqued to the manufacturer's recommendation.

Figure 4.23 - Example of fitted collar (right) and collar ready to fit (left)

4.7.17 Installing permeate and air connections

WARNING

Risk of Explosive Rupture or Violent Release

Failure to tighten a coupling according to the manufacturer's required torque values may result in an explosive rupture or violent release. Following installation, inspect all couplings for tightness as part of the regular preventive maintenance process.

CAUTION

Health Hazard

Avoid breathing PVC glue fumes and work in a well ventilated area.

NOTICE

Do not allow any glue or solvent to fall onto the fibers or cassette as this will result in irreversible damage.

Protect fibers and PVC piping from spills.

While installing the remaining couplings and spool pieces after the cassette is in the tank, make sure that no one steps on the membrane modules. It is acceptable to step on the cassette header and frame only!

After the cassette has been installed in the membrane tank, the final piping connections must be installed as shown in the technical drawings *(see B Appendix: Project documents)* and as described in the procedures outlined below.

4.7.17.1 Connecting permeate piping

NOTICE

The cassette is not designed to support significant weight. Do not walk, lean, or climb on the cassette while installing connections.

The permeate piping is connected by installing a coupling that joins the cassette to the rest of the permeate header. The coupling is an 8” connection.

Figure 4.24 - Installing permeate connection

To minimize the installation time and reduce the amount of work after the membranes are installed in the tank:

1. Just before dropping the cassette onto the leveling pins, mount the coupling to the cassette header and the pipe spool that connects to the other side of the coupling.
2. Tighten the coupling so that it can support the weight of the spool piece.
3. Lower the cassette onto the leveling pins.
4. Install the remaining spool pieces and couplings to connect to the

main permeate header. Remove the lifting module if it gets in the way of the work.

For systems where the permeate header is installed through the wall of the tank and is aligned with the cassette header:

1. Place the coupling on the section of the permeate header sticking through the tank wall.
2. Lower the cassette onto leveling pins.
3. Slide the coupling so that it catches both pipes.
4. Tighten.

4.7.17.2 Connecting aeration piping

Each cassette is provided with 1 x 3” air connections, depending on cassette and aeration type. These air connections provide air to the bottom center aeration channel that distributes air across the cassette by means of smaller aeration devices.

NOTE: *Always refer to the latest version of the “Approved for Construction” drawings.*

The aeration hose may be a flex hose or a hard pipe. To connect the aeration hose:

1. Ensure that the permeate piping connections are completed and all aeration connections at the cassette are completed.
2. Lower the cassette onto leveling pins and remove the lifting module if necessary, to make room to work.
3. Complete the aeration connections to the header as per the Approved for Construction drawing – connections can vary.

Figure 4.25 - Air connection behind the permeate pipe

4.7.18 Documenting installation

Using InStall or generating a digital Membrane Map, record the serial number and location of each cassette and membrane module as it is installed. Module location changes must be updated with InStall. Otherwise, a digital Membrane Map must be retained and updated whenever cassettes or modules are moved or replaced.

4.8 Removing glycerin

A comprehensive glycerin flush procedure is usually not needed in wastewater applications. On a new installation, glycerin removal is accomplished during Veolia standard clean water control testing of the system.

The simplest way to remove glycerin in wastewater applications is to recirculate the permeate in a closed loop within the bioreactor. The glycerin comes out into solution through the bioreactor and acts as a food for the biology during process startup. The load of the glycerin can be evaluated into the F:M loading during seeding or regular operations of the system.

Permeating at 20 to 40 lmh (12 to 24 gfd) for a duration of 15 hours is sufficient for glycerin removal from the membranes.

A COD or TOC test of the permeate can be performed, if required, to confirm the glycerin has been removed from membranes (compared against a background COD/TOC sample of the starting flush water).

4.9 Testing integrity during commissioning

With the cassette(s) installed, the following tests must be conducted to confirm the integrity of the system and membranes:

- bubble test.
- aeration check.

4.9.1 Bubble test

A bubble test is used to locate large leaks in the membranes. This procedure is to be performed on all new cassettes following installation, as well as whenever turbidity rises above acceptable levels.

To ensure that bubbles from broken fibers or a cassette hardware issue can be easily seen, perform the bubble test with the cassette submerged in relatively clean, clear water, such as UF permeate. This may require that the cassette first be removed from the membrane tank and desludged if necessary.

If the system has a PDT test port and isolations on the permeate pipe to the pump, multiple cassettes in a train can be tested at the same time. If using this method, the adapter for the individual cassettes is not necessary.

4.9.1.1 Performing a bubble test on a train of cassettes

To perform a bubble test on a train of cassettes:

1. Isolate the permeate pipe to the pump.
2. Reduce the water level in the membrane tank to a point just above the top of the membrane header. The membranes must remain completely submerged.
3. Attach the Portable Pressure Test Device (PPTD) to the same

permeate pipe (if that connection is available on the system). Go to *4.9.1.3 Connecting the PPTD* below.

4.9.1.2 Performing a bubble test on an individual cassette

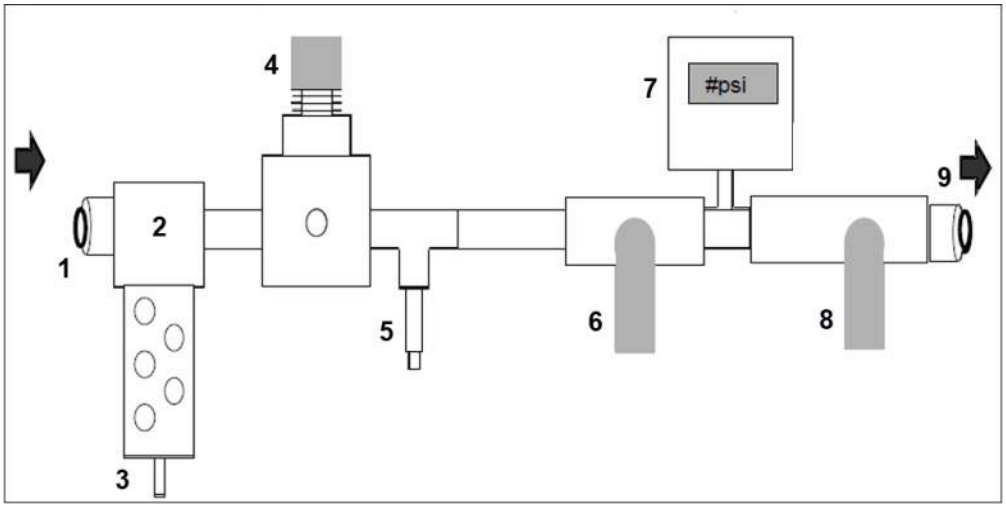
To perform a bubble test on an individual cassette:

1. Reduce the water level in the membrane tank to a point just above the top of the membrane header. ***The membranes must remain completely submerged.***
2. Isolate the cassette by closing the permeate and air isolation hand valves.
3. Disconnect the permeate connection and attach the adapter supplied with the Portable Pressure Test Device (PPTD) to the permeate connection on the cassette with the permeate pipe connection clamp (Straub or similar). Go to *4.9.1.3 Connecting the PPTD* below.

Figure 4.26 - Example of a test adapter (to be sourced locally) attached to a PPTD

NOTICE

When installing adapters, prevent water or materials from entering the open permeate line.



1: High-pressure 5:air connection from compressed air line (TP-01)

2: Air filter (F-95)

3: Drain

4: Pressure-regulating valve (fine adjustment) (PRV-9583A)

5: Pressure relief valve (PSV-9564)

6: Supply isolation hand valve (HV-9581A)

7: Pressure gauge (PI-9541)

8: Membrane safety isolation hand valve (HV-9581B)

9: Low-pressure air connection to membrane (TP-02)

Figure 4.27 - PPTD parts diagram

4.9.1.3 Connecting the PPTD

1. To connect the PPTD to the cassette or permeate manifold:

    a. Ensure that the membrane safety isolation hand valve (HV-9581B) and the pressure relief valve (PSV-9564) are closed *(see B Appendix: Project documents)*.

    ***TIP:** If the test pressure value has not already been provided by Veolia, contact Veolia now and request it before proceeding.*

    b. Ensure that the setting for the pressure relief valve (PSV-9564) is set sufficiently low enough to prevent damage to the membranes. This setting will be 138 mbar (2 psi) for horizontal membranes and, if the membranes are installed in the cassette, slightly above 200 mbar (3 psig) for vertical membranes.

    c. Open the supply isolation hand valve (HV-9581A).

    d. Attach the high-pressure air connection (TP-01) to the compressed air supply. The connection is found on the side of the PPTD and is labelled “IN.”

    e. Attach the low-pressure air connection (TP-02) to the tube fitting on the membrane hose adapter, which is on the supplied camlock fitting. The connection is found on the side of the PPTD and is labelled “OUT.”

    ***TIP:** The button used to turn the gauge ON and OFF is located just above the screen.*

    f. Ensure that the pressure gauge (PI-9541) has been turned ON. If the display fails to activate when the button is pressed, check the battery. If the value displayed does not appear accurate, disconnect the air supply. If the value does not revert to “0.00,” contact Veolia, as the gauge may need to be recalibrated.

2. Slowly adjust the pressure regulating valve (fine adjustment) (PRV-9583A) until the pressure reading shown on the gauge reaches the required test pressure of 200 mbar (3 psig).

WARNING

Pressurization Hazard

Ensure that pressure does not exceed the required test level.

3. After the pressure reading has reached the required level, slowly open the membrane safety isolation hand valve (HV-9581B), and then wait a minimum of 30 seconds to allow the pressure to stabilize.
4. After the pressure has stabilized, adjust the water level to 5 cm (2 in.) above the bottom of the cassette's permeate header (the membranes will remain fully submerged), and then wait 15 minutes to ensure the water has been purged from within the membranes.

Figure 4.28 - Setting PSV 9564 (left); opening HV-9581B

5. During this 15-minute purge, take the time to test the Portable Pressure test kit and hosing for leaks. To do this, take a spray bottle filled with water and soap; spray all the fittings from HV-9581A to the cam-lock fitting connected to the permeate hose. Take care not to spray electrical devices.

Figure 4.29 - Spray bottle spraying water and soap to camlock fitting

6. Examine the membranes for escaping bubbles (indicating a leak).
7. If a leak is found, analyze it and determine what type of bubble stream is being produced *(see 4.9.2 Bubble types)*. The repair procedure will vary depending on the type of bubble stream .
8. Repair any leaks found during the first examination, and then reduce the water level until it is level with the bottom of the cassette permeate header. Continue to examine the membranes and repair as needed.

If a module requires difficult or numerous repairs, contact Veolia for further information.

NOTICE	
	Do not run this test for longer than 15 minutes as the membranes may dry out.

4.9.1.4 Testing individual modules

NOTE: This test requires a module port plug kit.

Once the leaking module has been identified on the cassette, depending on the bubble type *(see 4.9.2 Bubble types)*, it may be necessary to identify the exact location to repair the leaking fiber or fibers.

To perform a test on an individual module:

1. Remove the cassette from the tank and set it down *(see 5.3.4 Lifting and moving ZeeWeed cassettes)*.
2. Remove the module from the cassette *(see 4.10 Installing and uninstalling new ZeeWeed modules)* and place it in a flat test tank of suitable size to fit the membrane.
3. Connect the PPDT and perform a bubble test on the horizontal membrane *(see 4.9.1 Bubble test)*. Note that the correct pressure on horizontal membranes ins 138 mbar (2 psi).

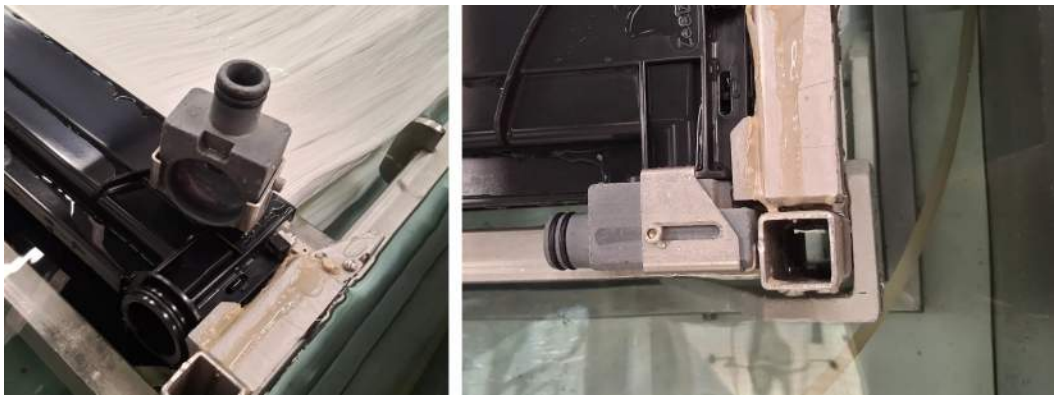


Figure 4.30 - Module plug kit assembly (Note that image is from factory test; field air connection is smaller)

To watch a video of the different bubble types, scan this QR code or follow the link:

https://youtu.be/zg2SYiAY180

To watch a video of the bubble test, scan this QR code or follow the link:

https://youtu.be/zKyHtZQPpU8

4.9.1.5 Troubleshooting the Portable Pressure Test Device

Table 4.2 - Troubleshooting the PPTD

Issue	Try This
PI display fails to appear when turned on	Check battery
PI display not showing 0.00 at initial startup with no connections made	Call Veolia - unit requires calibration
Constant declining pressure when HV-3581 A/B closed	Check for leaks in fittings

4.9.2 Bubble types

The size and type of bubbles released by a leak during a bubble test indicate the type of leak that has occurred. Bubbles are classified according to four types, as outlined below.

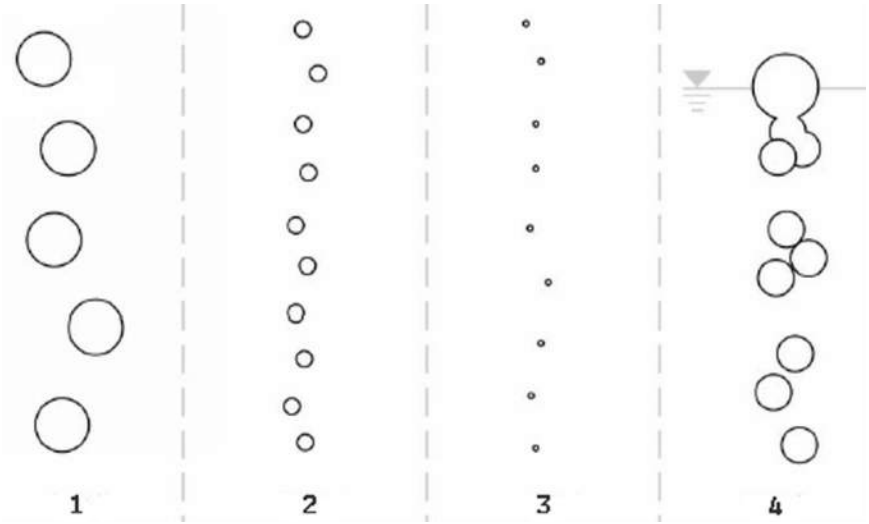


Figure 4.31 - Bubble types

TYPE 1: A Type 1 bubble stream appears as a steady flow of large bubbles, typically 10 mm (0.4") in diameter or greater. Type 1 streams are usually released by a severed membrane fiber. However, if the stream appears to come from one of the permeate headers, it may also be caused by an improperly installed O-ring.

TYPE 2: A Type 2 bubble stream is characterized by a steady flow of moderate-sized bubbles between 1 to 10 mm (0.04 to 0.4"). This form of leak is typically minor and often caused by punctured fibers or “pin holes” in the membrane. Type 2 leaks may not always require repair. Any larger leaks found during the bubble test must be repaired first, after which a second test will determine whether additional repairs for Type 2 leaks are necessary to bring performance up to specified levels.

TYPE 3: A Type 3 bubble stream appears as an intermittent stream of small bubbles (less than 1 mm (0.04")). This type of stream is typically due to air passing through unwetted pores. Unwetted pores allow passage of air but not water, and do not need to be repaired.

TYPE 4: Type 4 bubbles gather at the top of the cassette and release when the bubble is sufficiently large. This type of bubble is usually formed by accumulated Type 2 or Type 3 bubbles.

4.9.3 Checking membrane aeration

NOTICE	
	Install all cassettes before performing an aeration check.
	Air distribution must be as even as possible. If aeration is too high, it may cause excess vibration that will damage the membrane modules. If aeration is too low, it may not dislodge accumulated solids as intended.

If the installation procedure has been carried out correctly, the aeration assembly will be perfectly horizontal, providing an even distribution of air across the membranes.

Before installing hatches or other coverings over the cassettes, perform an aeration check by completing the following steps:

1. Start the blower and ensure that air is being supplied to the membrane cassettes.
2. Observe the bubble pattern on the surface of the tank. The surface must bubble evenly above the cassettes. If any uneven aeration is observed, the system must be stopped and the cause isolated. If the airflow is uneven, check the cassette's alignment and ensure that it rests level in the tank.
3. Check the air pipe connections for leakage and repair as necessary.
4. If multiple membrane tanks are used, turn aeration on in one membrane tank and off in another tank. Ensure there is no aeration in the membrane tank that is off.

After the system is fully installed and put into production, observe the aeration pattern within the individual cassettes to determine whether all of the modules are receiving equal airflow.

4.10 Installing and uninstalling new ZeeWeed modules

New cassettes are shipped with the modules already installed. The following sections provide information about how to install new modules that have been provided as replacements, as well as how to uninstall modules from the cassette for inspection or repair.

4.10.1 Installing new modules

A minimum of two operators are required to install a single module.

Before removing a new module from its packaging, inspect the amount of slack within the cassette and determine whether an adjustment is necessary.

The following equipment is required during the installation procedure:

- stepladder or work platform
- torque wrench
- cordless drill
- scissors
- NSF61-approved lubricant (example: Dow 111)
- M8 hex head drive.

CAUTION	
	Slip Hazard The glycerin solution used to preserve the membranes can create a severe slip hazard if spilled. Clean any spilled solution immediately.

NOTICE

Modules are delicate and can be damaged easily if mishandled. Do not use excessive force when installing or removing modules from a cassette, and ensure that the membrane fibers are protected from contact with tools or other objects.

To remove the module from its packaging:

1. Open the cardboard box and carefully cut open the mylar bag by cutting along the length of the packaging. Cut three sides to fully expose the membrane.
2. Confirm that all O-rings are present and lubricated. If an O-ring is missing, a new one will need to be installed.
3. With the assistance of another operator, grasp the module by the headers at either end and lift the module out of the box. Carry it as shown below and take care not to grab any fibers.

Figure 4.32 - Carrying a module

4. Without removing the clear plastic bag, examine the module within for obvious signs of damage that may have occurred during shipping. Also, confirm that all O-rings are present. If an O-ring is missing, do not open the bag until a replacement can be found.

After unpackaging the module, install it within the cassette. To install:

1. While an assisting operator holds the opposite header, grip the module header that will be inserted at the top of the cassette.

NOTICE	
	When moving a module, do not allow membrane fibers to drag along the floor or to bump against any other surface or object.

***TIP:** If necessary, clean the cassette rail and apply a water-soluble lubricant to the module grooves.*

2. Using a stepladder and while the assisting operator continues to support the bottom header, raise the top header and align the grooves on the top of the header with the cassette rail. Insert the grooves into the rail, and then ***gently*** slide the module into place until approximately 25 cm (10 in.) of its length remains outside the cassette.

Figure 4.33 - Sliding module top header into cassette rail

3. While the operator holding the partially installed top header continues to support it, align the bottom header with the center support assembly.

Figure 4.34 - Inserting the bottom header

4. Ensure that the header and center support assembly are properly aligned, and then, using gentle but firm pressure, carefully push the bottom header into the assembly.

Figure 4.35 - Pushing bottom header into assembly

5. After the bottom header has been connected to the center port assembly, gently push the top header into the top center support assembly.

Figure 4.36 - Pushing top header into assembly

6. Press the bottom header permeate spigot down into the permeate collector assembly.

Figure 4.37 - Pressing bottom header spigot down into permeate collector assembly

7. Install the bottom cradle assembly. To do this, align the nut into the bottom permeate assembly and the module headers, and tighten these bolts to 65 in-lb (7.3 Nm).

Figure 4.38 - Installing bottom cradle assembly

8. Install the top cradle assembly. To do this, align the nut into the top permeate assembly and the module headers, and tighten these bolts to 65 in-lb (7.3 Nm). As they are tightened, the module permeate spigots will press into the permeate assembly.

Figure 4.39 - Installing top cradle assembly

4.10.2 Using the module removal tool

The membrane module removal tool is a device to aid in the removal of a membrane module.

To install the tool on a module:

1. Align the tool with the module header.
2. Squeeze the silver clips on each side.
3. Slide the tool into place.
4. Release the clips; they will click into place.

   A handle is provided to help lever the module out if it won't move freely.
5. Lift the bottom header slightly so the permeate port is free of the permeate collector before it will pull out.

Figure 4.40 - Aeration blank plug

4.10.3 Removing modules from cassettes

A minimum of two operators are required to remove a single module from a cassette.

To remove a module:

1. Loosen the bottom cradle assembly. Do not remove the bolt from the nut. Instead, loosen the bolt enough to pull the assembly away from the cassette.

Figure 4.41 - Loosening bottom cradle assembly

2. Repeat this step on the top cradle assembly by loosening the bolt. As the bolt loosens, the top header may release from the permeate collector.
3. If the top header does not release from the permeate collector, gently pull down to the header until the permeate spigot is removed. During this step, do not grab or pull on the membrane fibers.

Figure 4.42 - Loosening top cradle assembly

4. Remove the bottom header. To do this, first pull up on the outer end of the fiber to release the permeate spigot from the permeate adaptor. Once free, pull out the bottom header to release the inner end of the header from the center support assembly. The bottom header is now free and must be supported.

Figure 4.43 - Removing bottom header

5. While the second operator supports the bottom header, use a work platform and grasp the outer end of the top module header. Gently pull the module away from the top center support assembly.
6. The headers have a feature molded onto each header that acts as a stop to prevent the header from freely falling from the cassette. This will be noticed when trying to remove the module by pulling straight out.
7. Once the header can no longer move straight out, push the outer end (by the permeate port) up. Once the outer edge is pushed up, release the module from the module guide.

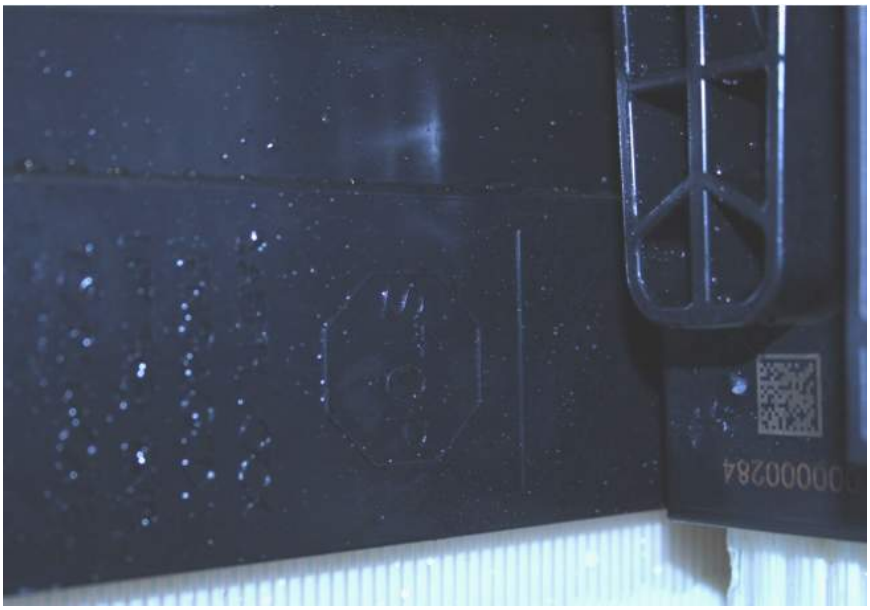


Figure 4.44 - Stop module feature

8. Before the top header is fully free of the cassette, carefully reach in between the adjacent module and grasp the inner part of the header with the second hand.
9. With each operator now supporting a header, remove the module.

4.10.4 Flex cassettes and permeate blank plugs

A cassette may arrive as a flex cassette. This means the cassette is not fully populated with modules and has some blanks fitted instead.

4.10.4.1 Permeate blank plugs

The permeate blank plug may be installed in the flex cassette or used to remove and blank off a damaged module until a replacement is acquired.

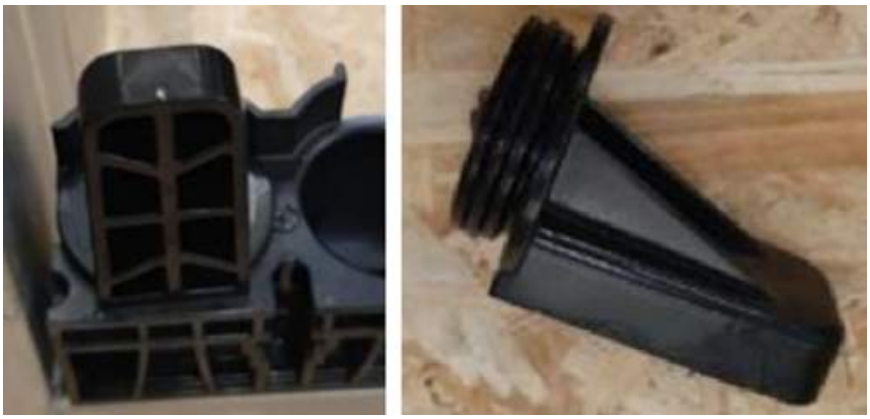


Figure 4.45 - Blank permeate plug

This blank plug fits into the permeate collector: one in the top permeate collector and one in the bottom permeate collector for each module that is being removed. The blank plug is fixed in place with the same cradle assembly that is used to fix the modules in place.

Figure 4.46 - Cassette with permeate blank plug

4.10.4.2 Aeration blank plug

A flex cassette may come with aeration blank plugs fitted instead of the LEAP aerators. Also, if removing modules, it may be a good idea to remove and blank off an aerator with these plugs.

Figure 4.47 - Aeration blank plug

To fit the plug, push it into place and twist to the right (clockwise) to lock it into position. To remove the plug, twist it to the left (counterclockwise) and pull it out.

4.10.4.3 Removing the LEAP aerator

To remove a LEAP aerator, it is necessary to lift the cassette to gain access to the underside. The M8 bolt must be removed (see *Figure 4.48 - LEAP aerator*, right).

Figure 4.48 - LEAP aerator

Once the bolt is removed, the aerator can be gently pulled; it will disconnect from its inner mount.

To refit the aerator, reverse the instructions.

When fitting a new aerator to a flex cassette, remember to remove the aeration blank plug.

4.10.5 Inspection ports

The ZeeWeed 500EV frame includes a couple of ports that can be used to inspect the inside of the frame.

4.10.5.1 Permeate inspection ports

There is a permeate inspection port at the bottom of each vertical corner channel. This is sealed with a cleanout cover and O-ring seal. It can be used to inspect the permeate channel for any fouling buildup inside the frame. The bolts are M6.

Figure 4.49 - Permeate inspection port

4.10.5.2 Aeration inspection port

There is an inspection port on the bottom cross member (cleanout side) on the cassette for inspecting the aeration channel for buildup of debris or foulants. The nuts are M8.

Figure 4.50 - Aeration inspection port

Figure 4.51 - Inside the aeration inspection port

4.11 Shutting down the system and preserving ZeeWeed membranes

It is strongly recommended that a chemical clean be performed before membranes are taken offline *(see 5.4 Cleaning)*. Periodic aeration may also be necessary to prevent anoxic or anaerobic conditions from developing in the membrane tank.

NOTICE	
	Membranes that have been isolated must be cleaned before being returned to service. If membranes are isolated for less than a week, perform a sodium hypochlorite maintenance clean. If isolated for longer than a week, perform a sodium hypochlorite recovery clean.

The following sections provide instruction on how to preserve membranes that will be taken offline.

4.11.1 Short-term shutdown

To prevent excessive bioactivity within the membrane tank, the aeration blowers must continue to operate at a recommended frequency of 5 minutes every 30-minute period. The mixed liquor must also be circulated for 5 minutes every 1 to 4 hours.

***TIP:** Aeration and recirculation frequencies are site-specific. Contact Veolia for details.*

4.11.1.1 Cassette hibernation

For temporary shutdown periods (up to 15 days), perform a recovery clean on the membrane cassettes and flush the membrane tank or tanks to remove any remaining mixed liquor or debris on the tank walls and floor. Membrane cassettes can be stored immersed in clean water with regular water testing and visual inspection as outlined below:

1. Keep the liquid level in the tank above the membrane cassette permeate headers at all times (visual confirmation necessary).
2. Maintain a residual free chlorine of up to 1 to 3 mg/L.
3. To ensure tank mixing, aerate the tank(s) once per week for 30 minutes.
4. Check chlorine levels twice weekly.

5. If the free chlorine residual drops to less than 0.2 mg/L, add sodium hypochlorite and aerate the tank to mix for two (2) minutes.
6. Based on chlorine consumption and the sight or smell of the tank water, cycle the membrane tank with fresh water twice per month, or more often as necessary (if biogrowth is detected).

Contact Veolia if the shutdown period will be longer than six (6) months. Glycerin preservation of the ZeeWeed cassettes may be a more practical option for longer periods of plant inactivity if the cassettes need to be removed from the membrane tank or need to be transported.

4.11.2 Shutting down the system for an extended period

NOTE: *Storing membranes longer than six (6) months is not recommended for wastewater applications. If long-term storage is required, contact Veolia for guidance.*

Shutting down the system for an extended period requires planning and preparation.

4.11.2.1 Preparing for shutdown

1. Walk through the system with plant personnel to discuss what equipment needs to be shut down and de-energized, which valves need to be isolated, and so on. Trace the affected lines using up-to-date P&IDs or flow sheets during the walkthrough prior to the shutdown.

   NOTE: *Throughout this procedure, ensure that ZeeWeed cassettes are kept sufficiently wet at all times.*

2. Pull each of the ZeeWeed cassettes for inspection. Inspect each ZeeWeed cassette and overall membrane fiber condition. Photograph and document the location of any discoloration or conspicuous damage to the membrane fibers (cut or pulled fibers, fiber abrasion), potting, and cassette frame, hoses, and connections.

Note what kind of debris is trapped in the fiber bundles, if any (rocks, sand, twigs, tools/hardware dropped into the tank, tank lining flakes, and so on). Report any findings to Veolia so appropriate action can be taken.

Take care when removing debris from membrane cassettes, as further damage may be inflicted on the membrane fibers if debris removal is performed improperly.

3. Observe and measure the fiber slack on each ZeeWeed cassette. If cassettes are severely sludged, slack measurement/adjustment can be performed after desludging is completed .

   Photograph the profile of the cassettes for future reference. The membrane fibers may tighten over time, so adequate fiber slack needs to be maintained to ensure that aeration remains effective and excessive tension is not placed on the fibers.

   Refer to *5.3.6 ZeeWeed fiber slack and shrinkage*.

4. Ensure that the appropriate confined space entry procedures are understood before entering the tank(s). Drain down the ZeeWeed tank or tanks and visually inspect the interior walls. Photograph and document the location of any cracking, rusting, or conspicuous damage to the tank or tank lining. If possible, drain the entire tank so that the floor of the tank can be inspected for damage as well. Report any findings to Veolia so appropriate action can be taken.

4.11.2.2 Desludging the membranes

If the membrane fibers are considerably sludged or have accumulated a fair amount of trapped solids, perform a desludging procedure *(see 5.3.3 Removing solids from the cassette)*.

4.11.2.3 Assessing membrane integrity

Perform bubble tests on all ZeeWeed modules to assess membrane integrity.

Failed tests suggest that there are leaks in membrane fibers or in cassette hardware/connections. If extensive membrane fiber repairs are required,

consider having these repairs performed during the shutdown period *(see 5.3.7 Repairing ZeeWeed fibers)*.

Repeat tests after repairs are performed to ensure that the repairs were successful and testing criteria are passed.

4.11.2.4 Cleaning the membranes

Perform both sodium hypochlorite and citric acid recovery cleans *(see 5.4 Cleaning)*. Contact Veolia if any additional clarification on cleaning procedures is needed.

4.11.2.5 Long-term shutdown

Long-term storage is not recommended for wastewater applications. If long-term storage is required, contact Veolia for guidance.

NOTICE	
	If a long-term shutdown is being initiated so that a cassette can be reconfigured or rebuilt, a Veolia representative must be present to maintain the warranty.

4.11.2.6 Maintaining auxiliary equipment

- If necessary, shelter and protect any equipment that is outside of the plant building. Relocate any of this equipment indoors or to another suitable location if outside temperatures are excessively high or low.
- The blower must be cycled on for 5 to 10 minutes every 24 hours (for drinking water plants), if possible, to prevent unnecessary fouling of the membranes due to bioactivity within the membrane tank. The PLC code can be modified to accommodate the aeration demand while the system is in “OFF” mode.

  ***NOTE:** Leave the vacuum line open to the permeate pump(s) and isolate all vacuum lines to the permeate side of the system to prevent water from entering piping.*

- Ensure all pumps and blowers are serviced as per the manufacturers' instructions *(see B Appendix: Project documents)*. Check oil levels and lubrication, as well as pump seals.
- Drain down and isolate particle counters, turbidity meters, low flow cells for pH and chlorine sensors, degassing columns, and any other locations where stagnant water is present or could accumulate. In drinking water plants, flush out analyzers with clean water and add sodium hypochlorite whenever possible to inhibit biogrowth. Otherwise, flush out all analyzers with deionized water occasionally – when placed back into service, some analyzers may need to be recharged or replaced and then calibrated. Consult with the manufacturers' instructions for each specific piece of equipment *(see B Appendix: Project documents)*.
- The backpulse tank should also be completely drained (or permeate can remain in the tank with a constant free chlorine residual of 1 to 2 g/mL to inhibit biogrowth).
- Flush out all chemical dosing pumps and associated piping/equipment with water. Use proper PPE and handling procedures for each chemical. Consult product Safety Data Sheets (SDSs) before proceeding with flushing.
- All valves, pumps, and other equipment to be cleaned or taken out of service must be properly locked and tagged out according to established procedures. Leave as many valves in the partly open position as possible.
- Clean trains before returning them to service. If the train has been out of service for less than a week, perform a maintenance clean on it with sodium hypochlorite before returning it to service. If the train has been out of service for longer than a week, perform a recovery clean on it with sodium hypochlorite before returning it to service.

4.11.2.7 Equipment that will continue to be operated

- **PROCESS PUMPS** - Alternate operation between the different process pumps weekly. Change the oil during the shutdown period. Operate

once per week until warmed up (may take longer than 10 minutes).

- **MEMBRANE BLOWERS** - Alternate operation between the different blowers every week. Change the oil during the shutdown period. Operate once per week until warmed up (may take longer than 10 minutes).
- **AIR COMPRESSORS** -Keep them in AUTO mode. Change the oil during the shutdown period. Operate once per week until warmed up (may take longer than 10 minutes). Drain the service air system of water.
- **AIR DRYERS** - Keep them in AUTO mode.
- **ACTUATORS** – Cycle once per week. Leave as many valves in the partly open position as possible.

4.11.3 Storing ZeeWeed membranes

NOTICE	
	Membranes must be stored in a dark, dry area with a storage temperature between 5º to 35º C (41º to 95º F).
	Protect membranes from freezing temperatures.
	Damage that is determined to have been caused intentionally (example: vandalism) will not be covered under the warranty.

The Installer must provide all facilities and services required for the storage, maintenance, protection, and security of the equipment and materials provided by Veolia.

When storing membranes, ensure that the following conditions are met:

- Store the membranes in assigned lay-down areas, indoors (or within a secure shelter), and atop wooden pallets or a similar form of raised platform. Do not store the membranes in locations where they may be contaminated by dirt or water.
- Access doors shall be adequate to accommodate the movement and handling of materials and equipment to be stored and shall be equipped with secure locks.
- Membrane cassettes/racks/frames will be stored upright on a level surface.
- Protect the membranes from exposure to excessive vibration or jostling.
- The membrane cassette crates must remain closed until the Installer begins membrane installation to prevent permanent membrane damage due to drying out.
- If upon removal from storage, mold is discovered on the membrane fibers, carefully repackage and contact Veolia for direction.

4.11.3.1 Storing packaged membranes

CAUTION	
	Slip Hazard The glycerin solution used to preserve the membranes can create a severe slip hazard if spilled. Clean any spilled solution immediately.

When storing membranes that are still in their original packaging, ensure that the following conditions are met:

- Membranes must be placed in a sheltered area protected from direct sunlight, temperatures below the freezing mark, extreme heat, and winds that may accelerate the drying process.
- Membranes are delivered in a vacuum-sealed bag that must remain sealed until they are ready to be installed.

It is recommended that the product be stored no longer than necessary before installation. If the installation is delayed longer than one (1) month, contact Veolia for additional instructions.

New modules that are preserved with glycerin solution, bagged, and factory-sealed may be stored for up to 12 months from the date they were manufactured. For the exact expiry date of a particular module, contact Veolia.

4.11.3.2 Storing wetted membranes

CAUTION

Chemical Hazard - Wear Appropriate PPE

Use respirator or ensure sufficient ventilation. Wear protective equipment including a chemical resistant apron, neoprene gloves, and goggles c/w face shield, at a minimum.

NOTICE

Do not allow membranes to dry out. Membranes will be damaged irreversibly if they are allowed to dry out.

Allowing membranes to come into contact with water (wetting) will compromise the preservative solution that protected them during shipment. After this has occurred, membranes must not be allowed to dry out under any circumstances *(see 4.4 Preventing membrane fiber drying)*.

4.11.3.3 Storage durations – wetted cassettes

Once membranes have been installed in a tank, they need to be kept wet at all times. When the protective glycerin solution is removed, the membranes become susceptible to drying.

For storage periods of up to approximately 15 days, simple immersion of the cassettes in water containing sodium hypochlorite (NaOCl) with a maximum

residual concentration of 3 mg/L is suitable. Monitor the residual every week and re-dose if the residual drops to less than 0.2 mg/L. Recovery cleaning of the membrane prior to storage is strongly recommended. If the membranes have been in service in an MBR application, it will be necessary to inspect them and remove debris (if necessary) prior to storage.

Periodic aeration may also be necessary to prevent anoxic or anaerobic conditions from developing in the tank. Test the water daily to ensure that the residual chlorine concentration is within acceptable limits; a simple swimming pool chlorine test kit is acceptable. Maintain a log recording daily NaOCl concentration and water temperature.

Longer storage durations are to be discussed with Veolia on a case-by-case basis.

4.11.3.4 Wetted membranes - long-term removal from water

NOTICE	
	Contact Veolia Customer Service for proper preservation instructions. If the membranes have spent time in storage, carefully check for any signs of mold on the fibers. If any mold is present, immediately rebag and contact Veolia for next steps, and also for advice on returning a sample for analysis.

4.11.3.5 Storing shipping frames and cassettes

- Store empty shipping frames in a safe place to avoid damage or contamination until they are shipped back to Veolia.
- Store empty cassettes out of direct sunlight and between 5 and 35ºC (40 to 95ºF) to avoid degrading the plastics. The ideal environment is indoors in a dry location.

4.12 Returning ZeeWeed membranes

Membranes that are still in their original packaging and that have been stored according to Veolia instructions may be returned to Veolia *(see 4.11.3 Storing ZeeWeed membranes)*. Any membranes received by Veolia that have been stored improperly or that have had their original packaging damaged may be subject to rejection or to additional fees required to restore the membranes to saleable condition.

Membranes that have been in operation may also be returned to Veolia, so long as the proper repackaging and shipment procedures are observed *(see 4.12.2 Preparing membranes for shipment)*

NOTICE	
	Be advised that destructive testing may be required during the evaluation of a returned membrane module. Therefore, modules sent to Veolia for evaluation may not be returned. If this presents a problem, inform Veolia before shipment.

4.12.1 Arranging the return of goods

Veolia will only receive membranes that are returned with a valid Return Goods Authorization (IBS) number.

To obtain an IBS number, contact Veolia by phone *(see 1.2.2 Contacting Veolia)*. When calling, have the original sales order or invoice ready.

NOTICE	
	When arranging shipment, ensure that membranes will be protected from extreme temperatures. Storage temperatures must remain within 5 to 35°C (41 to 95°F) at all times.

4.12.2 Preparing membranes for shipment

NOTICE	
	Do not allow membranes to dry out. Membranes will be damaged irreversibly if they are allowed to dry out.
	Boxes used to return membranes must support the module's top and bottom headers to prevent shifting during transport.
	If tape is used to seal bags containing membranes, do not allow the tape to come into contact with the membranes themselves. Doing so will cause permanent damage to the membranes.

All membranes being returned under warranty or for evaluation ***with the exception of those being returned for cleaning study*** must be preserved before repackaging *(see 4.11 Shutting down the system and preserving ZeeWeed membranes)*.

Membranes being returned for cleaning study ***must not*** be cleaned or preserved. Instead, to ensure membrane integrity during shipment, pour 0.5 to 0.75 L (2 to 3 cups) of potable water into the bag containing the membranes before sealing the bag.

TIP: *If the original bag in which the membranes were delivered has been kept and stored safely, it may be reused to return them.*

Membranes must be bagged and boxed individually. Bags must be sealed to prevent liquid from escaping, and boxes must be of a suitable size and durability. Veolia can provide shipping materials, if necessary.

Seal membranes within a leak-proof bag. To seal the bag, use a bag sealer or leak-proof tape. If tape is used, ***do not*** allow the tape to come into contact with the membranes themselves. Confirm that the bag has been securely sealed before placing the bagged membranes in a shipping box.

Individual membranes must be crated in a way that protects them from damage during handling and transport.

The following information must be clearly marked on the outside of the box and crate containing the membranes:

- IBS number
- site/facility name
- Veolia project number
- membrane module serial number.

4.12.3 Resealing the ZeeWeed cassette bag after an inspection

If a cassette needs to be resealed after it is inspected, follow this procedure. A minimum of two (2) people are required to reseal the cassette bag and re-crate the cassette.

4.12.3.1 Equipment

- Cordless drill with Phillips #2 screwdriver bit
- Vacuum cleaner
- Bag sealer

4.12.3.2 Resealing the cassette bag

After inspection, pull the cassette bag up as high as it will go over the cassette. Use care not to damage the cassette bag. Fold any excess from the cassette bag over the top of the cassette so that it will not sag or ball back down.

Figure 4.52 - Pulling the cassette bag up

The recommended method of resealing the bag is to use a preheated sealer. Pull the edges of the bag together tightly. With one person guiding the sealer, the other person should pull the bag to keep it tight behind the sealer. Run the sealer across the length of the cassette bag leaving an opening at the end big enough to slip in a vacuum hose.

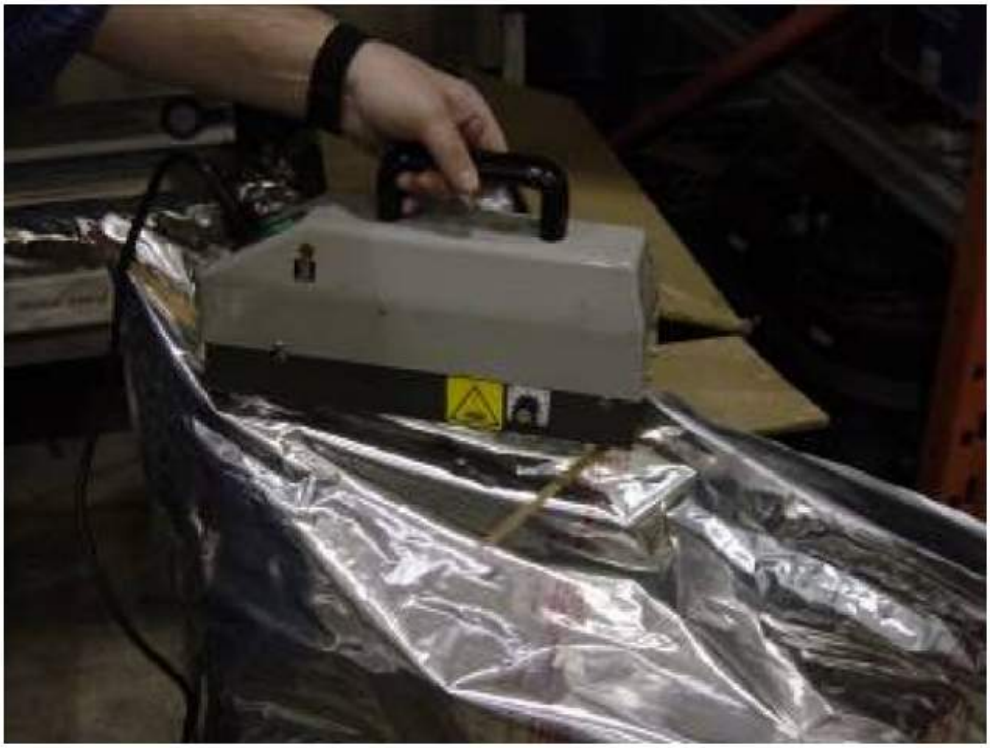


Figure 4.53 - Resealing the cassette bag

NOTICE	
	Do not lift the sealer up off the bag while sealing.

4.12.3.3 Vacuuming the cassette bag

Remove all excess air from the bag using a vacuum. Through the opening left at the end of the seal, insert the vacuum hose into the bag. Once all air has been removed, use the sealer to seal up the rest of the bag. Once complete, inspect the seal for any holes. If any are found, run the seal down the entire bag again.

4.12.3.4 Replacing crating material

Using care, re-crate the cassette. Replace all four (4) sides and the top of the crate using a cordless drill with a Philips #2 screwdriver bit. Ensure that the screws are placed in each location that they were removed from to ensure structural integrity of the shipping crate.

Figure 4.54 - Replacing crating material

4.13 Testing noise levels

Once the equipment is installed, perform a noise study following regulatory guidelines (example: OSHA) to determine if hearing protection is required. For more information, refer to the information about noise hazards in the *Safety Manual* *(see Noise hazards).*

If there are significant changes to equipment, perform a new noise study that follows regulatory guidance.

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5.1 About this section

This section outlines:

- the maintenance procedures required to ensure optimal membrane performance and lifespan, including information related to membrane fouling, handling, inspection, and repair.
- the procedures and chemicals used to clean and maintain the system as a whole, as applicable.
- the tools and procedures used to gather performance data and to monitor the physical condition of the system. This information is essential when assessing long-standing performance issues, establishing trends, and determining the durability of various components.
- general preventive maintenance that addresses the system as a whole. This section does not cover the entire scope of work required to keep the system operating at peak efficiency.

***TIP:** For detailed preventive maintenance information regarding specific components (example: pumps, valves), refer to the instructions provided by that component's manufacturer* *(see B Appendix: Project documents)**.*

CAUTION	
	Not to be Serviced by Users Only qualified and certified electricians shall perform electrical work (example: verifying that electrical equipment is performing properly, taking malfunctioning electrical equipment out of operation, verifying earth-ground bonding, and fixing electrical equipment).

5.2 Preparing for maintenance or service

Before performing maintenance, test the following for proper functioning:

- all safety critical switches (example: interlocks)
- any pressure gauges that will be used
- applicable pressure relief valves.

5.2.1 Locking out and tagging out equipment

Follow proper lockout/tagout (LOTO) procedures to control hazardous energy and protect workers from harm.

5.2.2 Securing the electrical cabinet

Make sure that the electrical cabinet is locked at all times. If Veolia provided the electrical cabinet, keys are also provided, but it is up to the operator to keep the cabinet secure and to only assign keys to people who are qualified and certified to work on electrical equipment.

Before the electrical cabinet is opened, verify that energy to the cabinet and interlocks are off.

5.3 Inspection and repair

This section outlines the various maintenance procedures required to ensure optimal system performance and lifespan. This includes optimal membrane performance and information related to membrane fouling, handling, inspection, and repair.

5.3.1 Membrane health

The fouling process starts when inorganic materials (such as minerals, hardness, iron, and coagulant carried over from the settlers) and organic materials come in contact with and anchor themselves to the membrane, and do not get removed with a simple backpulse. The membrane material itself is resistant to materials adhering to it, but the membrane pores allow foulants to anchor to the membrane surface.

Keeping trans-membrane pressure (TMP) low during permeation minimizes the amount of foulants that get pushed into the pores. In some cases, if the TMP levels during permeation are sufficiently low, it also allows these foulants to become dislodged during the backpulse process. Foulants that

cannot be removed by performing a backpulse must be cleaned using a chemical solution.

Once some foulants become anchored, it becomes easier for other foulants to become anchored. The rate of accumulation of foulants therefore increases exponentially; the TMP levels increase to push water through the fouling layer and new foulants find it easier to anchor to foulants than it is to anchor to the membrane.

5.3.1.1 Coagulant and membrane health

Overdosing coagulant beyond the point where it can completely react can result in a "sticky floc" that can foul membranes. Underdosing (usually 5% less than doses identified through jar testing) rather than overdosing is usually preferable as long as adequate organics removal is achieved to satisfy regulatory requirements and provide improved ultrafiltration operation.

In some cases, when TMP levels are low, a small amount of coagulant that is completely reacted can act as a protective blanket and shield the membrane from fouling materials. This coagulant layer gets blown off in the backpulse process. Too much coagulant carryover, even if completely reacted, will result in an excessive TMP rise that may result in increased fouling. Monitor the coagulant carryover determine whether it helps or hurts with performance.

TIP: *Perform regularly scheduled cleaning and share the flow amongst as many trains as possible to help keep TMP levels low. This reduces fouling and increases membrane life.*

5.3.1.2 Putting trains in standby

During periods of low flow demand, the system may set trains to STANDBY. During automated operation, the system will perform a backpulse on the train before setting it to STANDBY. (Performing a backwash on the trains before taking them offline is preferable to taking the trains offline while in the middle of operation.) The backpulse process sweeps the solids and foulants away from the membrane surface to minimize contact between any foulants

and the membranes in case the system stays in STANDBY for an extended period of time.

5.3.1.3 Regular cleaning for membrane health

Regular maintenance cleans and recovery cleans are effective in removing loosely anchored foulants that cannot be mechanically removed through the backpulse process. Cleans must be performed regularly even if there is no observed permeability improvement (especially when the membranes are new and exhibit excellent performance). Allowing foulants to remain anchored to the membranes even if there is no impact to performance (early on in the cycle) may allow the foulants to anchor themselves to the membranes in such a way that cleaning with the standard cleaning solutions may no longer reverse permeability losses.

5.3.2 Membrane fouling

The following section provides information on membrane fouling, types of foulants, and the processes used to remove them from the membranes.

5.3.2.1 Effects of fouling

The term “fouling” refers to the accumulation of unwanted deposits on a membrane surface.

Membranes form a physical barrier between water and the impurities it carries. During filtration, feedwater is driven across the membrane surface under pressure, leaving impurities on the surface. This gradual accumulation of impurities creates an increased resistance to , which in turn increases the amount of transmembrane pressure (TMP) required to maintain the same flow.

Membrane fouling can have the following negative effects:

- increased TMP in order to maintain normal permeate production
- increased energy requirement for normal operation
- reduced overall system efficiency
- reduced membrane lifespan.

5.3.2.2 Foulant types

Foulants include any materials that accumulate on the surface of a membrane and decrease that membrane's performance. Foulants are divided into the following four groups:

BIOLOGICAL: Aerobic and anaerobic living materials, such as bacteria, fungus, and algae. These organisms colonize on the surface of the membrane, blocking flow through the pores.

PRECIPITATIVE: Precipitative foulants, often caused by high pH levels and extremely hard mixed liquor, usually appear in the form of scale. Scale develops when compounds in mixed liquor are concentrated beyond their solubility. Common precipitative foulants include calcium carbonate and magnesium sulfate.

ADSORPTIVE: Adsorptive foulants include compounds that stick to the surface of the membrane, such as oil, polymers, cationic surfactants, and hydrocarbons.

SOLIDS ACCUMULATION: In UF systems used to treat mixed liquor containing a high level of solids, it is possible for solids to accumulate . At best, this type of fouling causes an increased TMP requirement. At worst, it will permanently damage the membrane. Adequate prescreening measures are the best methods for preventing this type of fouling.

5.3.2.3 Monitoring fouling

Regardless of the system's application, solids accumulation must be monitored regularly. Do the inspections monthly at first. This frequency can be adjusted in accordance with how often the membranes become fouled to the point where performance is affected.

Although all systems will become fouled over time, the following factors will generally result in more frequent and severe fouling:

- high TMP levels
- insufficient air flow during aeration

- non-uniform air distribution across the membranes during aeration (the cassette may not be level; the aeration assembly may be clogged or missing components)
- operating at a high solids mass flux (either a high net flux, high MLSS, or both)
- inadequate or malfunctioning prescreening measures.

The most accurate way of determining the presence of solids in the membranes is through regular membrane inspections. It is important to regularly inspect the tanks and modules for accumulation. If sludging is allowed to worsen, the accumulation will quickly become more compacted and difficult to remove.

Reoccurring high solids accumulation may indicate that the system has mechanical- or process-related issues that require resolution. If frequent and/or extreme fouling becomes a problem, Contact Veolia for additional support.

5.3.2.4 Preventing fouling

Preventive steps to minimize the extent and frequency of membrane fouling include backpulse sequences to scour solids from the membrane surface; chemically-enhanced maintenance cleans to prevent fouling; and recovery cleans to mitigate fouling.

Depending on the type of fouling, a chemical cleaning sequence may be performed with ***either*** an oxidizing solution targeting organic foulants ***or*** [low-pH] solution targeting mineral, precipitative foulants *(see 5.4 Cleaning)*.

TIP: *The procedures and associated chemicals used may vary depending on system configuration.*

Pretreatment chemicals

The risk of UF fouling can increase if pretreatment chemicals, such as polymers, coagulants, flocculants, or flocculant aids, are dosed upstream.

Excessive pretreatment chemical dosing, in which the chemical is not completely consumed or reacted in the pretreatment, can result in unused

chemical accumulating on the membrane fibers. This can contribute to fouling, impact membrane performance, and increase the required frequency of cleaning.

It is important to regularly perform calibration and drawdown readings on pretreatment dosing equipment to ensure the correct dose, and ensure controls are operating correctly and are appropriate for the incoming water flow rate and quality.

Contact a Veolia representative for additional guidance on chemical pretreatment for the UF system.

5.3.2.5 Removing foulants

The procedure used to remove fouling depends upon the type of foulant.

BIOLOGICAL: Exposure to a solution containing sodium hypochlorite will remove most biological foulants. Because it is easier to remove early biological growth, rather than established colonies, it is recommended that a schedule of frequent cleaning sessions with a low-strength sodium hypochlorite solution be established in place of infrequent cleaning sessions with a high-strength solution.

PRECIPITATIVE: Membranes fouled with precipitative scale are cleaned using a citric acid and/or a low pH solution. However, the best method of reducing precipitative fouling is to prevent it from occurring by lowering the concentration of precipitative foulants entering the system. Adding a lime water-softener and adjusting the mixed liquor pH level are common ways of controlling precipitative fouling.

ADSORPTIVE: Adsorptive fouling is extremely difficult to reverse, making it critical that oils, polymers, hydrocarbons, and other foulants of this type be removed from mixed liquor before it encounters the membranes. For more information about preventing adsorptive fouling, or if considering the use of polymers or surfactants, contact Veolia.

SOLIDS ACCUMULATION: Because proper aeration is the most effective method of preventing solids accumulation, it is important that the aeration process be inspected on a routine basis.

5.3.3 Removing solids from the cassette

Solids accumulation within the module is typically caused by fluctuations in feedwater quality and/or errors in process operations (such as inadequate membrane aeration). Cranes are specified and lifting modules are designed with sufficient excess capacity to accommodate a moderate amount of solids accumulation. Excessive accumulation, however, will result in loading that may encroach on the design safety factor of the cassette frame and lifting mechanism. Improper handling of overweight cassettes will increase the risk of injury, death, or property damage/loss.

If it is suspected that there is excessive solids accumulation within the modules, ensure that the cassette weight is within the allowed design weight limit of the lifting module and crane prior to lifting the cassette to perform a visual inspection *(see 5.3.4.5 Installing and using the crane scale)*.

Figure 5.1 - Accumulated solids

To ensure personal safety and optimal work productivity is maintained, a minimum of two (2) people are required to remove the cassette. At a minimum, at least one of the two persons should have successfully completed a certified crane training course. Coordination of work with plant operations staff should be completed with the scope of work in mind.

Before lifting the cassette, pre-plan where the cassette will be placed and ensure that the entire area is barricaded using appropriate measures and the proper safety equipment is available and utilized.

5.3.3.1 Desludging solids from the membranes

If possible, aerate the membrane cassette(s) for 2 to 12 hours without permeating before removing the cassette. This will remove some of the solids that have accumulated in the membrane fiber bundles.

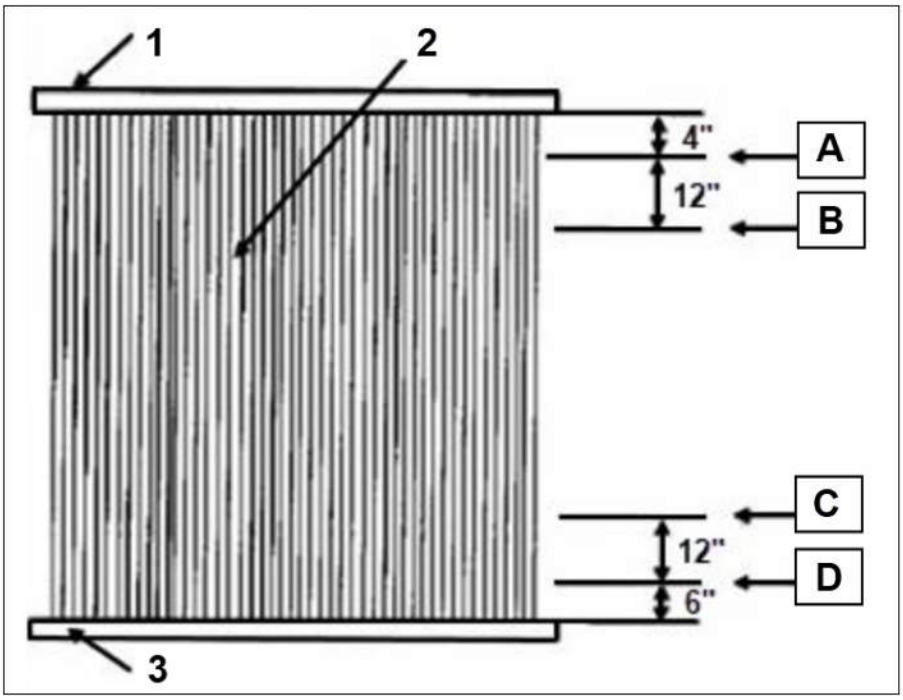
Alternatively, once it is determined that the cassette has excess solids accumulation by direct measurement, perform a desludging procedure to remove solids from the membranes and reduce the cassette weight.

If the membrane fibers are considerably sludged or have accumulated a fair amount of trapped solids, the following stepped aeration/tank drain procedure can be performed.

NOTE: *This procedure should only be performed if the plant uses positive displacement blowers; performing this procedure with centrifugal blowers will result in excessive aeration of the cassettes.*

The purpose of the following actions is to help loosen and remove any debris or sludge that is present on the membrane fibers, especially near the top and bottom headers.

1. Once the tank water level reaches Level A (see figure below, about 4” below the underside of the top module header), maintain this level and aerate for 120 seconds. While still aerating, continue draining down to Level B (about 16” below the underside of the top header).



1: Top module header

2: Membrane fibers

3: Lower module header

A: Level A

B: Level B

C: Level C

D: Level D

Figure 5.2 - Water levels

2. Once the tank water level reaches Level B, maintain this level and aerate for 120 seconds. While still aerating, continue draining down to Level C (about 18” above the lower header).

3. Once the tank water level reaches Level C, maintain this level and aerate for 120 seconds. While still aerating, continue draining down to Level D (about 6” above the lower header).

4. Once the tank water level reaches Level D, maintain this level and aerate for 600 seconds. Drain as much of the remaining water from the tank as possible. If feasible, open the train inlet valve to allow the influx of water to flush out the bottom of the tank of any solids. Use external means (example: a vacuum truck) to remove the solids from the bottom of the tank if accumulation is severe.

NOTE: *Manual desludging of the membranes may still be necessary. Consult Veolia if cassette sludging is severe or if it is a reoccurring issue.*

5. Refill the tank with water so that the membrane cassettes are completed submerged.
6. Repeat steps 4 through 11 while recording the turbidity value of the drained contents. Continue to repeat these steps as needed until the turbidity reading no longer shows a significant change in solids removal from one drain sequence to the next.

   To measure turbidity on the line, use a turbidity meter (an in-line meter installed on the permeate line).

If cassettes remain overweight after performing the solids removal procedure, a short (2 to 3 hour) recovery clean (preferably at approximately 30°C) is recommended. Recovery cleaning is expected to loosen the solids that are otherwise difficult to remove by aeration alone. The selection of the recovery cleaning chemical will depend on the cause of the solids accumulation. If solids accumulation is the result of high organic loading, sodium hypochlorite at a maximum concentration of 1,000 ppm should be used. If solids accumulation results from inorganic loading (coagulant/oxidant overdose), citric acid at a concentration of 2 g/L (optimum pH of 2.1 to 2.4) is recommended.

If the cassettes can be safely lifted out of the tank but are still considerably sludged, it may be necessary and more effective for the sludge to be removed manually using a high-volume, low- pressure stream of water. A rounded hose nozzle with an adjustable spray pattern can be used for this purpose. Do not use a fire hose or pressure washer for membrane desludging.

5.3.3.2 Removing accumulated solids manually

CAUTION	
	Chemical Hazard While performing this procedure, wear protective gloves, safety glasses, and any other protective equipment that may be required by local regulations.

NOTICE	
	Never spray membranes with a high-pressure water stream.

If the cassette's weight is within the acceptable limits of the lifting apparatus, but it still contains a significant amount of accumulated solids, use a garden hose with a rounded head and a ***low-pressure stream*** to dislodge solids from the cassette as it is being lifted.

An alternative is to construct a spraying tool which consists of a 1 to 2" diameter section of pipe with a 90° elbow attached at the end. The flow of water should be regulated with a valve such that when the tool is held horizontally at 1 meter (3 feet) high off the ground, and the water is directed sideways, the water should fall to the ground about 1 meter (3 feet) away. If the water shoots out further than the 1 meter distance, the pressure is too high and the flow should be reduced (or the line size increased). If the flow does not reach a distance of 1 meter, then the flow should be increased or the line size decreased. This method of ensuring that sufficient flow is obtained is simple, reproducible, and independent of line size. At this water velocity under these conditions, minimal stress is exerted on the fibers with a maximum degree of cleaning benefit.

Figure 5.3 - Removing sludge with hose

Begin by spraying the exterior cassette fibers, as well as the cassette frame. If the sludge is solidly packed into the cassette fibers, gently remove the sludge by hand from every affected module while flushing with low-pressure water (be sure to wear appropriate personal protective equipment such as chemical-resistant gloves, safety glasses, and so on).

Figure 5.4 - Spraying tool - 90° elbow

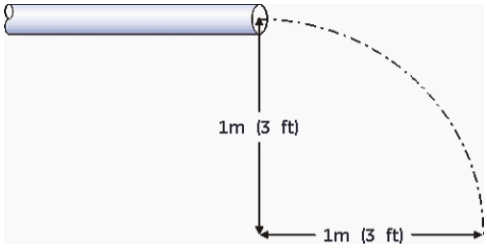


Figure 5.5 - Spraying tool calibration test

Care must be taken not to physically damage the membrane fibers while manually desludging – both high-pressure water and rough handling of the fibers during desludging can cause damage. Start flushing out sludge from the top of the membrane fibers and work downwards to the bottom header.

TIP: *Dense patches of sludge that have accumulated within 10 cm (4 in.) of the top or bottom headers may be left in place if they prove too difficult to remove without risking damage to the membranes. The middle portion of the fibers should be flushed thoroughly until no solids are present.*

The aeration tubes should be inspected, removed and cleaned as necessary.

Depending on the location and severity of the sludging, it may be advantageous to disassemble the cassette so that individual modules can be easily accessed to facilitate more effective and efficient desludging.

After manually desludging cassettes, return them to the membrane tank and repeat the desludging procedure to help dislodge and remove any loosened sludge. Performing recovery cleaning at this point will be beneficial for the membrane fibers and will be more effective since the sludge is no longer shielding the membrane fibers.

5.3.3.3 Recommendations

Solids accumulation should be regularly monitored (example: monthly). The following items may indicate higher risk of indication of solids accumulation:

- high TMP fouling events
- insufficient air flow rate to the membranes (blower failure)

- non-uniform air flow distribution across the membrane cassette (cassette not leveled, aerator plates clogged or missing)
- membranes operating at high solids mass flux (high net flux, high MLSS, or both)
- inadequate pre-screening
- poor effluent turbidity or effluent nutrients.

The most accurate way of determining the presence of solids in the membrane bundles is through regular membrane inspections. It is important to regularly inspect the tanks and modules for accumulation (monthly), as well as check for accumulation every time a Veolia representative is onsite. If sludging is allowed to worsen, the sludge becomes more compacted and difficult to remove, so preventing sludging from ever occurring is the best course of action.

Reoccurring sludging events may indicate that the plant has mechanical or process-related issues that require resolution. Contact Veolia for assistance if membrane sludging becomes a persistent problem.

5.3.4 Lifting and moving ZeeWeed cassettes

The following section explains how to safely lift and maneuver the cassette using the lifting module.

The membranes may only be exposed to open air for a limited amount of time *(see 4.4 Preventing membrane fiber drying)*. To avoid unnecessary delay, read this entire section before attempting to perform any of the procedures outlined below.

NOTICE

Do not allow membranes to dry out. Membranes will be damaged irreversibly if they are allowed to dry out.
(see 4.4 Preventing membrane fiber drying)

5.3.4.1 Personnel and equipment

WARNING	
	Equipment Hazard The hoist (or crane) must be load-tested, inspected, and properly rated for the full weight being lifted. All hoist (or crane) operators must be fully certified.

A minimum of two operators are required for this procedure, including at least one who is properly trained and certified to operate the crane, hoist, or other lifting apparatus that will be used.

It is also recommended that this process be completed under the supervision of a Veolia FSR. If an FSR cannot be present, ensure that one has been consulted regarding this procedure and any system-specific requirements before continuing.

This procedure will require approximately two (2) hours to complete.

The following equipment is required:

- ZeeWeed cassette lifting module.
- Safety gloves, safety glasses, and any additional personal protective equipment as required by local government or facility regulations.

5.3.4.2 Disconnecting cassette aeration and permeate piping

CAUTION	
	General Hazard This procedure involves tasks that may result in injury due to limbs or equipment becoming caught. Use caution while working and make note of possible pinch-points.
	General Hazard This procedure involves tasks that may result in injury due to strain or overexertion if the proper care is not taken. Avoid awkward postures or repetitive movements while working and rest as needed if discomfort occurs.

The following procedure must be performed when preparing to lift a cassette that is currently installed within the membrane tank.

To disconnect the cassette from the rest of the system:

1. Reduce the water level in the membrane tank so that it is below the permeate pipe for the cassette (to avoid having raw water enter the filtered side of the piping) but above the membrane fibers.
2. Close and lock-out the cassette's aeration isolation valve.

CAUTION	
	Pressurization Hazard Stand off to the side when disconnecting the aeration line from the cassette. Pressurized air may cause the coupling to release violently.

3. Partially open the aeration line's coupling and allow any pressurized air to escape slowly before continuing.
4. Disconnect the aeration line from the cassette.
5. Close and lock-out the cassette's permeate isolation valve.

6. Using potable water, thoroughly wash the permeate piping and coupling. Ensure that any accumulated sediment or debris is removed before proceeding.

NOTICE	
	Do not allow mixed liquor or debris to contaminate the coupling, or to enter the permeate piping.

7. Loosen the coupling that connects the cassette's permeate line to the permeate collection header, and then slide the coupling along the cassette's manifold, away from the permeate collection piping. Ensure that the cassette is completely disconnected from the permeate header.

Figure 5.6 - Pipe coupling

8. Remove the clamp collars on the leveling pins.
9. If necessary, move or restrain disconnected lines so that they will not entangle the cassette as it is lifted.

5.3.4.3 Preparing to lift

WARNING	
	Equipment Hazard The lifting module supplied by Veolia must be used at all times when lifting cassettes. ***Do not use chains or fabric straps to lift cassettes unless specifically instructed otherwise by Veolia.***

When preparing to lift a cassette, connect the lifting module to it in the same manner as when the cassette was first installed .

5.3.4.4 Weighing cassettes before lifting

WARNING	
	General Hazard A cassette that has been in service will weigh more than it did when it was first installed. To avoid severe personal injury caused by a collapse, carefully evaluate the load limits of all lifting equipment, and of the surface that the cassette will be set upon.
	Equipment Hazard Attempting to remove a heavily fouled cassette from the membrane tank may cause excessive stress on the lifting apparatus, resulting in a collapse that could endanger nearby personnel and cause severe damage to the system.

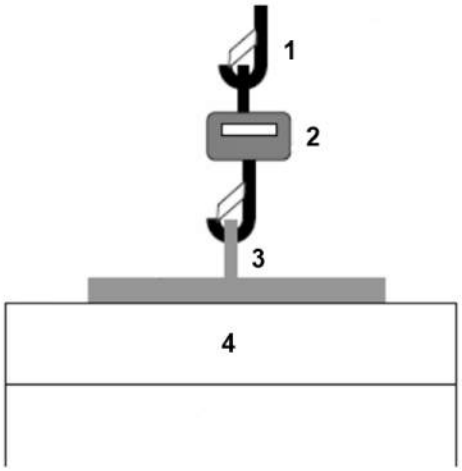
NOTE: *If the cassette has not yet been disconnected from the permeate and aeration lines and/or if the lifting module has not yet been connected to*

the cassette, perform these tasks as outlined in the sections above before continuing.

If there is visible sludging on the cassette and there is reason to believe that the sludged cassette may exceed the load limits of the lifting equipment, use a crane scale to weigh the cassette before it is removed from the membrane tank.

A cassette that has been in operation for extended periods may have accumulated significant amounts of solids. This will increase the cassette's overall weight. The amount of accumulated solids will vary greatly depending on several factors, including how long the cassette has been in operation since it last underwent a cleaning sequence.

5.3.4.5 Installing and using the crane scale



1: Crane hook
2: Crane scale
3: lifting module
4: Cassette

Figure 5.7 - Typical crane scale assembly diagram

To measure a cassette's weight:

1. Lower the water level in the train. Ensure that the train is removed from operation (OFF mode) and locked out where applicable.
2. Disconnect the hoist (or crane) from the cassette lifting module and install a properly rated crane scale between the crane hook and the

lifting module's lift-point.

3. Carefully lift the cassette. The full cassette weight will not be properly registered on the scale until it is fully emerged from the water. The volume of water retained in the cassette will affect the cassette weight. To ensure a proper weight, let the cassette drain completely before lifting further.
4. While monitoring the reading on the crane scale, begin slowly lifting the cassette. ***If the reading begins to approach the maximum capacity of the lifting apparatus, immediately stop lifting, slowly lower the cassette back into the tank, and initiate a desludging procedure****(see 5.3.4.4 Weighing cassettes before lifting)*
5. If the reading does not approach the maximum capacity, continue lifting until the cassette has been raised 15 cm (6 in), and then pause the lift.
6. Drain the tank until the water level has been reduced by 5 cm (2 in), and then monitor the crane scale. After the reading has stabilized, resume the lift.
7. Repeat steps 5 to 6 until the cassette has been lifted completely out of the water. The cassette's full weight cannot be properly determined until it is fully suspended above the water level.
8. Record the cassette's final weight, and then lower it back into the tank.
9. After the cassette has settled into place, remove the crane scale, connect the crane directly to the lifting module, and then proceed with lifting the cassette if required. ***Do not perform this procedure while the crane scale is still attached to the crane.***

NOTICE

Note that headroom clearance is reduced when adding the crane scale to the crane hook. If headroom clearance is an issue, the crane scale will need to be removed after reading and prior to cassette lifting.

Do not complete any lift with persons directly under or in the immediate vicinity of the cassette. The normal and safe operating practice of using guide ropes should always be used for controlling the lift and should be used to minimize any direct contact with the cassette.

5.3.4.6 Desludging heavy cassettes before lifting

If, after weighing, a cassette is considered too fouled to be safely lifted, remove the accumulated fouling by allowing it to aerate without permeation for 2 to 12 hours, as deemed necessary, and then weigh it again.

If it is not possible to keep the cassette out of service for an extended aeration period, perform a desludging procedure *(see 4.11.2.2 Desludging the membranes)*.

After completing this process, weigh the cassette again before proceeding with the cassette lifting procedure *(see 5.3.4.4 Weighing cassettes before lifting)*.

5.3.4.7 Lifting cassettes

WARNING

Lift Safety

Refer to the site lifting plan for full details on requirements and process.

NOTICE	
	Do not allow membranes to dry out. Membranes will be damaged irreversibly if they are allowed to dry out.
	Where possible, position the cassette away from HVAC fans, hear sources, and open doors where the cassette is more susceptible to drying.

If, after weighing, a cassette is considered light enough to lift safely, remove the cassette from the membrane tank by performing the following steps:

1. Ensure that all disconnected lines have been moved so that they will not entangle the cassette as it is lifted.
2. Slowly begin lifting the cassette. Continue to lift until the bottom of the cassette is at least 15 cm (6 in) above the top of the tank.
3. Remove the cassette to a clear, level location and inspect or replace membranes as needed ***as quickly as possible***.

   To prevent damage to the screen on the bottom of the cassette, slowly set the cassette down on a clear, flat area. Ensure that there is no debris, such as hardware, tools, rocks, gravel, and so on beneath the cassette.

   If a clear, flat area is not available, place the cassette on blocks of wood spanning diagonally across the corners of the cassette.

CAUTION	
	General Hazard For safety reasons, reinstall the tank cover or grating while the cassette is out of the tank.

5.3.5 Inspecting ZeeWeed cassettes

When inspecting the membranes, check for:

- obvious signs of damage or wear
- clear differences in one module compared to others in the cassette
- loose or missing fasteners or other hardware
- broken membrane fibers
- cracking or breaks in piping and headers.

If any of the above signs of damage are found, contact Veolia for further assistance *(see 1.2.2 Contacting Veolia)*.

When replacing the membrane cassette or installing new membranes, ensure that the new membranes are flushed and sanitized before resuming production. The glycerin preservation solution and packing that the membranes are shipped in are not hazardous materials, but must be disposed of in compliance with local environmental regulations.

5.3.6 ZeeWeed fiber slack and shrinkage

The amount of distance that separates the two headers in a membrane module can be adjusted to meet the specific operating requirements of each system. Although some adjustment may be required due to unique mixed liquor characteristics, ZeeWeed membrane modules are manufactured with an inherent amount of fiber slack (that is, the length of the membrane fibers is greater than the actual distance between the two headers).

Allowing the proper amount of fiber slack between the headers ensures that the fibers move freely during operation, which improves the effects of air scouring. Additionally, it is common for membranes to shrink slightly during operation, and permitting the proper amount of slack will accommodate this reduction in fiber length.

Figure 5.8 - Correct (left) and incorrect (right) slack adjustment

5.3.6.1 Factors that cause fiber shrinkage

Shrinkage is a physical change that can be expected in any product composed of synthetic polymers, and is not the result of a defective or damaged product. Shrinkage can cause damage, however, if the initial amount of fiber slack is not sufficient enough to accommodate the reduction in fiber length.

The optimal amount of fiber slack is a function of operating temperature, chlorine concentration, and time, and is thus specific to each system. Significant changes in fiber slack are generally observed in systems with higher operating temperatures, or where modules are exposed to certain solvents sometimes found in certain water treatment applications.

The expected rate of fiber shrinkage is also system-specific. As a general rule, however, high mixed liquor temperatures will result in higher rates of fiber shrinkage.

For example, a system operating at 35ºC (95ºF) will typically exhibit more fiber shrinkage than a system operating at 30ºC (86ºF) over the same period of time. Systems operating at temperatures below 25ºC (77ºF) are not expected to exhibit significant fiber shrinkage, and the need for slack adjustment is unlikely.

5.3.6.2 Results of fiber shrinkage and insufficient slack

NOTICE	
	Allowing modules to operate with insufficient slack for an extended period of time may cause irreversible damage to the membranes.
	Failure to identify and promptly address insufficient fiber slack may result in damage to the system. In extreme cases, failure to act may contribute to premature module failures, which may not be covered under the warranty.

If the fibers shrink during operation, the predetermined slack will disappear. A module with insufficient slack (“taut fibers”) may not perform at top efficiency because the random motion of the fibers during aeration is critical to efficient filtration.

It is important for operators to monitor the amount of slack in each module, even with systems operating below 25ºC (77ºF). If a module is found to exhibit an insufficient amount of slack adjust the slack immediately.

The following table provides a general guide as to how often fiber slack must be inspected (check a representative sample), based upon the system’s operating temperature. Take photographs that clearly show the amount of slack in the module being inspected to track gradual changes over time.

If it appears that the slack requires adjustment, it is strongly recommended that these photographs and any other recorded observations be forwarded to Veolia for review and examination before the adjustment procedure is performed.

Table 5.1 - Recommended slack inspection intervals

Maximum Operating Temperature	Recommended Inspection Frequency
0 to 24ºC (32 to 76ºF)	Every two years
25 to 30ºC (77 to 86ºF)	Once per year
Above 30ºC (86ºF)	Twice per year

5.3.6.3 Measuring fiber slack

It is important to monitor the fiber slack on modules and maintain it appropriately to ensure ideal system performance.

CAUTION

Personal Protective Equipment

Before starting work, don protective clothing, face mask, gloves, and boots.

Tools or parts required:

- Measuring tape
- Rubber hammer or similar plastic or rubber handle
- Marker
- Piece of string
- Sticking tape

To measure slack:

1. Remove the cassette from the tank. While it is being removed, use a high-flow, low-pressure water supply to hose down solids from the cassette.

NOTE: *This procedure requires the cassette to be out of the tank for an extended period. Therefore, the membranes must be sprayed with water every 30 minutes so they stay moist. Local weather conditions may require more frequent spraying.*

2. Use a measuring tape to mark the frame at the halfway point.

Figure 5.9 - Marking frame halfway down

3. Fix a piece of string with sticking tape to the center of one of the module headers, both top and bottom, reasonably tight.
4. Use the handle of a hammer or similar plastic or rubber hammer to move the membrane bundle along the center point marked to the left as far as it will go without putting pressure on the membranes. Be careful not to pull the string.

Figure 5.10 - Measuring deflection

5. Measure the deflection of the membrane with respect to the string. The fiber slack is double this value.

The slack on a new module is typically 13 to 13.5 cm. Once the slack reduces to 7 cm, it is time to put a plan in place to adjust the slack. If the slack reduces to 5 cm or less, immediate action is required.

5.3.6.4 Slack adjustment procedure

CAUTION	
	Contact Hazard Do not allow bare skin to come into contact with mixed liquor during the following procedure.

The following section provides information regarding the procedure for loosening or tightening membrane fiber slack.

This procedure requires the participation of two operators, both of whom must be equipped with proper safety equipment, including face mask, protective gloves, and boots at minimum.

***TIP:** Depending on environmental conditions, it may be necessary to soak the membranes more frequently than described here.*

This procedure requires that the cassette be removed from the membrane tank for an extended period. Using a ***low-pressure hose***, rinse the membrane fibers after the cassette has been removed from the membrane tank to clear any solids accumulation, and then continue to gently soak the membranes every 30 minutes during the slack adjustment procedure. Local weather conditions may require more frequent spraying.

Tools and equipment for adjusting slack

NOTICE	
	Use only stainless-steel or plated equipment during this procedure.

The following equipment is required during the slack adjustment procedure:

- 3/8 inch or 1/2 inch torque wrench (25 to 250 in-lb or 4 to 29 Nm)
- 3/8 inch or 1/2 inch ratchet (same size as torque wrench)
- long Allen drives (M5, M7, M8)
- aeration spacers
- slack adjustment center plate
- permeate slack adjustment plate
- food-grade anti-seize (example: White Knight)
- drill
- permeate O-rings.

Notes:

- New, longer (8 mm) hardware may need to be used depending on how many adjustment spacers are used.
- Apply food-grade anti-seize to all bolts (example: White Knight Anti-Seize)
- Review the latest ZW500EV Module Inspection Checklist for items to be inspected while cassette/modules are out of the water.

Adjusting slack

To adjust slack:

1. Use an M8 long Allen key or hex wrench to loosen all bottom cradle assemblies (below left). Use care not to chafe or damage hardware while loosening, and do not make contact with the fibers.
2. Once all bottom bolts are loose, remove all the bottom cradle assemblies (below right) and put them aside.

Figure 5.11 - Loosening cradle assemblies (left); removing cradle assemblies (right)

3. Loosen the upper cradle assemblies and remove them (below left).
4. Remove the bottom header of the module from the cassette below right). To do this, lift up on the outer edge and then pull the header out.

Figure 5.12 - Removing upper cradle assembly (left); removing bottom header (right)

The module can hang freely (below, left).

5. Remove the top header. To do this, pull the header down and out to the safety stopping feature (below right).

Figure 5.13 - Module hanging freely (left); removing the top header (right)

NOTICE	
	Any modules removed from the cassette must be carefully placed in a laydown area to avoid any handling contact with the fibers.

6. To gain access to the center support assemblies that are attached to the inner beam, remove modules in sets of four (4).
7. Use a long, M6 Allen drive to fully remove both center support assemblies.

Figure 5.14 - Removing inner supports

8. Place the new slack adjustment plate on the inner beam with the flat surface facing up. This plate spans two (2) center support assemblies and has a recessed feature on the bottom to help with alignment.

Figure 5.15 - Positioning slack plate

NOTE: *8 mm longer hardware is needed for each spacer added. Standard hardware is a button head socket cap screw M 6x8.*

9. Align the slack adjustment plate holes with the bottom beam and the center support assemblies. Use an approved NSF61 anti-seize and take care not to cross-thread the bolt while tightening.

Figure 5.16 - Aligning slack adjustment plate holes with bottom beams and supports (left); tightening bolts (right)

10. Torque these bolts to 17 Nm (150 in-lb) (above right).
11. To remove the permeate collector assembly, first remove the LEAP assembly. Remove the bolt from the bottom of the assembly on the outer edge of the cassette. The aerators can then be dropped down.

Figure 5.17 - Removing LEAP assembly

12. Each permeate collector assembly is held on by two (2) M8X40 socket head screws. Remove both screws on each permeate assembly. The assembly can then be removed.
    Ensure the O-ring and aeration hardware are accounted for during removal.

Figure 5.18 - Permeate collector assembly

13. The outer slack adjustment plates require an O-ring and there is one (1) plate per permeate collector; the collector also requires an O-ring. Ensure these are in place during assembly. Use O-ring lubricant to help hold them in place. The O-ring side of the plate faces down.

Figure 5.19 - Slack adjustment plate

14. Install the O-ring on the bottom of the permeate collector assembly and align the parts together on the cassette frame. 8 mm longer bolts are required.

Figure 5.20 - Aligning parts on permeate collector assembly

15. Torque each bolt to 7.3 Nm (65 in-lb).

Figure 5.21 - Torquing bolts

16. Use the supplied spacer to reinstall the aeration assembly to the permeate collection assembly. Original hardware can be reused.

Figure 5.22 - Adding spacer

17. Lift the aeration assembly into position and align it with the permeate collection assembly. Torque the bolt to 7.3 Nm (65 in-lb).

Figure 5.23 - Aligning aeration assembly with permeate collection assembly

18. Reinstall modules into the adjusted positions. Ensure O-rings are lubricated and present before installation and use two (2) people and a work platform during this process.

19. Slide the top header of the module into the guide rail (below left), while the bottom header is carefully inserted into place. Push the top header of the module firmly into the center support assembly (below right).

Figure 5.24 - Sliding top header into guide rail (left); pushing top header into center support assembly (right)

20. Push the bottom header of the module firmly into the center support assembly (below left).
21. Insert the bottom header permeate port into the bottom collector (below right).

Figure 5.25 - Pushing bottom header into center support assembly (left); inserting bottom header permeate port (right)

22. Reinstall the top cradle assembly. To do this, align the nut into the top permeate assembly and the module headers. As the bolts are tightened, the module permeate spigots will press into the permeate assembly. Torque the bolt to 7.3 Nm (65 inlb).

Figure 5.26 - Reinstalling top cradle assembly

23. Repeat the process for the bottom cradles and torque the bolts to 7.3 Nm (65 in-lb).

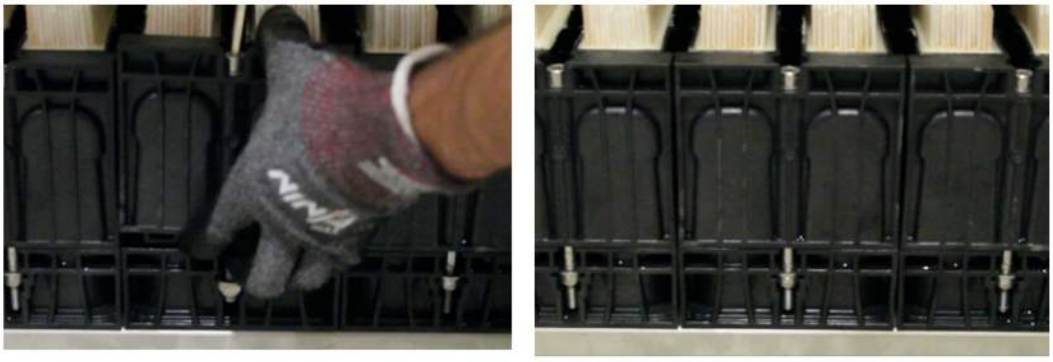


Figure 5.27 - Reinstalling bottom cradle assembly

24. Repeat steps 1 to 22 on the remaining permeate collectors and center support assemblies.
25. To complete the slack adjustment on the cassette, perform a positive pressure test to ensure that there are no leaks.

5.3.7 Repairing ZeeWeed fibers

NOTICE	
	The Membrane Map (provided separately) must be updated whenever the fiber repair procedure is performed. Failure to do so may limit future warranty eligibility.
	Do not separate strands that are glued together at the header, as this will cause damage to the membranes.

Membrane fiber repair is part of the routine preventive maintenance schedule. There are numerous site-specific factors that influence how often fiber repair is required. This procedure must be performed whenever regular testing indicates that broken fibers may be impacting performance *(see 5.5 Monitoring integrity and performance)*.

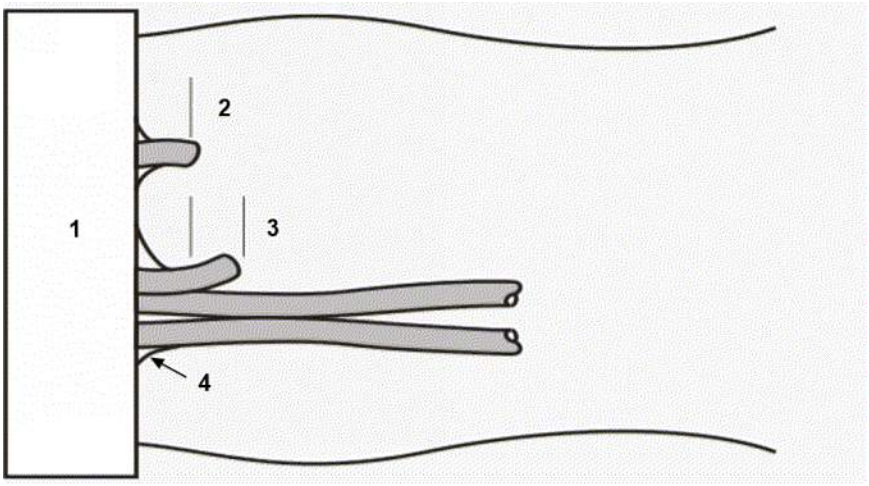
The procedure used to repair a damaged fiber will vary depending on the type of damage and the location along the fiber where it has occurred. The following sections outline the two primary repair techniques: axial silicone injection and subjacent silicone injection, as well as a third technique used occasionally, the pin method.

***TIP:** Veolia's optional DispensGun® silicone delivery tool can be used in place of a syringe during the following procedures.*

5.3.7.1 Axial silicone injection

For leaks detected at the end of the membrane fiber, or for fibers that have been cut badly or completely severed, perform an axial-injection repair by completing the following steps:

1. Remove the membrane module from the membrane tank and cut off the damaged portion 20 mm (3/4") from the potting material on the ZeeWeed header.



1: Module header

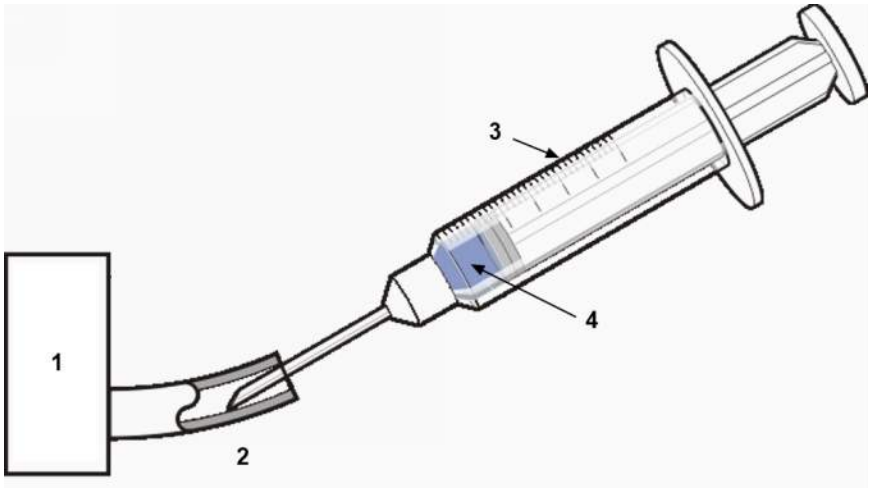
2: Cut position for a single fiber (20 mm gap)

3: Cut position for a fiber bundle (20 mm gap)

4: Drawn potting material

Figure 5.28 - Membrane fiber cut positions

2. Using a hypodermic syringe filled with silicone sealant (available from Veolia as part of a Membrane Repair Kit) insert the tip of the needle 10 mm (7/16") into the centre of the membrane lumen.



1: Module header

2: Severed fiber

3: Syringe

4: Food-grade silicone sealant

Figure 5.29 - Axial silicone injection (step one of four)

3. Apply light pressure when injecting the silicone. Fill the lumen back to the header, as indicated by the darkened zone in *(see Figure 5.30 - Axial silicone injection (step two of four))*. Filling typically takes 15 to 45 seconds.

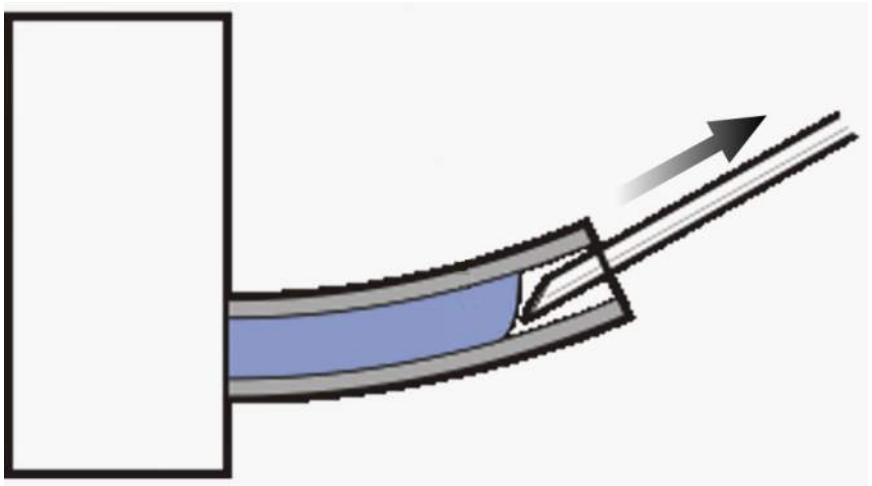


Figure 5.30 - Axial silicone injection (step two of four)

4. Slowly withdraw the needle while still injecting silicone to assure the lumen is completely filled.

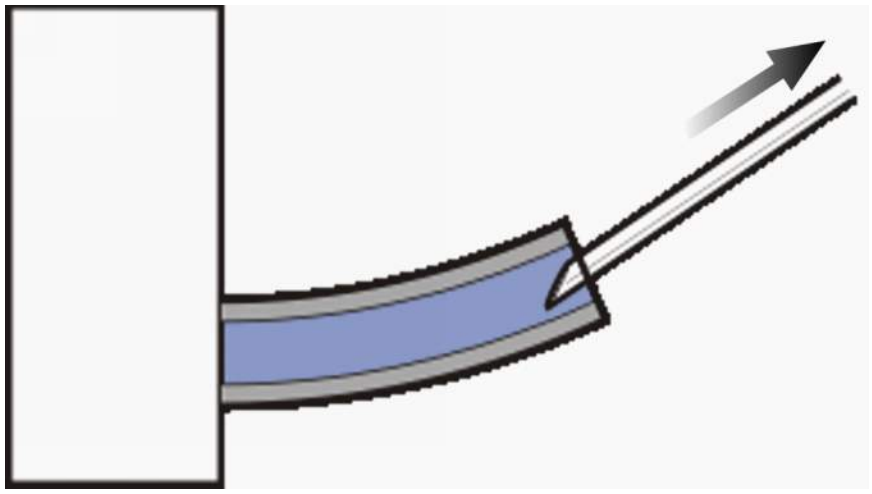


Figure 5.31 - Axial silicone injection (step three of four)

5. While still applying pressure to the syringe, use the tip of the needle to spread silicone over the cut end of the lumen.

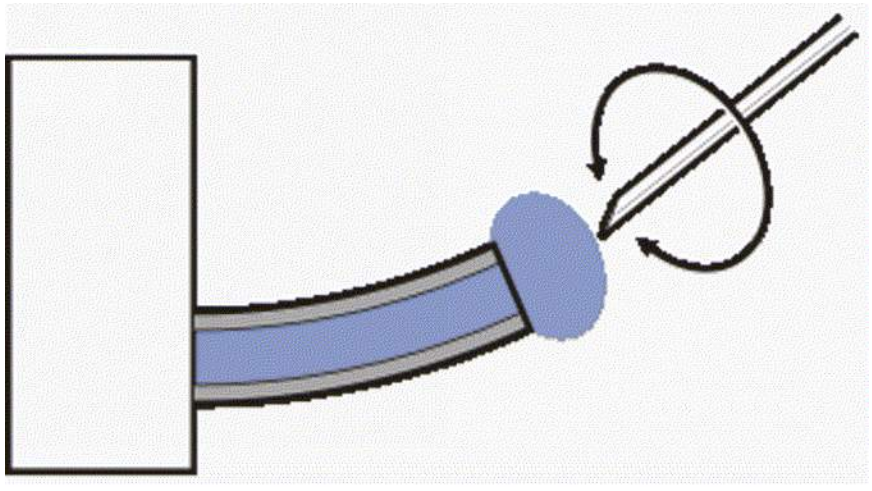


Figure 5.32 - Axial silicone injection (step four of four)

After the repair is complete, place the cassette back into the membrane tank. Allow 10 minutes for curing before performing further membrane testing.

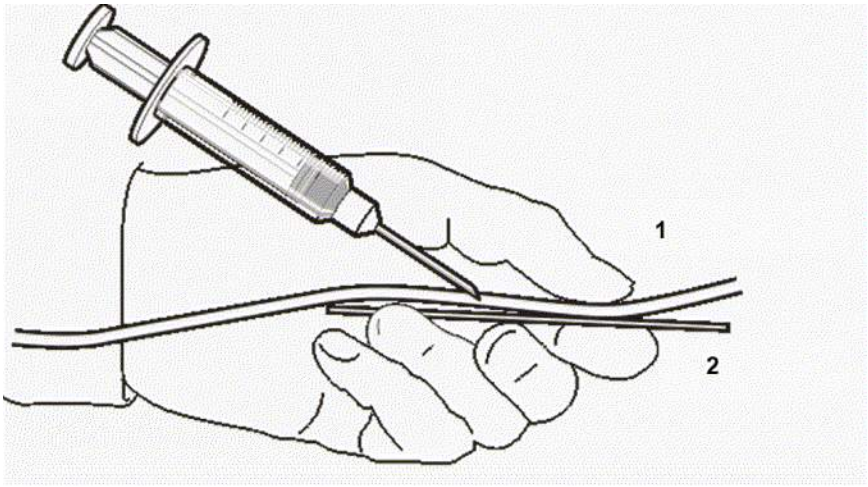
5.3.7.2 Subjacent silicone injection

For leaks detected along the middle of the membrane fiber, perform a subjacent-injection repair. To do this:

1. Remove the membrane module from the membrane tank.

CAUTION	
	Sharp Element Use a metal barrier (example: steel ruler) to protect the hand holding the fiber.

2. Using a hypodermic syringe filled with silicone sealant (available from Veolia as part of a Membrane Repair Kit), insert the tip of the needle into the lumen. When inserting, hold the syringe at an angle of 5 - 10º to the lumen and insert the tip 5 to 10 mm (3/16 to 7/16") from the leak. Ensure that the needle does not pass through the lumen completely, but only into the hollow center.

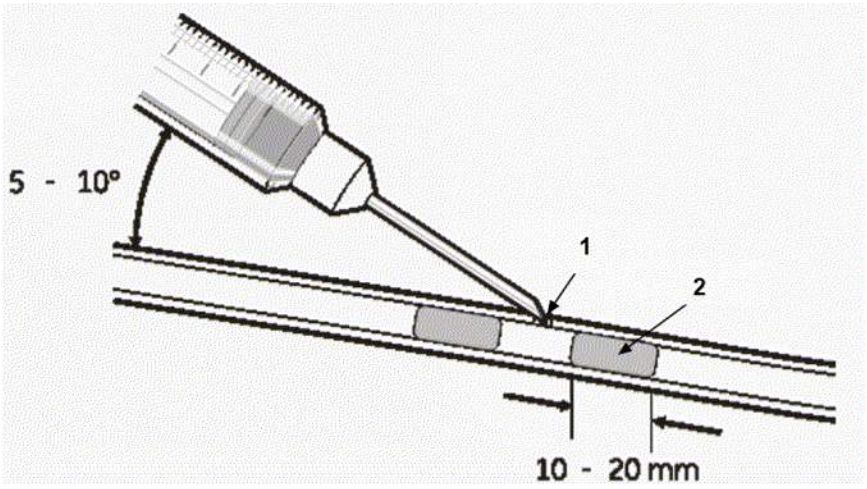


1: Support lumen with fingers positioned away from injection point

2: Steel ruler or other protective barrier

Figure 5.33 - Subjacent silicone injection (step one of two)

3. Apply light pressure to fill the lumen with silicone. Continue applying pressure while withdrawing the needle from the lumen, ensuring the puncture is sealed.
4. Repeat these steps on the other side of the leak, positioning the needle 5 to 10 mm (3/16 to 7/16") from the leak on the opposite side to the first injection point.



1: Leak

2: Injected silicone

Figure 5.34 - Subjacent silicone injection (step two of two)

After the repair is complete, place the cassette back into the membrane tank. Allow 10 minutes for curing before performing further membrane testing.

5.3.7.3 Repairing fibers using header pins

The pinning method can be used to seal header holes left by pulled fibers. This method is not 100% reliable in sealing the holes. As its use can produce leaks in neighboring fibers, all leaking fibers should continue to be sealed with silicone.

1. Locate the fiber hole in the module header from the pulled fiber (below, left).

NOTE: *Dropping the header (and inverting the module if the fiber is pulled from the top header) makes locating the leak much easier and there is less likelihood of damaging neighboring fibers during the pinning process.*

2. Note the tool has two ends - a hollow end and concave end. Insert the thick end of the pin into the hollow tool end (below, right).

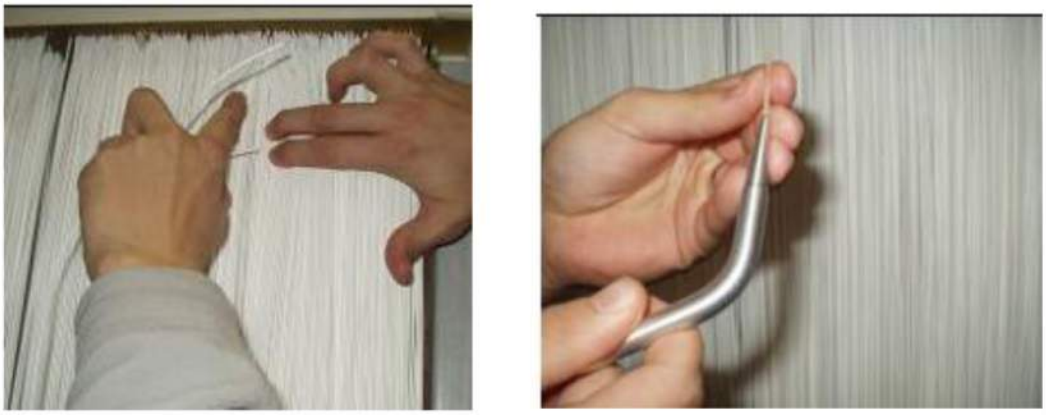


Figure 5.35 - Locating the fiber hole (left); hollow tool (right)

3. Using the pin repair tool, push the pin into the hole until the tool tip touches the urethane surface (below, left).
4. Using the concave end of the tool, carefully push the pin further into the urethane so that the top of the pin is just below the urethane surface. Do not add silicone - only place the dry pin in the hole (below, right).
5. Push carefully to prevent the tool from slipping off the pin. Cut and seal the loose fiber at the other header using the cut and seal repair method.

Figure 5.36 - Pushing the pin into the hole (left); placing the pin further into the hole (right)

To watch a video of MBR Fiber Repair, scan this QR code or follow the link:

https://youtu.be/zKyHtZQPpU8

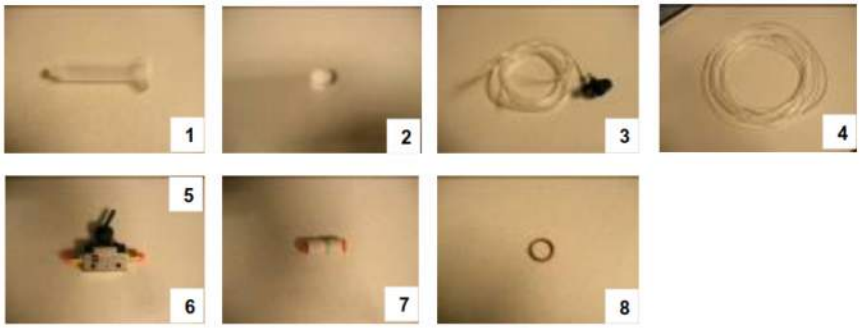
5.3.8 Setting up and using the Pneumatic Fiber Repair Kit

CAUTION	
	Eye Protection Required Safety glasses must be worn for personal safety as parts downstream of the air supply can become deadly projectiles if dislodged by accident. Always keep the unit pointed away from others.

This section describes, in detail, the procedure to set up and use the Pneumatic Fiber Repair Kit.

Figure 5.37 - Pneumatic Fiber Repair Kit

The parts of the kit include:



1: Syringe barrel
2: Plastic piston
3: Syringe cap with bar-style air fitting
4: 10 m of 5/32" polyurethane tubing
5: Toggle valve
6: 2x toggle valve fittings
7: Reducer fitting (5/32" tube - 1/4" tube)
8: Spare O-ring

Figure 5.38 - Membrane fiber cut positions

5.3.8.1 Assembling the kit

1. Attach one end of the 1/4" air tube to a 90 psi filtered industrial air supply. Attach the other end of the 1/4" tube to the 1/4" end of the reducer fitting.

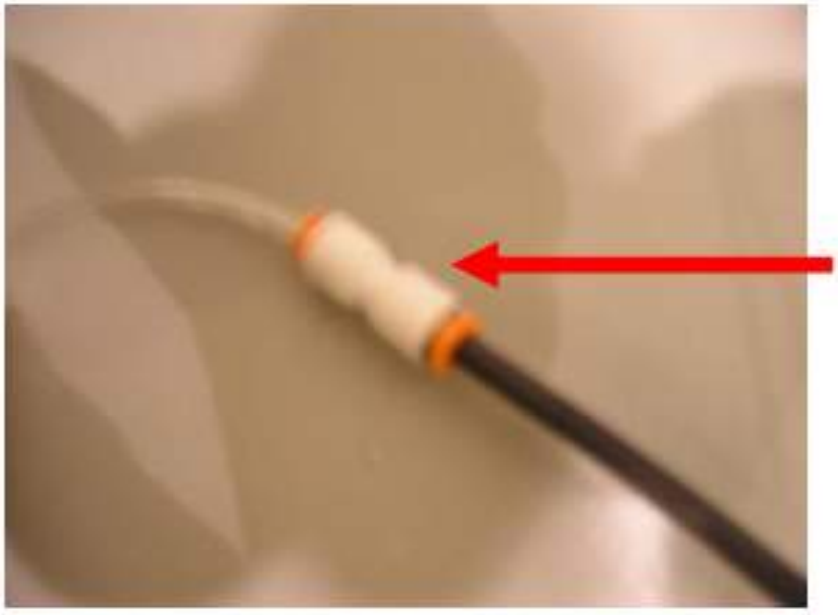


Figure 5.39 - 1/4" side of the reducer fitting

2. Attach one end of the 5/32" tube to the 5/32" end of the reducer fitting (below, left). Attach the other end of the 5/32" tube to the inlet end of the toggle valve (the inlet end is indicated by an arrow that shows the direction of flow) (below, right).

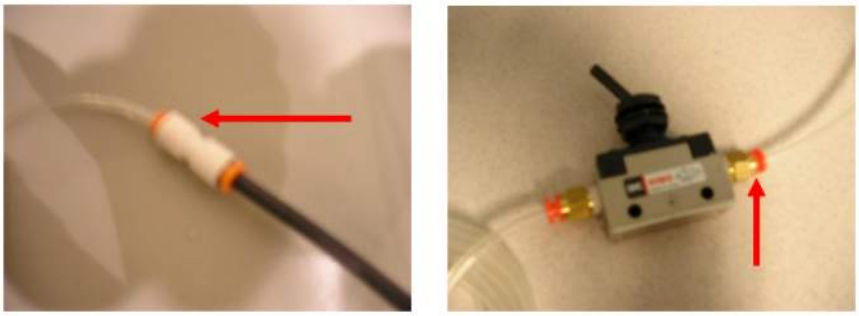


Figure 5.40 - 5/32" side of the reducer fitting (left); inlet side of toggle switch (right)

3. Ensure that the toggle switch is in the closed position before proceeding.

Turn on the air supply to ensure that no air flows through the toggle switch. Turn off the air supply once the closed position of the toggle switch has been verified.

NOTICE	
	Ensure a firm grip on the switch housing and point away from the body when turning the air on.

4. Attach the 5/32" air tube (with the syringe cap with a bar-style air fitting on one end) to the outlet side of the toggle switch.

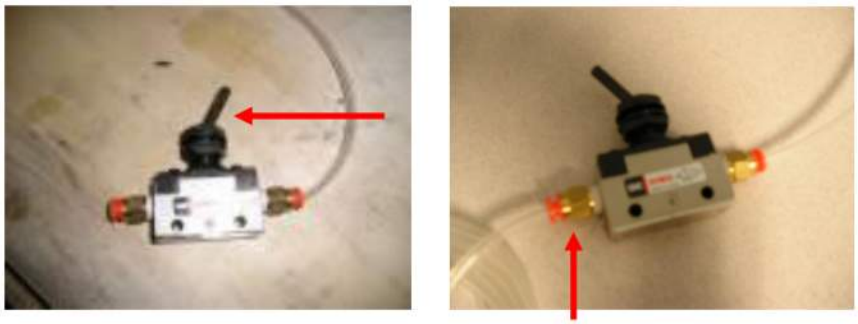


Figure 5.41 - Closed position (left); Outlet side of toggle switch (right)

5. Attach the needle tip to the plastic syringe. Ensure that the needle tip is securely locked in place before proceeding. The color of the needle tip can differ depending on the membrane being worked on. Ensure the correct one is used.

6. Fill the syringe with Shin-Etsu silicone no more than two-thirds (2/3) full. Place the plastic piston into the syringe and proceed to remove air from the syringe by pushing the piston forward until air is forced out the open end.

Figure 5.42 - Turn clockwise 90 degrees (left); Plastic piston (white) - press up until all air is gone from inside of syringe (right)

7. Attach the plastic syringe to the syringe cap with the bar-style air fitting. Turn the syringe 90 degrees clockwise and ensure that it is securely locked in place before proceeding.

Figure 5.43 - Turn clockwise 90 degrees (left); Ends of plastic piston locked underneath black syringe cap (right)

8. Turn on the air supply and toggle the switch to the open position. Verify that silicone is flowing out of the needle tip. Toggle the switch to the closed position once the silicone flow has been verified.

Figure 5.44 - Open position

5.3.9 Fiber harvesting for analysis

In some cases, it is helpful to return ZeeWeed fibers for cleaning and fouling studies, defect analysis, or autopsy.

CAUTION	
	General Hazard Handle fibers with care and keep contact with as little membrane surface as possible. Every contact made with fiber changes membrane surface, making analysis objectivity more difficult and, in case of severe plastic deformation due to the handling of samples, impossible.

5.3.9.1 Initial actions

When a membrane integrity issue is identified, contact the commissioning lead or a technical support representative. Describe the issue and provide as much information as possible (such as map indicating module(s) with issue, location of defect, relevant digital images, MIT data, existence of debris, and so on).

5.3.9.2 Collecting samples

For most testing requirements, 10 full length fibers are required. Cleaning studies cannot be started with less fibers unless advised otherwise. Get a sample from a module or train that is representative of the whole plant. Harvest the samples from the worst operating train. For any questions or concerns about harvesting, reach out to the appropriate team contacts listed below.

- Cut the full length of the fibers. Use a new pair of gloves while handling membranes at different locations to avoid cross-contamination. Never place membranes in an uncontrolled environment (like on the bench) and never handle the membrane with bare hands.
- Place the samples gently between moist lint free Kim wipes and seal them in a plastic bag (to ensure that the fibers are kept saturated at all times) immediately after harvesting. Place the bag in a plastic container to avoid additional damages. Be aware that using a plastic bag only makes samples susceptible to damage during shipping and handling.
- When submitting samples for defect analysis, mark the area of defect with a permanent marker as close to the defect as possible on either side, but pay special attention not to contaminate the defect area itself. The analysis cannot be performed on a contaminated sample.

  NOTE: *If the defect is located within the interface between the fiber and the potting, contact Veolia for clarification as necessary (section 4.0).*

- If appropriate, knot the fiber on the end opposite to the damage to indicate orientation in the module – and include a short description. Samples harvested from different locations should be preserved in separate containers. If possible, refrigerate the fibers until shipping to prevent bacterial growth during transit.

NOTE: *Do not add any preservations or disinfectants.*

Mark the container with the following information:

- equipment/tool (1+)
- site name
- CIT number
- name and contact details of harvester
- date samples were harvested on
- module serial number
- cassette serial number.

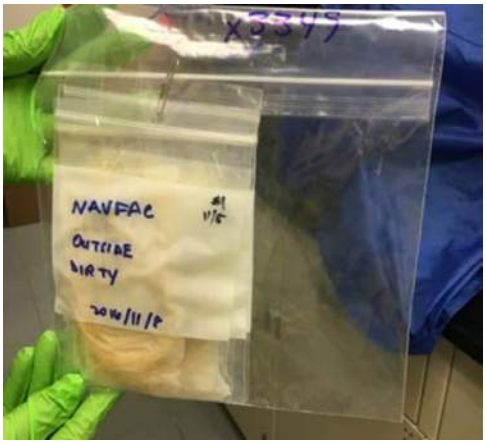


Figure 5.45 - Labeled bags

5.3.9.3 Shipping the fibers

Address the shipment to the attention of:

Request: All requests

Contact name: Gyula Malovecky

Contact information:

Veolia
Hungary Kft, Bláthy O u. 4.
Oroszlány
H-2840, Hungary

5.4 Cleaning

The procedures and controls used to clean the ZeeWeed membrane system have been designed and provided by others, and so cannot be accurately documented by Veolia.

The following information is intended only as a general guideline. The chemicals mentioned are those most commonly used to clean the ZeeWeed membrane system, however, other substances may have been selected for use with this system.

This information must be read in conjunction with the detailed cleaning outline provided by the third-party manufacturer who designed the system controls and operation sequences. In the event of a contradiction between information provided by Veolia and that supplied by the manufacturer, the manufacturer's information will always take precedence.

For information specific to individual components, such as pumps and valves, refer to the manufacturers' instructions *(see B Appendix: Project documents)*.

NOTICE	
	A substantive failure to adhere reasonably to the cleaning guidelines provided by Veolia, including the use of cleaning chemicals not approved for use in this application by Veolia, may render the warranty null and void.

5.4.1 Cleaning summary

The following table provides key details regarding the chemical cleaning sequences used in this system.

CAUTION	
	Chemical Hazard Sodium hypochlorite cleaning solution generates a corrosive gas that may create an asphyxiating atmosphere and poses a safety risk to those nearby. Adequate ventilation must be provided.

NOTICE	
	Do not pour chemicals directly onto the membranes.
	Excessive scaling may raise the pH of citric acid. When performing an acid maintenance or recovery clean, ensure that the solution pH is monitored throughout the process.
	During a maintenance clean, check the dosing tank to ensure the entire cleaning chemical has been consumed.
	The information provided in the following table is accurate at the time of installation, but is subject to change over time. Contact Veolia for up-to-date cleaning information. Annotate this table as needed.

Table 5.2 - ZeeWeed membrane cleaning summary for an MBR system

Chemical	Purpose	Design Concentration	Frequency	Total Vol. per Clean	Design pH
Oxidant Maintenance Clean (performed in sludge, in other words, without draining mixed liquor)					
Sodium hypochlorite 12.5% w/w, SG: 1.168	To remove organic foulants	200 mg/L*	Twice per week	[value]	N/A***
Acid Maintenance Clean (performed in sludge, in other words, without draining mixed liquor)					
Citric acid 50% w/w, SG: 1.24	To remove inorganic foulants	2,000 mg/L*	Once per week as required	[value]	N/A***
Oxidant Recovery Clean					
Sodium hypochlorite 12.5% w/w, SG: 1.168	To remove organic foulants	1,000 mg/L**	4 times per year	[value]	9 to 10.5 at under 30°C (86ºF) 9 to 10 at 30 to 40°C (86 to 104ºF)
Acid Recovery Clean					
Citric acid 50%**** w/w, SG: 1.24	To remove inorganic foulants	2,000 mg/L**	4 times per year	[value]	2.5 to 3.5

* Concentration in a backpulse stream

** Soak concentration in membrane tank

*** Mixed liquor pH will not change significantly due to chemical dilution and consumption by sludge.

**** May need to add stronger citric acid to achieve design pH.

*May need to add stronger citric acid to achieve design pH.

5.4.2 Cleaning chemicals

WARNING	
	Mixture Presents Health Hazard Allowing solutions containing citric acid and sodium hypochlorite to mix may create deadly chlorine gas, posing a severe safety hazard to all personnel within the facility. Make sure these solutions do not come into contact with one another.

CAUTION	
	Chemical Hazard Many chemicals give off vapors that pose a health risk. Always wear appropriate PPE and avoid breathing the mist or vapor. Refer to the SDS for guidance on appropriate PPE.
	Chemical Hazard Failure to observe all safety precautions outlined in the applicable SDSs while handling cleaning chemicals may result in injury.

NOTICE	
	Chemicals must be segregated based on compatibility. When storing chemicals, ensure that all relevant manufacturer's instructions regarding safe storage and handling are observed.
	Use of unapproved chemicals during a cleaning procedure may void the warranty.
	Ensure that all local government, industry, and site regulations regarding the handling and disposal of chemicals are followed.

TIP: *For more severe fouling, Veolia offers additional cleaning chemicals designed specifically for use with systems prone to fouling. Contact Veolia for more information.*

The type of cleaning chemical required depends on the type of fouling that needs to be cleaned. In this system, [high-pH] solution is used to remove biological fouling, while [low-pH] solution is used to remove precipitative fouling caused by accumulated mineral scales, iron, or other metals.

Safety and handling instructions for all cleaning chemicals that Veolia has supplied can be found in the applicable SDSs.

Contact Veolia for more information regarding chemicals that have been approved for use with this system.

5.4.3 Preparing cleaning chemicals

If the chemicals do not arrive pre-mixed, they will need to be prepared onsite.

NOTICE	
	Limit the sodium hypochlorite cleaning solution to a maximum pH of 10.5 at a temperature of less than 30ºC (86ºF), and a maximum pH of 10 at a temperature between 30 - 40ºC (86 - 104ºF).
	Citric acid solubility is 500 g/L at 10ºC (50ºF). Veolia does not recommend increasing the concentration beyond this amount.

Ensure that the chemical solution has been prepared in sufficient quantity. Use the following calculation to determine the amount of chemical required per liter of solution:

$$x \times y = z$$

Symbol	Represented Value
x	% by weight (as decimal)
y	Density
z	Amount (kg) required per liter of solution

EXAMPLE: For a 50% by-weight solution with a density of 1.24:

$$0.5 \times 1.24\,kg/L = 0.62\,kg/L$$

If a chemical injection pump will be used to add the solution into the system, ensure that the pump has been set to dose the proper amount when activated. If the solution will be added manually, reconfirm the amount being added before beginning and monitor the addition carefully.

5.4.4 Frequency of cleans

During normal operation, membranes can become fouled by mineral salts (example: calcium carbonate), iron, insoluble organics (example: oil), and biological matter, all of which can cause a decrease in membrane permeability. How often membranes require cleaning to remove these

foulants depends on specific operating conditions, including operating time, various flowrates, and mixed liquor characteristics.

***TIP:** Permeability drops if mixed liquor temperature decreases. This decrease is normal and does not necessarily indicate fouling.*

5.4.5 Cleaning logsheet

All information gathered during a clean must be recorded on the cleaning logsheet (provided separately in electronic format). This logsheet must be emailed or faxed to Veolia so that the effectiveness of cleaning procedures can be verified *(see 1.2.2 Contacting Veolia)*.

5.4.6 Cleaning methods

The following types of cleaning procedures must be performed at regular intervals in order to maintain normal operating parameters.

BACKPULSE: A backpulse reverses the normal production flowpath by pumping permeate back through the membranes from the inside out. This process helps to remove solids and foulants that may have accumulated on the membranes during operation, and is performed frequently at regular intervals

NOTICE	
	When performing a backpulse, never apply pressure greater than across the membrane, as doing so may decrease membrane lifespan.

RELAX: Relax is an alternative to the backpulse sequence. If a backpulse failure occurs and no pump is available, the PLC places the trains into RELAX mode

MAINTENANCE CLEAN: Fouling that cannot be removed by performing a backpulse must be cleaned using a chemical solution. This process, known as a maintenance clean, involves the use of specialized chemical solutions to dissolve/oxidize various types of foulants

RECOVERY CLEAN: A recovery clean is performed only to remove substantial amounts of fouling and involves the use of highly concentrated chemical solutions, heated cleaning solutions, and extended soak periods

5.4.7 Monitoring the effectiveness of a clean

Clean events and their effectiveness are highly dependent on the chemical dose and time. If either of these aspects are not achieved, the clean is likely to be less impactful for removal of biological or inorganic foulants. Long-term operation with cleans that are not achieving the design protocol or frequency can contribute to premature, irreversible fouling and membrane performance issues.

The information recorded on the cleaning logsheet includes cleaning doses achieved at various points of the clean (start, middle, end), and the soak time executed. It also evaluates the flows and TMPs before and after the clean to determine changes in permeability from the clean event.

The first group of data (clean dose and time) is useful in validating that the clean achieved the design chemical doses and exposure times.

5.4.7.1 Monitoring data

Monitoring the achieved dose over time can help identify if stock chemicals (especially sodium hypochlorite) have lost strength, if dosing timers have been changed accidentally, or if dosing pumps or instruments require maintenance or recalibration. These aspects must be investigated if clean doses are not as originally commissioned. Recording the dose information at various points in the clean (especially for recovery cleans), can identify how rapidly the chemical is being consumed. For example, if a clean begins with 1,000 mg/L of sodium hypochlorite, and has 500 mg/L remaining after 2.5 hours, this indicates a significant consumption of hypochlorite which may be a result of higher than normal biological foulants. Similarly, if an acid clean begins at 2.1 pH, and has reached a pH of 4 after 2.5 hours, this indicates a significant consumption of acid, which may be a result of higher than normal inorganic foulants.

5.4.7.2 Recording data

Recording the flows and TMPs before and after the clean allows for calculation of the membrane permeability. Permeability is a useful, normalized measurement of membrane condition. It is expected that the permeability after a clean will be greater than the permeability before a clean. The degree of this change will depend on how effective the clean was (achieving dose and time), and how much foulant was accumulated since the last clean. It is useful to track the permeability gain from various cleans over time to determine when conditions are changing, or when a clean is not performing as expected. However, it is possible for a well-executed clean to achieve little permeability improvement. For example, if the train has been cleaned recently or was running at unchallenging conditions, it is possible that the clean has little foulant to consume in the first place. This will be evident if the cleaning dose remains very similar across the clean time.

The Veolia InSight automated data logging system may provide additional visibility on these parameters and others related to cleaning. Using logsheet data in conjunction with InSight data can allow operators and managers to observe cleaning behavior and performance over long periods of time to optimize membrane system operation.

5.4.8 Ventilation

If the system is located indoors, the membrane tank must be properly ventilated in accordance with all local regulations.

5.5 Monitoring integrity and performance

This section provides information regarding the various tools and procedures used to gather performance data and to monitor the physical condition of the system.

This information is essential when assessing long-standing performance issues, establishing trends, and determining the durability of various components.

***TIP:** Data must be normalized before it can be properly evaluated (see 3.3 Calculations).*

5.5.1 ZeeWeed membrane permeability

Membrane permeability is a calculated operating parameter (flux divided by TMP) and must be measured at the following points:

- before and after each membrane clean
- at least once a day before and after a backpulse or relax.

The effectiveness of each clean can be verified by comparing the membrane permeability measurements taken before and after the clean is performed.

Water temperature directly affects water viscosity. Therefore, membrane permeability values must be corrected for temperature fluctuation over time in order to provide a meaningful long-term basis for comparison.

5.5.2 Sludge quality - Time to Filter (TTF) procedure

The Time to Filter (TTF) procedure is an analytical test parameter that provides critical data on the filterability of mixed liquor bioreactor sludge. It is a value (in seconds) corresponding to the amount of time required to filter certain volumes of water from a predetermined volume of sludge through a selected filter paper using a vacuum pump, funnel, and Erlenmeyer flask.

TTF is a vital tool that can improve MBR management. The ability to distinctly identify the cause of non-optimal plant performance is vital to maintaining efficient plant operation. Falsely attributing low permeability and high TMP values to membrane fouling will increase chemical consumption, plant downtime and man hours needed to perform membrane recovery cleans, while the root cause of the problem remains unaddressed. Poor sludge filterability can be indicative of process upsets that may have gone unnoticed and need to be addressed. Building a historic database of regular TTF measurements allows Veolia and its clients to closely monitor process performance and make informed decisions about improving plant management.

When treatment plants experience higher observed TMP values or decreased membrane permeability, the TTF test can provide an indication of the factors relating to the change by determining whether sludge characteristics are contributing. Further, TTF has been shown to be an excellent way to track changes in sludge filterability, thereby allowing proactive process adaptations ahead of plant upsets.

5.5.2.1 How does TTF affect plant performance?

By measuring the time to filter water from a sludge sample under vacuum, plant staff can anticipate stable or unstable membrane performance. The lower the TTF value, the easier it is to filter, allowing membranes to operate at a lower TMP or higher flux. Large precipitation events, spike loading from unnatural sources, or similar events can degrade the bioreactor sludge. Such degradation can cause the sludge to become less filterable (higher TTF) and be misinterpreted as increased membrane fouling.

5.5.2.2 Requirements

The Time-to-Filter procedure can be performed in 10 to 15 minutes. Mixed liquor samples collected to perform daily Mixed Liquor Suspended Solids (MLSS) analysis can be used to determine the TTF. Ideally, TTF should be measured daily to assess changes in sludge quality. Building a database of TTF values will help forecast changes in membrane performance.

5.5.2.3 Preparation

Before TTF analysis, ensure the equipment is available and set-up as outlined below. TTF is measured at a vacuum of 15“ Hg which should be adjusted prior to start of analysis. The required MLSS sample to conduct the test is 200 mL. Further, measure and record the temperature of the sample as well as the mixed liquor suspended solids concentration (mg/L). Finally, record any anomalies in weather, plant performance, and so on on the logsheet below or in a similar document.

Safety risk assessment recommendations

A wastewater treatment plant poses several potential health hazards if good housekeeping practices are not followed. Immunization protects against

infection, but common sense is required when performing maintenance activities.

***NOTE:** Veolia employees are vaccinated for tetanus and hepatitis A and B.*

Follow proper safety procedures to prevent injury when performing this procedure. If there are any concerns, it is recommended that employees discuss these with the personal physician.

CAUTION	
	Wear Appropriate PPE Prevent skin and eye contact by wearing gloves and appropriate eye protection. Do not expose cuts or open sores to feedwater.
	Wash Hands Ensure that hands are washed with soap on a regular basis, especially before eating. After contact, wash hands thoroughly with soap and warm water. This is particularly important before eating, drinking, or smoking.
	Eyewash and Safety Shower An eyewash station and safety shower should be in the work area.

Required parts

The TTF kit is comprised of two separate kit options - lab equipment only or lab equipment with vacuum pump and accessories. If a vacuum pump equipped with a vacuum regulator and gauge is already available on site, the client may choose to order the lab equipment only.

Table 5.3 - Lab Equipment Kit - Order No. 3085733

Component	Item No.	Qty	Description
Filter Papers Whatman Glass Microfiber 934-AH, 9CM, 1.5µm	3085725	1	Placed inside the Buchner funnel as a filtration barrier.
Buchner funnel 100 mm OD	3085723	1	Holds the filter and the 200 mL sample of mixed liquor. The funnel is placed on top of the Erlenmeyer flask.
Erlenmeyer suction flask (1,000 mL)	3085724	1	The graduated cylinder is placed inside the Erlenmeyer flask and the Buchner funnel sits on top of the flask.
Modified 100 mL graduated cylinder Or alternatively: Purchase glass graduated cylinder with removal plastic base (available through Amazon.com)	3085726	1 1	**This graduated cylinder will need to be modified on site to fit inside the Erlenmeyer flask.** Cut the base off of a 100 mL plastic graduated cylinder with a hacksaw or angle grinder or, alternatively, purchase a glass graduated cylinder with removable plastic base. It is used to collect and measure the sample filtered from the mixed liquor.
Rubber stopper #8 (modified)	3085727	1	To form a good seal between the Erlenmeyer flask and the Buchner funnel, the stem of the funnel is placed inside the opening in the rubber stopper and this assembly (rubber stopper + funnel) is placed on top of the Erlenmeyer flask.
Stopwatch	3085979	1	Used to measure duration for 25 mL, 50 mL and 100 mL to be collected inside the graduated cylinder.
Thermometer	3085980	1	Used to determine the temperature of the mixed liquor sample.
Beaker 250 mL, plastic	3085728	1	To measure 200 mL mixed liquor sample for TTF analysis

Table 5.4 - Lab Equipment with Vacuum Pump Kit option - 115V 60 Hz Order No. 3085734

Component	Item No.	Qty	Description
Vacuum pump, 115/60 (set to 15” Hg)	3085729	1	Pump is attached to the Erlenmeyer flask (through the vacuum regulator), creating a vacuum of 15” Hg during the TTF analysis.
Vacuum regulator, 0 to 29" Hg, 2.47cfm with gauge	3085730	1	The regulator, connected to the vacuum pump on one end and the Erlenmeyer flask on the other end, allows vacuum pressure to be regulated to 15” Hg.
Reducer Bushing, 3/8x1/8, thread x thread	3085831	1	Fits into the vacuum side of the pump and holds the 1/8” nipple that connects the vacuum regulator to the pump.
Nipple 1/8"x1" NPT (M) x NPT(M), 316SS	3085832	1	Connects vacuum regulator to pump at 90º to the pressure gauge.
Male pipe adapter, polyethylene, 1/8" x 1/4"	3085731	1	Fasten pipe adaptor into vacuum regulator at 180º from the pressure gauge.
1/4" plastic tube	3071302	1.5 to 2 ft	Used to connect the pressure gauge and vacuum pump to the Erlenmeyer flask.
Erlenmeyer suction flask (1,000 mL)	3085724	1	The flask is connected to the vacuum pump.
Filter Papers What-man Glass Microfiber 934-AH, 9CM, 1.5µm	3085725	1	Placed inside the Buchner funnel as a filtration barrier.
Buchner funnel 100 mm OD	3085723	1	Holds the filter and the 200 mL sample of mixed liquor. The funnel is placed on top of the Erlenmeyer flask.

Component	Item No.	Qty	Description
Modified 100 mL graduated cylinder Or alternatively: Purchase glass graduated cylinder with removal plastic base (available through Amazon.com)	3085726	1 1	**This graduated cylinder will need to be modified on site to fit inside the Erlenmeyer flask.** Cut the base off of a 100 mL plastic graduated cylinder with a hacksaw or angle grinder or, alternatively, purchase a glass graduated cylinder with removable plastic base. It is used to collect and measure the sample filtered from the mixed liquor.
Rubber stopper #8 (modified)	3085727	1	To form a good seal between the Erlenmeyer flask and the Buchner funnel, the stem of the funnel is placed inside the opening in the rubber stopper and this assembly (rubber stopper + funnel) is placed on top of the Erlenmeyer flask.
Stopwatch	3085979	1	Used to measure duration for 25 mL, 50 mL and 100 mL to be collected inside the graduated cylinder.
Thermometer	3085980	1	Used to determine the temperature of the mixed liquor sample.
Beaker 250 mL, plastic	3085728	1	To measure 200 mL mixed liquor sample for TTF analysis

Table 5.5 - Lab Equipment with Vacuum Pump Kit option - 230V 50 Hz Order No. 3087345

Component	Item No.	Qty	Description
Pump - Vacuum,0.02HP, 230/50, CP	3087342	1	Pump is attached to the Erlenmeyer flask (through the vacuum regulator), creating a vacuum of 15” Hg during the TTF analysis.
Vacuum regulator, 0 to 29" Hg, 2.47cfm with gauge	3085730	1	The regulator, connected to the vacuum pump on one end and the Erlenmeyer flask on the other end, allows vacuum pressure to be regulated to 15” Hg.
Reducer Bushing, 3/8x1/8, thread x thread	3085831	1	Fits into the vacuum side of the pump and holds the 1/8” nipple that connects the vacuum regulator to the pump.
Nipple 1/8"x1" NPT (M) x NPT(M), 316SS	3085832	1	Connects vacuum regulator to pump at 90º to the pressure gauge.
Male pipe adapter, polyethylene, 1/8" x 1/4"	3085731	1	Fasten pipe adaptor into vacuum regulator at 180º from the pressure gauge.
1/4" plastic tube	3071302	1.5 - 2 ft	Used to connect the pressure gauge and vacuum pump to the Erlenmeyer flask.
Erlenmeyer suction flask (1,000 mL)	3085724	1	The flask is connected to the vacuum pump.
Filter Papers What-man Glass Microfiber 934-AH, 9CM, 1.5µm	3085725	1	Placed inside the Buchner funnel as a filtration barrier.
Buchner funnel 100 mm OD	3085723	1	Holds the filter and the 200 mL sample of mixed liquor. The funnel is placed on top of the Erlenmeyer flask.

Component	Item No.	Qty	Description
Modified 100 mL graduated cylinder Or alternatively: Purchase glass graduated cylinder with removal plastic base (available through Amazon.com)	3085726	1 1	**This graduated cylinder will need to be modified on site to fit inside the Erlenmeyer flask.** Cut the base off of a 100 mL plastic graduated cylinder with a hacksaw or angle grinder or, alternatively, purchase a glass graduated cylinder with removable plastic base. It is used to collect and measure the sample filtered from the mixed liquor.
Rubber stopper #8 (modified)	3085727	1	To form a good seal between the Erlenmeyer flask and the Buchner funnel, the stem of the funnel is placed inside the opening in the rubber stopper and this assembly (rubber stopper + funnel) is placed on top of the Erlenmeyer flask.
Stopwatch	3085979	1	Used to measure duration for 25 mL, 50 mL and 100 mL to be collected inside the graduated cylinder.
Thermometer	3085980	1	Used to determine the temperature of the mixed liquor sample.
Beaker 250 mL, plastic	3085728	1	To measure 200 mL mixed liquor sample for TTF analysis

5.5.2.4 TTF values

TTF values are inherently tied to MLSS levels. A higher MLSS value will cause a thicker cake layer to form faster when filtering with paper filters and result in a larger TTF under the same conditions. MBRs typically operate with MLSS in the range up to 8,000 to 11,000 mg/L. MLSS values should be recorded for every test and this effect taken into consideration whenever comparing TTF results from different tests.

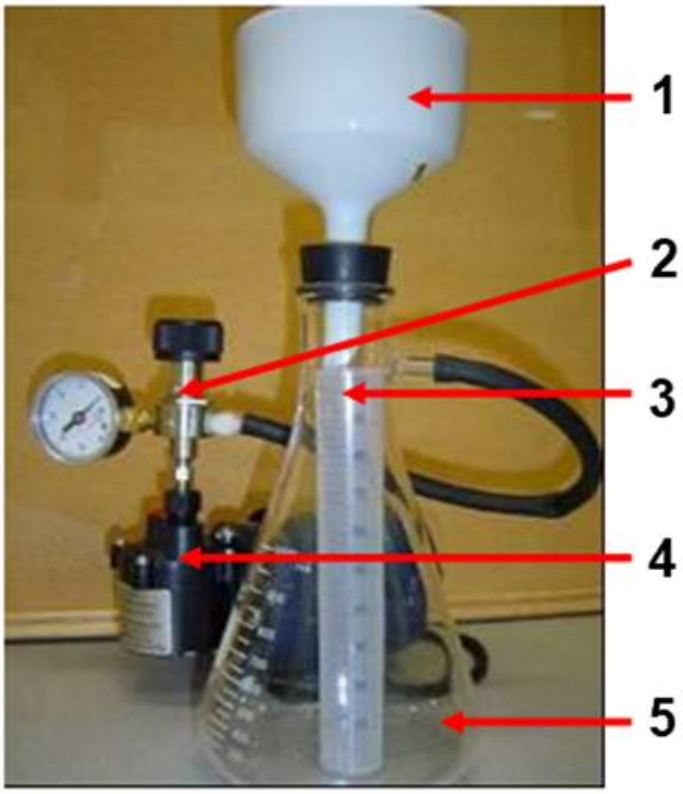
Excellent TTF is less than 100 seconds (for 100 mL). Average TTF is 100 to 200 seconds (for 100 mL). Fair TTF ranges between 200 and 300 seconds,

and difficult sludge has a TTF greater than 300 seconds (for 100 mL). This range of values assumes a sample temperature of 15ºC. Similar to permeability, TTF improves at higher temperatures and the temperature of every sludge sample should be recorded.

5.5.2.5 Procedure

This procedure is adapted from Standard Methods – 2710 H to measure the filtration rate of sludge. The test consists of placing a sludge sample in a Buchner funnel with a filter paper, applying a vacuum, and measuring the time required to filter 50% of the original sludge sample. TTF is a function of how easily the sludge releases water and the porosity of the filter cake layer. Higher TTF values mean poorer sludge filterability, and thus a reduction in TTF values will correspond to improvement in sludge filterability.

1. Assemble the equipment. The TTF kit is comprised of lab equipment and a vacuum pump. While assembling the vacuum pump, take care to properly attach the vacuum regulator to the pump. Setting up the laboratory equipment should take 5 to 10 minutes.



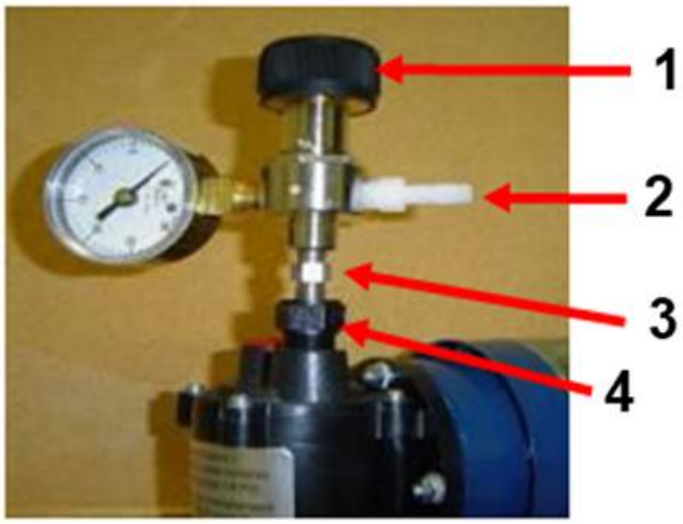
1: Buchner Funnel - size 250 mL
2: Vacuum regulator
3: Graduated cylinder
4: Vacuum pump
5: Erlynmeyer flask

Figure 5.46 - Equipment assembly

2. Assemble the vacuum pump. To do this:
    a. Wrap the supplied Teflon sealing tape around the fitting thread of all fittings to eliminate any possible leakage.
    b. Secure the 3/8 x 1/8 reducer bushing into the vacuum port of the pump without overtightening.
    c. Secure the 1” (1/8”) SS nipple into the reducer bushing.

Figure 5.47 - Vacuum pump assembly (3/8" x 1/8" bushing)

3. Attach the 1/8" x 1/4" male pipe adapter to the vacuum regulator port located 180° to the pressure gauge.
4. Secure the vacuum regulator to the vacuum pump using the port located 90° to the pressure gauge.



1: Vacuum regulator
2: 1/8" x 1/4" male hose adaptor
3: 1/8" SS nipple
4: 3/8" x 1/8" bushing

Figure 5.48 - Connecting vacuum regulator to vacuum pump

5. Assemble the lab equipment. To do this:

a. Place the graduated cylinder inside the Erlenmeyer flask.

b. Place the stem of the Buchner funnel inside the opening in the rubber stopper.

c. Move the rubber stopper up, as far along the stem of the Bucher funnel as possible.

   This will ensure an airtight seal during the measurement.

d. Place the Buchner funnel with the rubber stopper around the stem, on top of the Erlenmeyer flask.

e. Using a rubber hose, attach the Erlenmeyer flask to the male pipe adaptor of the vacuum regulator.

1: Rubber stopper

2: Buchner funnel

Figure 5.49 - Lab equipment

6. Place one 9 cm Whatman 934 AH glass fiber filter paper in the Buchner funnel and wet it to form a good seal.

7. Adjust the pressure regulator to 15” Hg (51 kPa).

NOTE *If the pressure is set to 15” Hg with little or no load on the suction side of the pump, the vacuum will vary when a sample is*

added. Before the first test, the suction side of the pump should be blocked (or Buchner funnel covered) to verify the maximum vacuum of the regulator setting.

Figure 5.50 - Connecting vacuum regulator to vacuum pump

8. Obtain a sludge sample from the membrane tank. If membrane tanks have unique sludge characteristics (in other words, sludge is not the same across all trains), a sample from each membrane tank should be obtained and tested individually.

9. Add a 200 mL sludge sample to the Buchner funnel and, using a stopwatch, record the time to filter 25, 50 and 100 mL, which corresponds to 12.5%, 25% and 50% of the initial sample.

   ***NOTE** The time required for 25 mL can be very short with good sludge (i.e. < 5 sec) and skipped if necessary.*

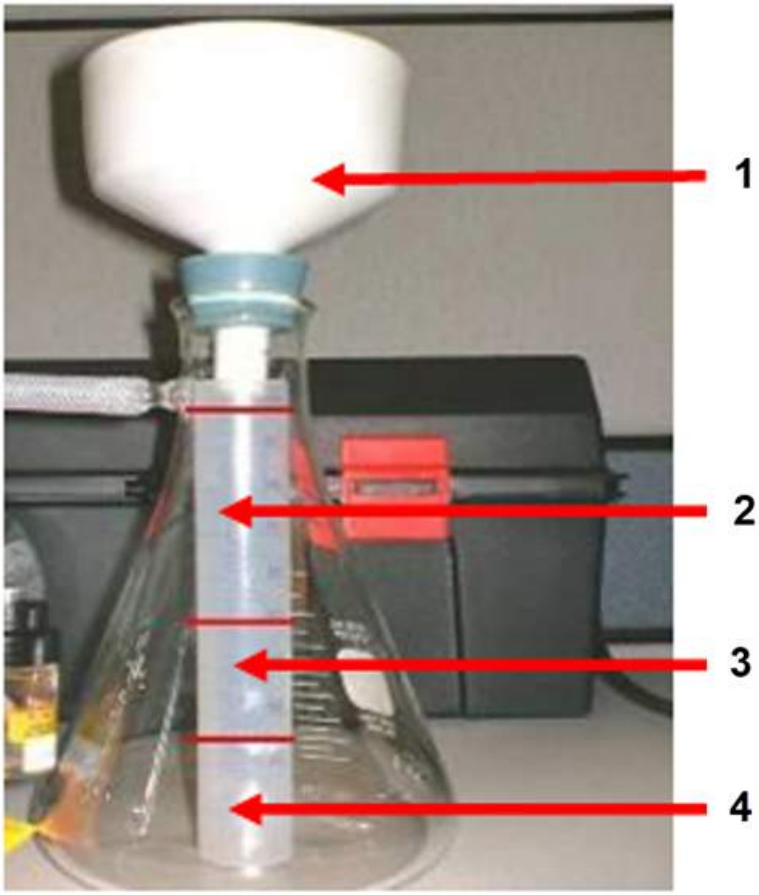


Figure 5.51 - TTF procedure

1: Add 200 mL mixed liquor into Buchner funnel

2: Time: 100 mL

3: Time: 50 mL

4: Time 25 mL

Figure 5.52 - Connecting vacuum regulator to vacuum pump

10. Determine the MLSS of the original samples and record the temperature.

Perform the test at least once or twice per week using aerobic sludge at the actual MLSS and at 10 g/L where dilution is required due to higher MLSS sample concentrations.

5.5.2.6 Important information about plant operation

- Fill in all applicable and available parameters on the TTF logsheet (see below).
- Fill in any events that coincide with changes in TTF or plant operation on the Events logsheet.

5.5.2.7 Reporting and interpreting results

The MBR Product Group is interested in obtaining TTF as well as plant operating data. This information will primarily allow us to help our clients interpret the TTF results and aid us in further understanding the impact of mixed liquor filterability characteristics on MBR plant performance. Please forward any TTF results together with plant operating data or any anomaly observations to the address below.

For technical clarification on the Time to Filter procedure and forwarding of data, contact Veolia.

To purchase kits or replacement parts contact a Veolia representative.

Sample logsheet for TTF

Table 5.6 - Sample logsheet for TTF

Date	Time	Sample No.	Sample Train TMP (psi)	Sample Train Flow	Total Plant Flow (g/d)	Mixed Liquor Temp (oF)	Mixed Liquor DO (mg/L)	MLSS (mg/L)	pH	TSS (mg/L)	BOD (mg/L)	Ammonia (mg/L)	25 mL	50 mL	100 mL

5.5.3 Sieve test for wastewater solids

The sieve test can be used to determine the amount of material that is contained in the mixed liquor of an activated sludge wastewater (WW) treatment plant. It can be used to quantify the effectiveness of the pretreatment and screening equipment of the plant. A poor sieve test result indicates that there may be a problem with the pretreatment system, while a good result indicates that the pretreatment system is likely working well.

5.5.3.1 Preparation

The sieve test requires a relatively large sample volume of mixed liquor (typically 60 to 200 L or 15 to 50 gallons). For this reason, it is important that the sample location be convenient for operator access and from safety points of view. The best sample location is typically a sample valve located on the discharge side of the mixed liquor recirculation pump.

If applicable, ensure that all personnel are properly tied off and are using fall restraint personal protective equipment (PPE) and that coordination with the applicable plant operations staff has been completed before sampling.

5.5.3.2 Equipment and tools

- Pail or bucket to collect the mixed liquor from the sample port
- Plastic gloves
- Eye protection/face shield if required
- Stack of sieves
- Clean wash water (garden hose with spray nozzle)
- Analytical balance (scale)
- Aluminum trays
- Oven (105°C)

Figure 5.53 - Equipment

5.5.3.3 Procedure

1. Assemble a stack of sieves of the following sizes (largest sieve on top):
   - 2.00 mm (ASTM No. 10)
   - 1.00 mm (ASTM No. 18)
2. Collect from a sample port and carefully pour a known volume (60 to 200 L) of representative mixed liquor through the sieves.

   The correct volume of mixed liquor to use for the test will depend on how much material is collected on the sieves. The key is to use a sample volume that is large enough to ensure that enough material is collected to be easily weighed (in other words, collect at least as much material as shown in *Figure 5.55 - Examples of collection: 2 mm sieve (left) and 1 mm sieve (right)*.

Figure 5.54 - Pouring mixed liquor through sieves

   For a very clean or very thin (low MSS) sample, this may mean a sample volume of 200 L (50 gal) or more. For a very dirty or very thick (high MLSS) sample, this may mean a sample volume of 60 L (15 gal) or less.

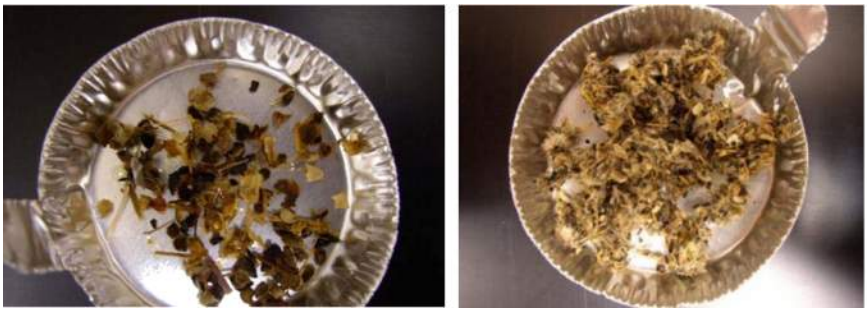


Figure 5.55 - Examples of collection: 2 mm sieve (left) and 1 mm sieve (right)

3. Pour clean water through the sieve periodically (if necessary), taking care not to lose any screenings by spraying them out of the sieves.
4. Shake the sieves gently and wash through with clean water to rinse away the biomass and to clean the collected screenings.
5. Record the weight of each of the empty trays (in grams).
6. Separately collect the screenings from each sieve, and transfer to pre-weighed aluminum trays.
7. Dry the trays of screenings in an oven at 105°C for a minimum of eight (8) hours, or overnight.
8. If the mixed liquor suspended solids (MLSS) of the sample is not known, then a separate sample of the same mixed liquor should be collected and analyzed for MLSS.
9. Weigh the trays again to determine the dry weight of the screenings. Record the weight of each tray in grams.
10. For each sieve size, calculate the screenings concentration using the following equation:

$$\frac{\text{(Weight of tray plus dry screens (grams)} - \text{Weight of empty tray (grams))} \times 1000}{\text{Sample volume (L)}} = \text{mg/L}$$

11. For each sieve size, normalize the results calculated in Step 10 for MLSS concentration using the following equation:

$$\frac{\text{Screening concentration calculated in previous step (mg/L)} \times 10{,}000\ \text{mg/L}}{\text{MLSS concentration (mg/L)}} = \text{mg/L normalized}$$

5.5.3.4 Disposal

The waste materials used in the sieve test procedure can be disposed of in the regular trash, or in the same container that is used to collect the screenings from the raw wastewater.

5.5.4 Logsheets

Logsheets, which are provided as electronic copies, are used for manually recording operational data and analytical results.

PERFORMANCE LOGSHEETS: Performance logsheets include those used for recording process data. Electronic copies of these documents will be provided by Veolia. Completed performance logsheets must be emailed to Veolia on a weekly basis to facilitate the ability of Veolia to provide guidance.

SETPOINT LOGSHEET: The setpoint logsheet is used to record all changes made to setpoints associated with the system or its various components (example: pumps). Because a complete loss of power to the system will cause the PLC to reboot using the original setpoints stored in the electronically erasable programmable read only memory (EEPROM), it is essential that this logsheet be updated whenever setpoints are changed so that the most recent values can be reentered.

5.5.5 InSight remote monitoring

InSight is a powerful remote-monitoring support tool available as an option with most Veolia systems. Contact Veolia for more information about subscribing to this service *(see 1.2.1 Available services)*.

5.6 Preventive maintenance

The information provided in this section is intended as a general preventive maintenance outline that addresses the system as a whole. This section does not cover the entire scope of work required to keep the system operating at peak efficiency.

For detailed preventive maintenance information regarding specific components (example: pumps, valves), refer to the instructions provided by that component's manufacturer *(see B Appendix: Project documents)*.

NOTICE	
	Before attempting to inspect or repair a component, read all information provided in the manufacturer's instructions *(see B Appendix: Project documents)*.
	Standby equipment (example: rotating pumps) must be placed into operation periodically to avoid equipment failure, as recommended by the equipment manufacturers. Refer to the applicable manufacturer's instructions for more information *(see B Appendix: Project documents)*.

5.6.1 Scheduling preventive maintenance

NOTICE	
	Failure to adhere to the preventive maintenance schedule outlined in this manual may render the warranty null and void.

The following schedule outlines the inspection and maintenance tasks that must be performed regularly to maintain optimal performance, and to prevent damage due to wear or corrosion.

For detailed information regarding the inspection and maintenance of specific components (example: pumps, instrumentation), refer to the instructions provided by that component's manufacturer *(see B Appendix: Project documents)*. ***Failure to perform the preventive maintenance tasks outlined in the manufacturer's instructions, and to log when these activities are performed, may impact future warranty eligibility.***

5.6.1.1 General preventive maintenance schedule

The following preventive maintenance schedule includes general procedures to be performed for all applicable assemblies and components in the system.

NOTICE	
	Perform preventive maintenance of all equipment as per the manufacturer's instructions *(see B Appendix: Project documents)*.
	Ensure that the instrument calibration schedule is strictly followed.

Table 5.7 - General preventive maintenance schedule

Task
Daily
Complete the daily logsheet.
Inspect all piping and connections for signs of leakage.
Check that all chemicals are available in sufficient quantity.
Clean any spills or debris and remove any corrosion from piping or instruments.
Confirm all components are fitted securely.
Check for leaks and excessive condensation.
Weekly
Collect a complete set of water samples.
Check the spare parts inventory and order replacements as needed*(see B Appendix: Project documents)*. The spare parts list is available upon request if it is not already included.
Check all pump seals for signs of leakage and repair as needed *(see B Appendix: Project documents)*.

Task
During production, inspect all pumps for excessive vibration or high oil temperature.
Inspect all pump motor mountings.
Review the most recent operating data and make note of any trends or changes in performance.
Check all couplings for looseness and ensure proper torque values are applied. Refer to the manufacturer's instructions for details *(see B Appendix: Project documents)*.
Monthly
Lubricate all pumps.
Inspect and calibrate all instruments. Follow manufacturer guidelines for maintenance schedule on instrumentation *(see B Appendix: Project documents)*.
Quarterly
Where possible, remove fan covers and clean dust from fans and airways using low-pressure compressed air and/or a dry cloth.
Back up the PLC processor onto the system's EEPROM memory, and copy the PLC ladder logic and operator interface design to an external archive (if applicable).
Annually
Disassemble and inspect all touchpoints (that is, locations where two components touch) for corrosion.
Disassemble and inspect all flange and gasket mating surfaces for corrosion.

Task
Where possible, inspect grounding rods for signs of wear.
Check the ground rod. Copper-clad ground rods last longer than galvanized rods. Also, check the clamp or weld connections for corrosion.
Within a Five-Year Period
Every two (2) to four (4) years, replace the PLC battery.
Every five (5) years, replace the UPS.

5.6.1.2 ZeeWeed preventive maintenance schedule

The following preventive maintenance schedule is specific to the membranes and related components.

Table 5.8 - ZeeWeed preventive maintenance schedule

Task
Daily
Measure pH of mixed liquor, membrane tank, and permeate samples.
Monthly
Confirm that aeration is normal by inspecting aeration pattern(s).
Perform ***separate*** [low-pH] and [high-pH] chemical cleans*.
Annually
Check the indicator cassette's frame and all associated components for corrosion *(see 5.6.2 General inspection)*.
Inspect the inside of the membrane tank for damage. Repair as needed.
Perform a general inspection on the indicator cassette from each train *(see 5.6.2 General inspection)*.

* Monthly initially until optimum interval is established.

5.6.2 General inspection

The general inspection procedure is used to determine the overall state of the system and its various components.

5.6.2.1 Gathering and recording information

Record the following information on the membrane map or through InStall for each cassette inspected:

- site name
- inspector's name
- inspection date
- train number
- cassette position
- cassette serial number.

In addition to collecting the information listed above, take photos at each step of the inspection and file them with the recorded findings.

Contact Veolia regarding templates that can be used to organize information collected during inspection.

After completing the inspection, submit all findings, photos, and any updated documents to Veolia.

5.6.2.2 Inspection frequency

Inspections are recommended one (1) to two (2) times per year on a single cassette from each train, using the same cassette during each inspection. This cassette, known as the "indicator cassette," acts as a sample for the entire train, eliminating the need to inspect each individual cassette.

***TIP:** After the first year of operation, inspection frequency can be adjusted based on past findings and recorded trends in system operation.*

For systems with operating temperatures greater than 30ºC (86ºF), or where there is a high possibility that suspended solids might accumulate within the membrane tanks, it is recommended that the inspection procedure be performed more frequently.

Contact Veolia for assistance with determining the optimum inspection frequency for this system.

5.6.2.3 Before removing the cassette

Record the following information before the indicator cassette is removed from the membrane tank.

Checking aeration pattern

Before the cassette is removed from the membrane tank for inspection, perform a visual examination of the aeration pattern with the water level within the membrane tank 7.62 to 10.16 cm (3 to 4 in.) above the top of the cassette. While the cassette is being aerated, a rectangular bubble pattern must be visible on the surface of the water directly above it. Note any inconsistencies, including insufficient or imbalanced air distribution.

Checking lines and connectors

Examine the following components for signs of damage or wear:

PIPING: Confirm that all piping sections connected to the cassette are in good condition. Note any cracks or discoloration and check that all connections are tight.

CONNECTORS & HOSES: Confirm that all connectors and hoses are securely attached and show no signs of wear or damage.

WARNING	
	Risk of Explosive Rupture or Violent Release Failure to tighten a coupling according to the manufacturer's required torque values may result in an explosive rupture or violent release. Following installation, inspect all couplings for tightness as part of the regular preventive maintenance process.

5.6.2.4 Removing the cassette

When removing a cassette with accumulated solids, verify the rated capacity of lifting modules, cranes, and the cassette lifting module before attempting a lift *(see 5.3.4 Lifting and moving ZeeWeed cassettes)*.

As the cassette is removed from the tank, use a weight scale to ensure that components under load are within their design capacity. Ensure that the cassette remains level throughout the lift and inspect the aeration assembly for solids accumulation.

5.6.2.5 After removing the cassette

NOTICE	
	The unauthorized alteration of equipment or parts provided by Veolia with the membrane modules may render the warranty null and void.

Record the following information after the indicator cassette has been removed from the membrane tank.

LEAP AERATION: Check for sludge accumulation on the underside of the cassette, paying particular attention to the chambers in the LEAP aerator. If sludge is present, wash it out to maintain optimum performance. Inspect the plastic construction for any damage and replace if necessary. Inspect the hardware and O-rings, and replace as necessary if anything is missing or damaged.

AERATION: Clear any blockage found in the aerators and note the location of plugged or clogged aerators on the Inspection Template. To remove blockage, the aerator will need to be removed. There is one bolt holding each aerator in place, located on the underside of the cassette towards the outer edge of the cassette. Recheck the aeration pattern after cleaning.

SHELLS: Closely examine the cassette and membranes for signs of aquatic life, particularly in the form of shells, which can be as small as 1 mm in length *(see Protecting against macro organisms)*.

Figure 5.56 - Shells

CASSETTE FRAME & HARDWARE: Check the cassette frame welds for signs of leaking or corrosion. Check all connections for loose or missing fasteners.

SOLIDS ACCUMULATION PATTERNS: Take full-length photographs of all four sides of the cassette. Note any solids accumulation on the Inspection Template. Contact Veolia if excessive solids accumulation or debris (example: twigs, leaves) is found.

Figure 5.57 - Acceptable (left) and unacceptable (right) solids accumulation

MEMBRANE FIBER SLACK: Check the amount of slack exhibited by membrane fibers in the indicator cassette *(see 5.3.6 ZeeWeed fiber slack and shrinkage)*.

5.6.3 Special requirements for ZeeWeed lifting module owners

DANGER	
	Equipment Hazard Lifting modules that have been altered are no longer rated to perform as per original factory specifications and may present a serious threat to personnel if used. Structural assessments and lift test results confirming that the altered module is safe must be provided by the lifting module's owner, in accordance with all relevant local government, industry, and facility regulations.

Customers who have purchased a lifting module are subject to the owner's responsibilities outlined under ASME code B30.20-2010. Key duties defined by this code include, but are not limited to:

TIP: *These requirements apply only to customers who have purchased one or more lifting modules.*

- regular inspection of a module that has been altered or repaired.
- regular confirmation that all necessary decals are present on the lifting module and are legible. In addition to any notices required by local government, industry, and facility regulations, these include decals that display:
  - empty (unloaded) weight
  - "Read O&M manual before using" notice
  - rated lift capacity.
- load-testing for modules that have been altered or repaired
- creation of a maintenance program

  TIP: *Refer to the relevant ASME regulations for details regarding minimum inspection requirements.*

- regular recorded service inspections in accordance with frequency of use
- creation of training programs for new operators required to work with or around lifting modules
- ensuring that modules are operated safely
- ensuring that modules are kept in compliance with ASME code B30.20-2010.

For a full outline of owner's responsibilities, refer to ASME code B30.20-2010.

5.6.4 Preventing stainless steel corrosion

A water treatment system may include various stainless steel components, such as piping and associated fittings and connectors. System operators must follow the preventive maintenance steps provided below to prevent corrosion from forming on stainless steel piping and components.

5.6.4.1 Causes of corrosion

Surface contamination and chlorine attack are the primary causes of stainless steel corrosion. Both issues can lead to serious degradation if they are not resolved quickly.

SURFACE CONTAMINATION: If stainless steel components are installed with carbon steel tools, or if they are not protected from nearby welding or grinding work, carbon steel particles may embed in stainless steel surfaces. Exposure to water that contains rust particles or to iron-laden dust and dirt can also cause surface corrosion.

CHLORINE ATTACK: Chlorine-induced corrosion can occur when chlorinated water splashes on stainless steel surfaces, or when chlorine vapors condense on these surfaces due to inadequate ventilation or high humidity.

CREVICE LOCATIONS: Any point where two components touch, and where condensation or moisture may gather, can be considered a crevice location. Streaks of rust that appear to originate from within a crevice location may be indicators of more extensive corrosion that can only be

exposed by disassembling the components, so regularly disassembling and inspecting crevice locations is recommended.

5.6.4.2 Protecting against corrosion

Take the following precautions to reduce instances of stainless steel corrosion:

CLEAN REGULARLY: Stainless steel piping and components must be kept clean and dry. Keep potential contaminants (example: solvents, carbon steel tools), away from stainless steel components.

MINIMIZE CONTACT: Protect stainless steel surfaces from contact with chlorinated water, and remove contamination as soon as it is observed. Avoid performing tasks such as welding or grinding near stainless steel components. If this sort of work must be done near a stainless steel surface, ensure that it is properly protected.

HANDLING AND INSTALLING COMPONENTS: Properly weld and passivate new or repaired piping. Avoid the use of different metal fasteners and joining components. Ensure that the interior and exterior surfaces of new components are thoroughly cleaned before installation.

If excessive condensation appears on piping surfaces, adjust the ventilation system or add dehumidification measures.

5.6.4.3 Detecting, cleaning and repairing corrosion

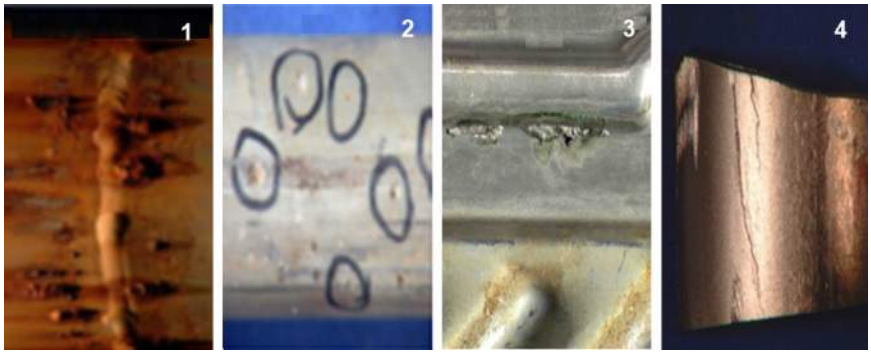
The following sections include recommendations on detecting, cleaning, and repairing corroded or contaminated components.

Detecting embedded iron

The simplest test for free, embedded iron is to wash down the stainless steel part with clean water, allow it to dry (or drain), and wait 24 hours. If there are rust streaks on the surface of the stainless steel, iron is present.

The following list provides examples of corrosion and where they may occur:

- any rust found on stainless steel
- streaks of rust coming from behind a crevice location (that is, a location where two components touch)
- pitting patterns, especially in the vicinity of a weld or weld Heat Affected Zone (HAZ)
- cracking, which may be revealed with a dye penetrant.



1: Tubercle mounds along a weld

2: Pitting

3: Crevice corrosion at a gasket edge

4: Stress corrosion cracking (SCC)

Figure 5.58 - Examples of corrosion

The ferroxyl test is a more sensitive indicator of embedded iron. To perform this test, apply a ferroxyl solution with a spray bottle, and then check for a blue stain within 15 seconds of the application. A blue stain will indicate iron contamination.

Table 5.9 - Ferroxyl test solution ingredients

Ingredient	Amount
Distilled Water	1,000 mL
Nitric Acid, 60-67%	20 mL
Potassium Ferricyanide	30 g

CAUTION

Chemical Hazard

When handling this test solution, wear chemically-protective gloves, protective clothing, and a face shield. Avoid inhaling the atomized spray. For additional safety information, refer to the SDSs for the chemicals used to create the solution.

Prepare the solution specified in the table above by first adding the nitric acid to the distilled water, mixing well, and then adding the potassium ferricyanide. Once prepared, apply the ferroxyl solution to the stainless steel.

Cleaning and repairing surface corrosion

NOTICE

Do not allow cleaning compounds to fall into tanks or other vessels.

Any corrosion found on a stainless steel surface can be removed by scrubbing with the appropriate wire brush. After the oxidized areas have been brushed clean, apply a pickling paste to the affected area to chemically clean the surface and remove any embedded contaminants.

For extensive corrosion, consider a hot water, high-pressure wash application to remove the majority of contaminants first.

Table 5.10 - Effective cleaning methods

Task	Cleaning Agents	Notes
Routine cleaning	Warm water, soap, ammonia, and detergent	Apply with a sponge or soft cloth.
Smears and fingerprints	3M Stainless Steel Cleaner and Polish, Arcal 20, Lac-O-Nu, Lumin Wash, Stainless Shine	Provides a barrier film to minimize fingerprints.
Stubborn stains and discoloration	3M Stainless Steel Cleaner and Polish, Twinkle, Liquid Nu Steel, Household Cleaners	Using a dry or damp cloth, rub lightly in the direction of the polish lines of the stainless steel.
Grease and oil	Any good commercial detergent or caustic cleaner.	Apply with a sponge or soft cloth in the direction of the polish lines of the stainless steel.

There are various protective coatings that can be used as an added precaution to help prevent stainless steel contamination and corrosion. Clear lacquers are preferred over the colored lacquers and paints, as they allow the operator to check the condition of the stainless steel surface below the coating.

6 Troubleshooting

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6.1 About this section

This section provides information regarding some of the most common issues and frequently asked questions related to this system and its associated components.

Several training courses related to troubleshooting techniques and skills are available upon request. For more information, contact Veolia.

6.2 General precautions

CAUTION	
	General Hazard Failure to observe the following precautions may result in injury or damage to the system.
	General Hazard Proper Personal Protective Equipment (PPE) must be used when carrying out troubleshooting activities involving hazardous materials or situations. Procedures must be developed by the end user to address potential hazards and the PPE required for those situations.

NOTICE	
	Address any questions about the cause or response to a system problem to Veolia field services. Completed daily operating logsheets will be necessary to help determine the cause.

Observe the following precautions at all times while attempting to resolve issues with the system:

- When working with a system or component that contains stored energy (example: a pressurized line, a VFD panel with a residual electric charge), ensure that the energy has been discharged from all associated components and piping before beginning work. For example,

when working with valves connected to compressed air lines, the line must be fully disconnected from the valve before work may begin. Simply actuating the valve does not sufficiently depressurize the line.

- All routine troubleshooting must be performed according to the safety regulations and instructions specified by the component's manufacturer. Read all relevant safety information provided in the manufacturer's instructions before attempting repairs *(see B Appendix: Project documents)*.
- Wear suitable protective equipment when working with pumps, piping, or other components that may have contained caustic or acidic chemicals.

In the event of a contradiction between information provided in this section and that supplied by the manufacturer, the manufacturer's information will always take precedence.

Always use the manufacturer's literature for troubleshooting instructions for specific components *(see B Appendix: Project documents)*.

CAUTION	
	Equipment Hazard Do not change system operating parameters to address any problem where the cause cannot be identified. This may serve to mask operating problems and damage equipment.

6.3 Troubleshooting quick-reference

The solutions provided in this manual address common issues related to this [system or stack]. This information is intended only as a brief summary and does not cover all possible issues and scenarios. For more detailed troubleshooting information regarding a specific component, refer to the manufacturer's instructions *(see B Appendix: Project documents)*.

In the event of a contradiction between troubleshooting information provided in this manual and information supplied by the manufacturer, the manufacturer's information will always take precedence.

In the troubleshooting procedures provided in this manual, when instructed to “check” a component, ensure that the following actions are performed where applicable:

- Examine any and all electrical, signal, hydraulic, and pneumatic connections for corrosion, loosening, or breakage.
- Inspect electrical wiring for short-circuits and poor connections.
- Examine fuses for continuity.
- Examine switches for proper positioning and operation.

In situations where the cause of a problem is not clear, or where process changes appear to be required, contact Veolia before making any significant changes to operating parameters.

If the problem caused a system shutdown, after addressing all possible causes, restart the system. If the system restarts and runs normally for approximately 30 minutes, the problem has been corrected or was transitory. If another system shutdown is triggered, stop all operation and contact Veolia. Completed operating logsheets will be necessary for Veolia representatives to determine the cause of the issue.

WARNING	
	Not To Be Serviced By Users Troubleshooting procedures involving mechanical or electrical components must be performed only by qualified personnel.
	Refer to Manual All operators must familiarize themselves with the applicable safety information before performing any of the procedures outlined here.

The following table provides troubleshooting information for the ZeeWeed membranes and related components.

Table 6.1 - ZeeWeed troubleshooting quick-reference

Cause	Corrective Action
Low Flow Shutdown	
Flow valve or solenoid valve downstream of pump discharge is closed	Check valves for correct operation
Hand valves on pump discharge are throttled or closed	Verify correct position of hand valve, as per P&IDs
High TMP Shutdown (Low Pressure)	
Hand valve upstream of pump inlet is throttled or closed	Verify correct position of hand valve, as per P&IDs
System recovery has drifted to higher than designed limit	Compare current with design system recovery
Membranes require cleaning	
PID tuning overshooting the flow or pressure control setpoints after backpulse	Contact Veolia
header pressure transmitter or any of the membrane tank level float switches malfunctioning	Check instrument calibration; check readings on HMI
High-Pressure Shutdown (Backpulse)	
Hand valve upstream of pump inlet is throttled or closed	Verify the correct position of hand valves, as per P&IDs
Timers for pressure shutdowns too quick	Contact Veolia
Level Problems (Analog)	
Failed 24 V DC power supply	Verify power supply outlet

Cause	Corrective Action
Problems with moisture in probe	Check probe seals
Level Problems (Digital)	
Switch compromised by chemicals	Inspect switch
Blown fuse	Inspect fuses, replace as needed
Switch programmed incorrectly	Verify switch input to PLC compared to program
Leaking or Cut Fiber	
Damaged fiber	Repair fiber .

6.4 Permeate quality

Several issues may result in reduced permeate quality, though the most common are damaged membranes and a leak in the cassette seal. The following information can be used to address both of these problems.

6.4.1 Membrane damage

To determine if membrane fibers have been damaged, examine the permeate from each membrane cassette, taking particular note of the permeate turbidity and comparing current readings to historical trends. If the permeate does not meet acceptable standards, it is likely that a module within that cassette contains one or more damaged fibers. After identifying the cassette, locate the damaged module by either visual fiber inspection or by conducting a bubble test *(see 4.9.1 Bubble test)*. Inspect and repair or replace any damaged modules to bring the overall system performance up to appropriate levels .

6.4.2 Cassette seal leakage

A leak in a cassette seal may be the result of either improper installation or gradual loosening during operation. Check these connections periodically to

ensure that they are properly installed and to avoid permeate contamination by mixed liquor.

6.5 Troubleshooting components

This section provides guidance for issues that are common to some system components.

6.5.1 [Permeate or Process] pump

Certain types of pumps will lose their prime if excessive amounts of air enter the flow. Water in contact with air at atmospheric pressure naturally contains dissolved gases. After the water crosses the membrane boundary, the lower pressure encountered within the membranes reduces the solubility of these gases, creating bubbles in the permeate flow.

This system includes an air-extraction assembly designed to remove entrained air from the permeate flow before it encounters the [permeate or process] pump. However, if a leak has developed, or if TMP levels are too high, this may not always prevent air from disrupting the pump's operation.

PROBLEM: The [permeate or process] pump will not achieve prime due to air inside permeate header or pump intake line.

Possible causes include:

- air leaks along piping
- cracks or missing seals along permeate piping
- failed check valves
- valves that may allow air to enter the permeate header (example: permeate sample valves) are not closed properly
- excessive TMP.

Recommended solutions include:

- Close all valves that may allow air to enter the permeate header.
- If a leak is suspected, use a spray bottle to coat fittings and piping along the permeate header with a soap solution and watch for soap bubbles

formed during a backpulse sequence (when the header is positively pressurized). After locating the leak(s), repair or replace damaged connectors, fittings, or piping as needed.

- Ensure that the backpulse tank volume is well above the discharge point on the tank.
- Determine if the air release valve rubber seat has become stuck. If so, it will prevent air from being vented from the permeate header.
- The higher the TMP, the greater the likelihood of air being pulled across the membranes. If high TMP is suspected of causing excessive entrained air within the permeate header, initiate a chemical clean to restore TMP to an optimal level.
- Request a program change to ensure that flow valves remain open in STANDBY.

6.5.2 Air release valves

PROBLEM: Air cannot be removed from the permeate header, due either to the air release valve seat sticking in the top discharge port on the valve housing, or blockage inside the orifice port.

Possible causes include:

- Rust formed on the internal surface of the air release valve is preventing the float from rising and falling freely inside the housing.
- The seat is set too far away from the top side of the support arm.
- Flakes of rust from a non-epoxy–coated air release valve housing have broken free and lodged in the orifice vent, creating a blockage and preventing air from being removed from the air separator.

Recommended solutions include:

- Shut down the train, remove the air release valve housing cover, and inspect the interior surface of the air release valve. Ensure that the valve fits snugly against the orifice and check for rust. If rust is present, refer to the manufacturer's instructions for additional troubleshooting

information *(see B Appendix: Project documents)*.

- Ensure that the float moves freely inside the air release valve housing. If not, remove any obstructions preventing movement.

6.5.3 Aeration components

Proper aeration during backwash is essential for normal operation. To avoid aeration problems, ensure that air filters are replaced in accordance with the manufacturer instructions *(see B Appendix: Project documents)*, and regularly inspect all air connections and piping for damage. Immediately repair any damaged or worn aeration components found during inspection.

6.5.4 Chemical metering pumps

WARNING	
	Pressurization Hazard Use extreme caution when working with or around chemical pumps and associated piping, as significant pressure can build within a blocked discharge line.
	Wear Personal Protective Equipment Proper protective equipment must be worn at all times (goggles, gloves, and a suitable splash apron at minimum).

PROBLEM: The chemical metering pump has lost pressure.

Possible causes are:

- associated valves are malfunctioning
- pump is malfunctioning.

Recommended solutions include:

- After ensuring that the pump is deactivated and that all associated lines are depressurized, remove the foot valve from the pump inlet and

ensure that no blockage has formed around it or the inlet. After reinstalling the foot valve, perform the same check on all ball valves associated with the chemical skid.

- After inspecting the valves, if the pump still does not operate properly, consult the associated manufacturer's instructions *(see B Appendix: Project documents)*.
- If the manufacturer's instructions do not provide a solution, contact Veolia for further assistance.

6.5.5 General component failure

If a component has failed and cannot be repaired by performing maintenance and troubleshooting procedures as outlined in the manufacturer's instructions *(see B Appendix: Project documents)*, ensure that the component has been locked out (if applicable), and then record the make, model, part number, and tag number *(see 1.1.1 Locking out components)*.

After isolating and documenting the component, check the Recommended Spare Parts List (RSPL) for parts availability and contact Veolia to order a replacement.

6.5.6 Bioreactor foam

Increased foaming conditions in the bioreactor may be caused by a foaming agent in mixed liquor or a limit on one of the required components for biological oxidation. Limiting feed COD, insufficient DO or limiting nutrients may decrease organism activity. Each of these conditions must be evaluated if foaming becomes an issue.

If foaming becomes excessive, ensure that the foam control sprayer is operating properly to prevent foam from spilling out of the bioreactor. If extreme foaming is occurring and the sprayer cannot control it, contact Veolia for assistance.

Foam escaping from the bioreactor may release biomass, reducing the bioreactor's TS and VS levels. Depending on the extent of the foam spill, this may reduce the system's ability to treat mixed liquor.

Following a foam spill, the bioreactor TS and permeate COD must be measured to determine the extent of the biomass loss and the impact on permeate quality. If the effluent quality is unacceptable and the bioreactor TS concentration has decreased significantly, the feed rate must be reduced, if possible, to maintain normal operating parameters.

Strategies for minimizing bioreactor foam generation include the following:

CONTROLLING BIOREACTOR TEMPERATURE: Maintaining an optimum temperature within the bioreactor is an effective way of controlling foam production. The bioreactor is designed with an ideal operating range of 20 to 35ºC (68 to 95ºF). Temperatures greater than 35ºC (95ºF) can contribute to foaming and must be avoided.

REMOVING SLUDGE FROM TOP OF BIOREACTOR: Foam-generating substances created during production may concentrate near the surface of the bioreactor. If this occurs, sludge wasting from the top of the bioreactor using a vacuum to collect material will assist in reducing the effect these substances have on foam buildup. Ensure that collected waste is stored and disposed of properly.

REDUCING SLUDGE AGE: Foam is more likely to develop as sludge ages. If the TSS level is used as a measure of sludge age, the MLVSS concentration must also be checked regularly (monthly at minimum). TSS indicates the level of both organic and inorganic solids, whereas MLVSS measures only organic solids. Therefore, the MLVSS level is the true measurement for sludge age. A reduced MLVSS level indicates a higher likelihood that foam will develop.

PROBLEM: Foam.

Possible causes are:

- Anaerobic bacteria are reacting to aeration or presence of filamentous bacteria.
- Aerobic bacteria are stressed or dying.
- Detergents are present.
- Grease or floating material is present.

Recommended solutions include:

NOTICE

Never reduce the ZeeWeed membrane aeration level.

- Reduce bioreactor aeration. After stable operation is achieved at a lower aeration, slowly return the aeration to normal levels.
- Attempt to knock down the foam.
- Address any obvious process problems.

The preferred method of foam control in MBR systems is through the use of design features that provide continuous or periodic foam removal, typically as part of the waste sludge system. In some cases, these design features are not included in the plant design, or are insufficient. In these situations, foam can be controlled through the use of a chemical antifoam product.

Antifoam products must meet the following criteria:

- effective for the specific type of foam that has developed
- compatible with system components downstream (example: ZeeWeed modules)
- must not foul the ZeeWeed membranes.

For a list of approved antifoam products to use with ZeeWeed MBR systems, contact Veolia and ask for *TechNote GPM-60 ZeeWeed 500 1000 1500 Chemical Compatibility*.

NOTICE

Consult Veolia before using antifoam products not included in the list.

6.5.7 Bioreactor performance

Bioreactor Dissolved Oxygen (DO) and Oxygen Uptake Rate (OUR) can be used as indicators when determining the cause of a change in bioreactor performance. Factors contributing to changes in bioreactor performance are outlined in the following sections.

6.5.7.1 Increased dissolved oxygen and decreased oxygen uptake rate

The most likely cause of an increase in bioreactor DO and a decrease in OUR is a sudden decrease in the Chemical Oxygen Demand (COD) loading.

- Check the F:M ratio to confirm that it is within typical limits.
- Check the bioreactor pH and temperature. If the pH is not within 7.0 to 8.5, adjust the pH by adding an approved acidic or caustic chemical as needed.
- Verify the pH controller and sensor.
- Check the temperature of the bioreactor. Low temperatures outside the ideal operating range will slow biological activity and increase the DO level.
- To verify the system is receiving sufficient nutrients, check the UF permeate for residual ammonia and phosphorus. If there is less than 2 mg/L of either substance, increase nutrient dosage.

If OUR remains low, check mixed liquor composition. Some substances (example: sodium hypochlorite) will inhibit or destroy the biological population. If such substances are found within mixed liquor, additional pretreatment measures may be required to remove them before mixed liquor enters the bioreactor. Contact Veolia for more information.

6.5.7.2 Decreased dissolved oxygen and increased oxygen uptake rate

A decrease in DO and increase in OUR could be caused by an increase in F:M ratio, microbial activity, and oxygen demand.

- Increase the aeration rate to maintain the average DO and meet the higher oxygen demand.
- Determine the F:M ratio. If poor permeate quality persists and the F:M ratio has increased, decrease the F:M ratio by reducing the mixed liquor flowrate, if possible, or allow the bioreactor Volatile Suspended Solids (VSS) or Volatile Solids (VS) concentration to increase.

6.5.7.3 Bioreactor pH

An unsuitable bioreactor pH (outside the range of 7.0 to 8.5) could reduce permeate quality. If the pH is outside of this range and/or the effluent COD is significantly increased, the pH sensor must be checked and recalibrated. If the pH controller is malfunctioning and the source of the problem cannot be rectified, the bioreactor pH can be adjusted manually by slowly adding an approved acid or base to the bioreactor until the desired pH is achieved.

6.5.7.4 Bioreactor temperature

An extreme temperature change (example: increase or decrease of 6.7ºC (20ºF) could reduce permeate quality. If the temperature is outside of the normal range 29.4 to 40.5ºC (85 to 105ºF) and/or the permeate COD has increased significantly, corrective action must be taken. Contact Veolia for more information.

6.5.7.5 Bioreactor dissolved oxygen

For the anoxic zone, the bioreactor DO should be operated at 0.2 to 0.5 mg/L. For the anaerobic zone, the DO should be operated at 1.5 to 2.0 mg/L. Sometimes it can do well at 1.0 to 1.5 mg/L, but the effluent ammonia must still remain below 1 mg/L. This helps inhibit the growth of anaerobic bacteria. If the DO has increased or decreased significantly and permeate

quality has become unacceptable, take corrective action to return the DO level to the above range.

Some corrective actions include (but are not limited to):

- checking blower flow to ensure the blowers are providing enough air
- checking for local dead pockets to determine if the diffusers are clogged
- checking the COD/BOD and TKN values to make sure they are within the design range.

Check and correct the issues. If the issue is due to high organic load, reduce the flow rate to the bioreactor temporarily until the DO is restored.

6.5.7.6 Bioreactor TSS

Generally, TSS levels should be at 8,000 mg/L or less. The maximum bioreactor TSS concentration is application-specific, but should never exceed 12,000 mg/L. If problems associated with high TSS levels are occurring, reduce the TSS levels by removing bioreactor contents.

If the bioreactor TSS has decreased significantly and no clear cause can be identified, other sources of biomass loss must be investigated (example: process pump seal or piping leak).

6.5.7.7 Bioreactor nutrients

Soluble nutrients, particularly nitrogen and phosphorus, are required for biological growth. To ensure that sufficient nutrients are available, examine permeate for ammonia, TKN, and soluble phosphorus. If permeate contains more than 1 mg/L of each of these substances, sufficient nutrients are available for biological growth. If not, nutrient addition rates must be increased.

If permeate contains these substances in greater quantities than 10 mg/L, reduce the nutrient addition rates. This is particularly important if there are criteria regarding the amounts in which these substances can be present in permeate.

6.5.7.8 Bioreactor recovery following an upset condition

An upset condition is defined as any phenomenon that inhibits, destroys, or removes the biological population such that it can no longer function properly and achieve the COD, BOD, or ammonia discharge criteria. Many of the upset conditions are outlined above and include extreme pH or temperature shifts, the presence of microbial inhibitory or toxic compounds, or the loss of significant quantities of biomass through foam spills or other means.

If an improper operating condition is present (example: extreme pH or temperature), the condition must be corrected. After the situation has been rectified, the biological population will generally return to normal operation in a short period of time. Recovery time will depend on the severity of the upset condition, and can vary from hours to days.

During the upset condition, the effluent COD, BOD, and ammonia may increase. In the recovery period, the mixed liquor flowrate could be reduced, if feasible, to assist in maintaining acceptable COD and BOD levels.

In cases where the upset has resulted in the destruction or loss of biomass, longer recovery period will be required to allow the microbial population to multiply and return to normal levels. If feasible, the feed rate could be reduced in the recovery period to maintain the normal F:M ratio.

6.5.8 Enhanced coagulation process

Very low pH (less than 3) will foul membranes within hours due to inorganic fouling. Chlorine cannot clean inorganic fouling. A soak period using an acid solution at a pH level of 2.2 to 2.5 is required.

PROBLEM: Sudden drop in pH.

Possible causes include:

- overdose of coagulant
- overdose of acid
- underdose of base
- change in mixed liquor alkalinity.

Recommended solutions include:

If the membranes are not fouled:

1. Stop permeation.
2. Adjust the pH of concentrate to desired value using an approved acid or base. If chemicals are not available, drain the tank to waste and refill.
3. Aerate for at least 20 to 30 minutes.
4. Start permeation while keeping a close watch on pH.

If the membranes are fouled, performing an acid clean will recover most of the membranes' integrity.

PROBLEM: Unexpected gradual decline in permeability.

Possible causes include:

- operating outside design flux
- the recovery is too high; check the reject flow
- feed organics or color have changed
- issue with pH setpoint or calibration of pH probe
- air distribution problem
- solids accumulation on membranes has increased. (Dense or de-watered solids in the fiber bundle.)

Recommended solutions include:

NOTICE	
	Do not use a high-pressure hose when rinsing solids from the membranes.

- Up to 20.32 cm (8 in.) of solids accumulation is within the normal range. For solids accumulation on membranes, drain the membrane tank while aerating. Rinse out the tank before performing a chemical clean.

PROBLEM: High particle counts or turbidity.

Possible causes are:

- post-flocculation in enhanced coagulation environment.

Recommended solutions include:

- Post flocculation, which is the precipitation of iron or aluminum salts, is controlled by adjusting pH.

6.5.9 Backpulse tank alarm

PROBLEM: The Backpulse tank level low low alarm has triggered. The pump is set in the STOP state.

Possible causes include:

- Backpulse tank level is at or below the low low setpoint.

To resolve this issue:

1. Check the level in the Backpulse tank. If the level is not low, then the transmitter is not functioning correctly. Refer to the manufacturer's instructions for troubleshooting procedures. (missing or bad snippet)

   TIP: *For detailed information regarding a particular valve's location or natural state, refer to the technical drawings. (missing or bad snippet) For operation and maintenance information, refer to the manufacturer's instructions. (missing or bad snippet)*

2. Ensure that all valves associated with the Backpulse tank are functioning correctly by confirming the following points for each valve:

   - The valve actuates correctly when triggered.
   - The valve returns to its natural state when the system is deactivated.
   - The valve shows no obvious signs of damage or wear.

3. When the level of the Backpulse tank returns to the operating level, switch the pump back to AUTO.

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A Appendix: Certificates and declarations

For a copy of the applicable Veolia management system certification, see the following page or pages.

Current issue date:	15 February 2024	Original approval(s):
Expiry date:	2 January 2027	ISO 9001 - 24 March 2020
Certificate identity number:	10583753	ISO 14001 - 24 March 2020
		ISO 45001 - 2 December 2020

Certificate of Approval

This is to certify that the Management System of:

Veolia Water Technologies & Solutions (UK) Limited Partnership

Hydro House, Newcombe Way, Orton Southgate, Peterborough, PE2 6SE, United Kingdom

has been approved by LRQA to the following standards:

ISO 9001:2015, ISO 14001:2015, ISO 45001:2018

Approval number(s): ISO 9001 – 0019565, ISO 14001 – 0079355, ISO 45001 – 00026382

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

The scope of this approval is applicable to:

Research & development, sales, onsite product and application support, commercial operations, customer care, design, engineering, project management, procurement, manufacturing, assembly, warehousing, installation, commissioning, laboratory analysis, remote technical support, field service and support, operation of water treatment plants, remote monitoring, diagnostics and analytics, mobile water treatment equipment, analytical laboratory process control instruments, distribution of analytical reagents and reference standards, as applicable to the following industries: Chemical Processing, Facilities, Refining, Food & Beverage, Microelectronics, Metals & Mining, Municipal, Pharma & Life Sciences, Power, Pulp & Paper, Upstream Oil & Gas and others in need of water and process treatment solutions.

Marta Escudero

Regional Director, United Kingdom and Americas (UKAM)

Issued by: LRQA Limited

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Issued by: LRQA Limited, 1 Trinity Park, Bickenhill Lane, Birmingham B37 7ES, United Kingdom

Certificate identity number: 10583753

Certificate Schedule

Location	Activities
Veolia Water Technologies & Solutions (UK) Limited Partnership Hydro House, Newcombe Way, Orton Southgate, Peterborough, PE2 6SE, United Kingdom	**ISO 9001:2015, ISO 14001:2015, ISO 45001:2018** Central Office for the ISM Management System.
Monsal Limited OSC Building, Hydro House, Newcombe Way, Orton Southgate, Peterborough, PE2 6SE, United Kingdom	**ISO 9001:2015** Development, engineering, design, management of build, construction and commissioning of advanced anaerobic digestion products, technologies and solutions that treat wastewater sludges and organic waste converting them into Biogas, Bioenergy and digestate products.
Veolia Water Technologies & Solutions (UK) Limited Partnership / ES Business Newcombe Way, Orton Southgate, Peterborough, PE2 6SE, United Kingdom	**ISO 9001:2015, ISO 45001:2018** The design, Installation, Regeneration, Operation and Maintenance of Water Treatment systems for Industrial Applications.
Veolia Water Technologies & Solutions (UK) Limited Partnership / CMS Business Newcombe Way, Orton Southgate, Peterborough, PE2 6SE, United Kingdom	**ISO 9001:2015** Sales, design and developing, engineering, procurement, distribution and servicing of process and water treatment speciality chemicals, laboratory reagents and laboratory supplies. Sales, design, delivery and servicing of treatment programs; assembly and field service of delivery systems for process and water treatment speciality chemicals.
Veolia Water Purification Systems Ltd. Bandet Way, Thame, OX9 3SJ, United Kingdom	**ISO 9001:2015, ISO 14001:2015, ISO 45001:2018** Design, manufacture, sale, installation, commissioning, service and distribution of water treatment systems, equipment and products. For industrial, scientific, laboratory medical and healthcare sectors. Technical support and training services.
Veolia WTS Belgium SA/NV Parc Industrial des Hauts-Sarts, Rue de Hermée 175, 4040 Herstal, Belgium	**ISO 9001:2015, ISO 45001:2018** Sale. execution / delivery of services for water treatment

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Certificate Schedule

Location	Activities
	facilities and provision of associated services such as operation, maintenance and installation of water treatment facilities. Sale and operation of mobile units for water treatment. Managing operations of investment for industries under contract BOT for water treatment plants and ancillaries.
Veolia Water Technologies & Solutions Belgium Toekomstlaan 54, 2200 Herentals, Belgium	**ISO 9001:2015, ISO 14001:2015** Manufacture, Distribution and Storage of Water and Process Treatment Chemicals.
Veolia Water Technologies & Solutions Belgium Herentals Sales Office Toekomstlaan 54, 2200 Herentals, Belgium	**ISO 9001:2015** Sales, engineering, manufacturing, procurement, distribution and servicing of process and water treatment speciality chemicals.
Veolia Water Technologies & Solutions Belgium Interleuvenlaan 25, 3001 Haasrode, Belgium	**ISO 9001:2015** Purchasing for chemical and feed equipment; product compliance and marketing. Laboratory and analytical services for water process system solutions.
AQUASOURCE Avenue Didier Daurat 20, BP 4050, 31029 Toulouse Cedex, France	**ISO 9001:2015** Design, Sales, Supply and Installation of Ultrafiltration Systems, Equipment and Services.
Veolia WTS France Siège social sis 1, Place Montgolfier - Immeuble L'Aquarene, 94417 Saint-Maurice, France	**ISO 9001:2015, ISO 14001:2015** Sales, Design, Delivery and Servicing of Treatment Programs; assembly and field service of delivery system for process and water treatment speciality chemicals.
Veolia Water Technologies & Solutions Eau Industrielle Siège social sis 1, Place Montgolfier - Immeuble L'Aquarene, 94417 Saint-Maurice, France	**ISO 9001:2015, ISO 14001:2015** Operation and maintenance of water treatment industry.

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Certificate identity number: 10583753

Certificate Schedule

Location	Activities
OZONIA France WT, Siege social sis 1, Place Montgolfier - Immeuble L'Aquarene,, 94417 Saint-Maurice, France	**ISO 9001:2015** Design, sale, supply and installation of Ozone systems, products, equipment and services.
Veolia Water Technologies & Solutions Eau Industrielle 2/4 avenue des Canuts, 69120 Vaulx en Velin, France	**ISO 9001:2015, ISO 14001:2015** Operation and maintenance of water treatment equipment under BOT Contract.
Veolia WTS France 2/4 avenue des Canuts, 69120 Vaulx en Velin, France	**ISO 9001:2015, ISO 14001:2015** Sales, Design, Delivery and Servicing of Treatment Programs; assembly and field service of delivery system for process and water treatment speciality chemicals.
Veolia Water Technologies & Solutions Eau Industrielle 'Immeubles' Le Leeds – 253 Boulevard de Leeds, 59777 Lille, France	**ISO 9001:2015, ISO 14001:2015** Operation and maintenance of water treatment equipment under BOT Contract.
Veolia WTS France Rue Paul Sabatier 44, 71530 Crissey, France	**ISO 9001:2015, ISO 14001:2015** Manufacturing, procurement, distribution and servicing of process and water treatment speciality chemicals.
Veolia WTS Germany GmbH Daniel-Goldbach-Straße 17-19, 40880 Ratingen, Germany	**ISO 9001:2015** Sales of process and water treatment programs, speciality chemicals, laboratory supplies and equipment. Design and servicing of process and water treatment speciality chemicals. Design, sales, service and commissioning of physical water and waste water treatment equipment.
Veolia WTS Germany GmbH Salegaster Chaussee 1 (Gebäude H675), 06803 Bitterfeld-Wolfen, Germany	**ISO 9001:2015, ISO 14001:2015** Manufacturing and application technology of RO Membranes.

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Certificate Schedule

Location	Activities
Veolia Water Hungary Kft Vigadó u. hrsz.: 2011, 2800 Tatabanya, Hungary	**ISO 9001:2015, ISO 14001:2015, ISO 45001:2018** Procurement, engineering, manufacturing, and service of synthetic membrane products, including UF and RO elements. Research and development of membrane technologies, delivery of complete water and wastewater treatment systems including design, assembly, execution, contract management, maintenance and service. Distribution of analytical lab instruments and spare parts. Distribution and manufacturing of corresponding standards and reagents. Servicing of analytical lab instruments.
Veolia Water Hungary Kft Bláthy Ottó u. 4., 2840 Oroszlány, Hungary	**ISO 9001:2015, ISO 14001:2015, ISO 45001:2018** Procurement, engineering, manufacturing, and service of synthetic membrane products, including UF and RO elements. Distribution of F&M products. Research and development of membrane technologies. Delivery of complete water and wastewater treatment systems, including design, assembly, execution, contract management, maintenance, and service.
Veolia Water Hungary Kft Vaci Greens Building A, Vaci ut 117-119, 1138 Budapest, Hungary	**ISO 9001:2015** Customer care activities.
Veolia WTS Italy S.R.L Via Broletto 46, 20121 Milan, Italy	**ISO 9001:2015, ISO 14001:2015** Sales, design and developing, engineering, manufacturing, procurement, distribution and servicing of process and water treatment speciality chemicals, laboratory reagents and laboratory supplies. Sales, design, delivery and servicing of treatment programs; assembly and field service of delivery systems for process and water treatment speciality chemicals.
Veolia WTS Belgium SA/NV Ekkersrijt 8817, 5692 JW Son En Breugel,	**ISO 9001:2015, ISO 45001:2018**

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Certificate Schedule

Location	Activities
The Netherlands	Operation and maintenance of water treatment facilities, plus related services.
Veolia WTS Belgium SA/NV Willem Barentszweg 4, 5928 LM Venlo, The Netherlands	**ISO 9001:2015, ISO 45001:2018** Sale. execution / delivery of services for water treatment facilities and provision of associated services such as operation, maintenance and installation of water treatment facilities. Sale and operation of mobile units for water treatment. Managing operations of investment for industries under contract BOT for water treatment plants and ancillaries.
Veolia Water II Technologies & Solutions Portugal, Unipessoal LDA Rua General Ferreira Martins nº 8 – 2º, 1495-137 Lisbon, Portugal	**ISO 9001:2015** Sales, onsite product and application support, commercial operations, engineering, project management, field service and support, operation of water treatment plans, remote monitoring, diagnostics and analytics, mobile water treatment equipment, analytical laboratory process control instruments across all industries requiring water, wastewater and process treatment solutions.
Ionics Iberica S.L.U Oficina Santa Cruz, Avda. Manuel Hermoso Rojas 4, Torre I oficina 11, 38003 Santa Cruz de Tenerife, Spain	**ISO 9001:2015, ISO 14001:2015** Commercial activities (proposals), project management, production, assembly, installation, commissioning, servicing, provision of mobile water treatment systems, field service activities, remote technical support, operation and maintenance of water treatment plants.
Water & Process Technologies & Solutions Spain SLU Santa Leonor 39, 28037 Madrid, Spain	**ISO 9001:2015** Sales, commercial operations, engineering and project management.
Veolia Water Technologies and Solutions Spain S.L. AV Hermanos Bou S/N - Entrada Campos Federativos, 12003 Castellòn, Spain	**ISO 9001:2015, ISO 14001:2015** Design, assembly, installation, maintenance and technical support of drying units and other equipment for the treatment of wastewater, sludge, and biomass,

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Certificate Schedule

Location	Activities
	including heat pump technology and / or recovery of waste heat or other heat sources. Sales, procurement, installation, commissioning, remote technical support, field service support and operation of water treatment plants.
Water & Process Technologies & Solutions Spain SLU Coneixement, 6, 08850 Barcelona, Spain	**ISO 9001:2015** Sales, onsite product and application support, commercial operations, customer care, design, engineering project management, procurement, assembly, warehousing, installation, commissioning, remote technical support, field service and support, operation of water treatment plants, remote monitoring, diagnostics and analytics, mobile water treatment equipment, analytical laboratory process control instruments, distribution of analytical reagents, and reference standards for industries in need of water, wastewater and process treatment.
Veolia Ozonia Switzerland AG Stettbachstrasse 1, 8600 Dübendorf, Switzerland	**ISO 9001:2015, ISO 14001:2015, ISO 45001:2018** Innovation, marketing, design, development, manufacture and sale of facilities and equipments with services.
Veolia Water Technologies & Solutions Middle East FZE Jebel Ali Free Zone South, Dubai, United Arab Emirates	**ISO 9001:2015, ISO 14001:2015** Sales, manufacturing, procurement and distribution of process and water treatment speciality chemicals. Sales, design, delivery and servicing of treatment program, assembly and field service of delivery systems for process and water treatment speciality chemicals.

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B Appendix: Project documents

Appendix E

General Terms and Conditions of Sale – Sale of Capital Equipment

1. Exclusive Terms and Conditions. Together with any other terms the Parties agree to in writing, these General Terms and Conditions – together with the last proposal in order of time issued by the Seller – form the exclusive terms ("Agreement") whereby Buyer agrees to purchase, and Seller agrees to sell products and equipment (jointly "Equipment") and to provide advice, instruction and other services in connection with the sale of that Equipment ("Services"). If Buyer sends to Seller other terms and conditions to which Seller may not respond, including but not limited to those contained in Buyer's purchase order, such shall not apply. This Agreement may only be revised by a change order approved in writing by both Parties. All terms not defined herein shall be defined in Seller´s proposal.

2. Equipment and Services. The Equipment to be delivered and the Services to be provided shall be as set out in this Agreement. Unloading, handling, storage, installation, and operation of Buyer's systems or the Equipment are the responsibility of Buyer. Buyer shall not require or permit Seller's personnel to operate Buyer's systems or the Equipment at Buyer's site.

3. Prices and Payment. Buyer shall pay Seller for the Equipment and Services in accordance with the payment schedule (as set forth in Seller´s proposal or, if applicable, in any special conditions agreed to in writing by the Parties). Unless otherwise specified in writing, payment is due net thirty (30) days from the date of Seller's invoice. Seller may require a Letter of Credit or other payment guarantee, in which case the stated amount of the guarantee will be adjusted by Buyer in the event of any currency-based adjustment to prices or payment amounts per the Payment Schedule, and Buyer shall deliver the adjusted guarantee within five (5) days of request by Seller. Buyer agrees to reimburse Seller for collection costs, including 2% (two per cent) interest per month (not to exceed the maximum amount permitted by applicable law), should Buyer fail to timely pay. Buyer shall have no rights to make any deduction, retention, withholding or setoff relating to any payments due under this Agreement.

4. Taxes and Duties Seller shall be responsible for all corporate taxes measured by net income due to performance of or payment for work under this Agreement ("Seller Taxes"). Buyer shall be responsible for all taxes, duties, fees, or other charges of any nature (including, but not limited to, consumption, gross receipts, import, property, sales, stamp, turnover, use, or value-added taxes, and all items of withholding, deficiency, penalty, addition to tax, interest, or assessment related thereto, imposed by any governmental authority on Buyer or Seller or its subcontractors) in relation to the Agreement or the performance of or payment for work under the Agreement other than Seller Taxes ("Buyer Taxes"). The Agreement prices do not include the amount of any Buyer Taxes. If Buyer deducts or withholds Buyer Taxes, Buyer shall pay additional amounts so that Seller receives the full Agreement price without reduction for Buyer Taxes. Buyer shall provide to Seller, within one month of payment, official receipts from the applicable governmental authority for deducted or withheld taxes. Buyer shall furnish Seller with evidence of tax exemption acceptable to taxing authorities if applicable, prior to execution of the Agreement by both Parties or issuance by the Seller of the order acceptance. Buyer's failure to provide evidence of exemption at time of order will relieve Seller of any obligation to refund taxes paid by Seller.

5. Delivery, Title, Risk of Loss. Unless otherwise specified in this Agreement, Seller shall deliver all Equipment to Buyer FCA (Incoterms 2020) Seller's facility. The time for delivery of the Equipment to Buyer shall be specified in this Agreement. Seller's sole liability for any delay in delivery of the Equipment shall be as expressly set out in this Agreement. The place of delivery specified herein shall be firm and fixed, provided that Buyer may notify Seller no later than forty-five (45) days prior to the scheduled shipment date of the Equipment of an alternate point of delivery, Buyer shall compensate Seller for any additional cost in implementing the change. If any part of the Equipment cannot be delivered when ready due to any cause not attributable to Seller, Buyer shall designate a climate-controlled storage location, and Seller shall ship such Equipment to storage. Title and risk of loss shall thereupon pass to Buyer, and amounts payable to Seller upon delivery or shipment shall be paid by Buyer along with expenses incurred by Seller. Services provided herein shall be charged at the rate prevailing at the time of actual use and Buyer shall pay any increase, and Buyer shall pay directly all costs for storage and subsequent transportation. Failure by Buyer to take delivery of the Equipment shall be a material breach of this Agreement.

Title and risk of loss to the Equipment shall be transferred from Seller to Buyer at the point of delivery upon handover in accordance with this Agreement. Title and risk of loss to the Services shall pass as they are performed.

6. Warranties and Remedies. Seller warrants that Equipment shall be delivered free from defects in material, workmanship and title and that Services shall be performed in a competent, diligent manner in accordance with any mutually agreed specifications. Seller's warranty does not cover the results of improper handling, storage, installation, commissioning, operation or maintenance of the Equipment by Buyer or third parties, repairs or alterations made by Buyer without Seller's written consent, influent water which does not comply with agreed parameters, or fair wear and tear.

Unless otherwise expressly provided in this Agreement, the foregoing warranties are valid for:

(a) chemicals and Services, for six (6) months from their date of delivery or the provision of Services;

(b) consumables, including filters and spiral wound membranes (other than spiral wound membranes for process treatment), the earlier of twelve (12) months from date of first use of fifteen (15) months from their date of delivery;

(c) spiral wound membranes for process fluid treatment, ninety (90) days from their date of first use;

(d) ultrafiltration membranes (ZW500, ZW700B, ZW1000, ZW1500), twelve (12) months from their date of delivery;

(e) Equipment other than chemicals and consumables, the earlier of, fifteen (15) months from delivery or shipment to storage, or twelve (12) months from start-up/first use;

(f) software, ninety (90) days from the date of receipt;

(g) Equipment not manufactured by Seller, the warranty shall be the manufacturer's transferable warranty only,

Any claim for breach of these warranties must be promptly notified in writing, and Buyer shall make the defective item available to the Seller, or the claim will be void. Seller's sole responsibility and Buyer's exclusive remedy arising out of or relating to the Equipment or Services or any breach of these warranties is limited to repair at Seller's facility or (at Seller's option) replace at Seller's facility the defective item of Equipment, and re-perform defective Services. In performance of its

obligations hereunder, Seller will not control the actual operation of either Buyer's systems or the Equipment at the Buyer's site.

Warranty repair, replacement or re-performance by Seller shall not extend or renew the applicable warranty period.

The warranties and remedies are conditioned upon (a) proper unloading, handling, storage, installation, use, operation, and maintenance of the Equipment and Buyer's facility and all related system in accordance with Seller's instructions and, in the absence, generally accepted industry practice, (b) Buyer keeping accurate and complete records of operation and maintenance during the warranty period and providing Seller access to those records, and (c) modification or repair of Equipment or Services only as authorized by Seller in writing. Failure to meet any such conditions renders the warranty null and void.

The Buyer will be entitled to assign to a subsequent owner of the Equipment the warranties of the Seller under this Agreement, provided that a prior written notification is sent to the Seller and the assignment agreement contains terms and conditions which provide the Seller with the protections of the warranties and limitations on liability contained in the Agreement. Subject to Buyer's compliance with the foregoing requirement, such warranty rights are expressly assignable by the Buyer to a subsequent owner of the Equipment. Except as provided herein, Buyer is not entitled to extend or transfer this warranty to any other party. The warranties and remedies set forth in this article are in lieu of and exclude all other warranties and remedies, statutory, express or implied, including any warranty of merchantability or of fitness for a particular purpose.

Unless otherwise expressly stipulated in this Agreement, Seller gives no warranty or guarantee as to process results or performance of the Equipment, including but not limited to product quality, flow, production, capacity, membrane life, chemical consumption, regulatory compliance or energy consumption.

7. General Indemnity. Seller shall indemnify and hold harmless Buyer from claims for physical damage to third party property or injury to persons, including death, to the extent caused by the negligence of Seller or its officers, agents, employees, and/or assigns while engaged in activities under this Agreement. Buyer shall likewise indemnify and hold harmless Seller from claims for physical damage to third party property or injury to persons, including death, to the extent caused by the negligence of the Buyer, its officers, agents, employees, and/or assigns. In the event such damage or injury is caused by the joint or concurrent negligence of Seller and Buyer, the loss shall be borne by each Party in proportion to its negligence. For the purposes of this article (i) "Third party" shall not include Buyer or any subsequent owner of the Equipment, their subsidiaries, parents, affiliates, agents, successors or assigns including any operation or maintenance contractor, or their insurer; and (ii) no portion of the Equipment is "third party property".

8. Compliance with Laws and Permits. All permits, authorisations, and licenses which are required to construct, install and/or operate Buyer's facility or equipment, to use the Equipment, or to manage and dispose of any wastes, discharges, and residues resulting from Buyer's use of the Equipment, shall be obtained and maintained by Buyer at Buyer's sole expense. Buyer is responsible for compliance with all laws and regulations applicable to the storage, use, handling, installation, maintenance, removal, registration, and labelling of all Equipment after delivery of the Equipment, as well as for the proper management and disposal of all wastes, discharges, and residues.

9. Buyer's Site Conditions. Buyer warrants that any data furnished to the Seller concerning conditions at Buyer's site (including but not limited to any existing Buyer facility, equipment or processes, influent water or other substances to be treated or measured with the Equipment) is accurate and complete, and the Seller reserves the right to utilize the most appropriate design compatible with generally accepted engineering practices, and to make changes in details of design, manufacture and arrangement of Equipment unless precluded by any limitations specified in this Agreement. Seller shall notify Buyer of (1) any conditions at Buyer's site which materially differ from those indicated in the data furnished by Buyer, (2) any previously unknown physical conditions at Buyer's site of an unusual nature, not revealed by previous investigations and differing from those ordinarily encountered in the type of work provided for in this Agreement, and (3) the presence of any Hazardous Materials (as defined below), the existence of a contaminated soil, unexploded ordinance, or archaeological remains. If such conditions cause an increase in Seller's cost or in the time required for the performance of Seller's obligations, Seller shall be entitled to an equitable adjustment in the Agreement price and an extension in the time for performance.

10. Hazardous Materials and Wastes. In the event that Seller encounters any Hazardous Materials (meaning toxic substances, hazardous substances, pollutants, contaminants, regulated wastes, or hazardous wastes as such terms may be defined or classified in any law, statute, directive, ordinance or regulations promulgated by any applicable governmental entity) at Buyer's site, other than Hazardous Materials introduced by Seller or that are otherwise the express responsibility of Seller under this Agreement, Buyer shall immediately take whatever precautions are required to legally eliminate such Hazardous Materials so that the Seller's work under this Agreement may safely proceed. At no time shall Seller be deemed to have taken title to or the responsibility for the management or disposal of any wastes, Hazardous Materials, influent water, any resultant product streams, wastewater streams, discharges, cleaning materials, or any other materials or substances processed by the Equipment or otherwise located at Buyer's site. Seller does not take responsibility for and hereby expressly disclaims responsibility for the characterization or disposal of wastes, Hazardous Materials, or for the identification, selection, or management of disposal facilities for any wastes.

11. Excusable Delays. Seller shall not be liable nor in breach or default of its obligations under this Agreement to the extent performance of such obligations is delayed or prevented, directly or indirectly, due to causes beyond the reasonable control of Seller, including, but not limited to: acts of God, natural disasters, unusually severe weather, fire, terrorism, war (declared or undeclared) epidemics, material shortages, insurrection, act (or omissions) of Buyer or Buyer's contractors/suppliers or agents, any act (or omission) by any governmental authority, strikes, labour disputes, transportation shortages, or vendor non-performance. The delivery or performance date shall be extended for a period equal to the time lost by reason of delay or non-performance, plus such additional time as may be necessary to overcome the effect of the delay or non-performance. If delivery or performance is delayed for a period exceeding 180 (one hundred and eighty) days, either Party may terminate this Agreement without further liability provided that Seller shall be paid an amount equal to that which would be payable to Seller under the article entitled "Termination". If Seller is delayed by any acts (or omissions) of Buyer, or by the prerequisite work of Buyer's other contractors or suppliers, Seller shall be entitled to an equitable adjustment in schedule, price and/or performance, as applicable.

12. Emergencies. If the safety of Seller's personnel is threatened or likely to be threatened by circumstances outside the reasonable control of Seller, including but not limited to war,

armed conflict, civil unrest, riots, terrorism, kidnapping, presence of or exposure to hazardous materials, unsafe working conditions, or by the threat of such circumstances or a lack of adequate protections against such circumstances, Seller shall be entitled to take all necessary steps to ensure the security and safety of its personnel including the evacuation of personnel until such circumstances no longer apply. Any such occurrence shall be considered an excusable delay event. Buyer shall reasonably assist in the event of any such evacuation.

13. Confidentiality, Intellectual Property. Both Parties agree to keep confidential the other Party's proprietary non-public information, if any, which may be acquired in connection with this Agreement. Buyer will not, without Seller's advance written consent, subject Equipment to testing, analysis, or any type of reverse engineering. Seller retains all intellectual property rights including copyright which it has in all drawings and data or other deliverables (including the Equipment) supplied or developed under this Agreement. Buyer agrees that it will not file patent applications on the Equipment or any development or enhancement of the Equipment, or of processes and methods of using the Equipment, without Seller's express prior written permission. Buyer further agrees that in any event any such patents will not be asserted against Seller or its other buyers based upon purchase and use of such Equipment. Seller grants to Buyer a non-exclusive, non-terminable, royalty free license to use the intellectual property embedded in Equipment delivered to and paid for by the Buyer, as well as any drawings, design or data delivered to and paid for by the Buyer, for the purposes of owning, financing, using, operating and maintaining the relevant Equipment at Buyer's site. Such license may only be assigned to a subsequent owner of the Equipment or to an operations and maintenance subcontractor. Such license does not extend to the re-creation of the Equipment or the manufacture of spares or consumables by Buyer or third parties.

Any software Seller owns and provides pursuant to this Agreement shall remain Seller's property. Seller provides to Buyer a limited, non-exclusive and terminable royalty free project-specific license to such software for the use, operation or maintenance at Buyer's site of any Equipment purchased hereunder to which the software is a necessary component. Buyer agrees not to copy, sub-license, translate, transfer, reverse engineer, or decode the software.

Seller shall indemnify and hold harmless Buyer from any rightful claim of any third party that any Equipment or Service infringe a patent in effect in the USA, an EU member state or country of delivery (provided there is a corresponding patent issued by the USA or an EU member state), or USA copyright or copyright registered in the country of delivery. If the Buyer notifies the Seller promptly of the receipt of any such claim, does not take any position adverse to the Seller regarding such claim and gives the Seller information, assistance and exclusive authority to settle and defend the claim, the Seller shall, at its own expense and choice, either (i) settle or defend the claim and pay all damages and costs awarded in it against the Buyer, or (ii) procure for the Buyer the right to continue using the Equipment or Service, or (iii) modify or replace the Equipment or Service so that it becomes non-infringing, or (iv) remove the infringing Equipment and refund the price. The above paragraph shall not apply to any misuse of Equipment or Equipment which is manufactured to the Buyer's design, or to alleged infringement arising from the combination, operation, or use of any Equipment or Services with other equipment or services when such combination is part of any allegedly infringing subject matter. The foregoing list of sub-sections (i), (ii), (iii), and (iv) and related terms state the entire liability of the Seller for intellectual property infringement by any Equipment or Service.

14. Limitations on Liability. Notwithstanding anything else contained in this Agreement, to the maximum extent permitted by law, and regardless of whether a claim is based in contract (including warranty or indemnity), extra-contractual liability, tort (including negligence or strict liability), statute, equity or any other legal theory:

(a) THE TOTAL LIABILITY OF THE SELLER AND OF ITS INSURER FOR ALL CLAIMS ARISING OUT OF OR RELATING TO THE PERFORMANCE OR BREACH OF THIS AGREEMENT OR USE OF ANY EQUIPMENT OR SERVICES SHALL NOT EXCEED THE TOTAL PRICE PAID BY BUYER UNDER THIS AGREEMENT OR (IN THE CASE OF AN AGREEMENT FOR SERVICES WITH A TERM OF MORE THAN ONE YEAR) THE ANNUAL PRICE PAYABLE BY BUYER UNDER THIS AGREEMENT;

(b) IN NO EVENT SHALL SELLER BE LIABLE FOR ANY LOSS OF PROFIT OR REVENUES, LOSS OF PRODUCTION, LOSS OF USE OF EQUIPMENT OR SERVICES OR ANY ASSOCIATED EQUIPMENT, INTERRUPTION OF BUSINESS, COST OF CAPITAL, COST OF REPLACEMENT WATER OR POWER, DOWNTIME COSTS, INCREASED OPERATING COSTS, CLAIMS OF BUYER'S CUSTOMERS FOR SUCH DAMAGES, OR FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, INDIRECT, PUNITIVE OR EXEMPLARY DAMAGES;

(c) SELLER'S LIABILITY SHALL END UPON EXPIRATION OF THE APPLICABLE WARRANTY PERIOD, PROVIDED THAT BUYER MAY CONTINUE TO ENFORCE A CLAIM FOR WHICH IT HAS GIVEN NOTICE PRIOR TO THAT DATE BY COMMENCING AN ACTION OR ARBITRATION, AS APPLICABLE UNDER THIS AGREEMENT, BEFORE EXPIRATION OF ANY STATUTE OF LIMITATIONS OR OTHER LEGAL TIME LIMITATION BUT IN NO EVENT – TO THE EXTENT PERMITTED BY APPLICABLE LAW – LATER THAN FIVE (5) MONTHS AFTER EXPIRATION OF SUCH WARRANTY PERIOD.

For the purposes of this article, "Seller" shall mean Seller, its affiliates, subcontractors and suppliers of any tier, and their respective agents and employees, individually or collectively. If Buyer is supplying Seller's Equipment or Services to a third party, Buyer shall require the third party to agree to be bound by this article. If Buyer does not obtain this agreement for Seller's benefit for any reason, Buyer shall indemnify and hold Seller harmless from all liability arising out of claims made by the third party in excess of the limitations and exclusion of this article.

15. Termination. This Agreement and any performance pursuant to it may be terminated by either Party, and the consequences of such termination shall be as set out in the next paragraph, if the other Party

(a) becomes insolvent, makes an assignment for the benefit of its creditors, has a receiver or trustee appointed for the benefit of its creditors, or files for protection from creditors under any bankruptcy or insolvency laws; or

(b) fails to make any payment when due or to establish any payment security required by this Agreement, or commits a material breach or defaults in its material obligations under this Agreement, and such default is not cured within thirty (30) days of written notice from the other Party.

Upon the termination of this Agreement by Buyer for cause (i) Seller shall reimburse Buyer the difference between that portion of the Agreement price allocable to the terminated scope and the actual amounts reasonably incurred by Buyer to complete that scope, and (ii) Buyer shall pay to Seller (a) the portion of the Agreement price allocable to Equipment completed, and (b)

amounts for Services performed before the effective date of termination. Upon the termination of this Agreement by Seller for cause Buyer shall pay to Seller within thirty (30) days of receipt of invoice the price of all Equipment or Services delivered at the date of termination, plus an amount equal to all costs and expenses incurred in the engineering, sourcing, financing, procurement, manufacture, storage and transportation of the Equipment including materials, work in progress and any cancellation charges assessed against Seller by Seller's suppliers including reasonable overhead and profit on all such costs and expenses. Alternatively, if any schedule of termination payments has been agreed between the Parties, Buyer shall pay to Seller within thirty (30) days of receipt of invoice the amounts set out in that schedule.

Seller shall have the right to suspend performance upon written notice to Buyer in any case where Seller would have the right to terminate the Agreement under this article, without prejudice to Seller's right to terminate this Agreement for cause. Any cost incurred by Seller in accordance with any such suspension (including storage costs) shall be payable by Buyer upon submission of the Seller's invoice(s). Performance of the Seller's obligations shall be extended for a period of time reasonably necessary to overcome the effects of such suspension.

16. Governing Law, Dispute Resolution. This Agreement shall be governed by the substantive laws of the State of New York. In the event of a dispute concerning this Agreement, the complaining Party shall notify the other Party in writing thereof. Management level representatives of both Parties shall meet at an agreed location to attempt to resolve the dispute in good faith. Should the dispute not be resolved within thirty (30) days after such notice, the complaining Party shall seek remedies exclusively through arbitration. The seat of arbitration shall be the federal district court in Philadelphia, PA, and the rules of the arbitration will be the Commercial Arbitration Rules of the American Arbitration Association, which are incorporated by reference into this article.

Notwithstanding the foregoing, each Party shall have the right to commence an action or proceeding in a court of competent jurisdiction, subject to the terms of this Agreement, in order to seek and obtain a restraining order or injunction to enforce the confidentiality intellectual property provisions set forth in the first two paragraphs of article 13; nuclear use restrictions set forth in article 17, or to seek interim or conservatory measures not involving monetary damages.

17. No Nuclear Use. Equipment and Services sold by Seller are not intended for use in connection with any nuclear facility or activity, the Buyer warrants that it shall not use or permit others to use the Equipment or Services for such purposes, without the advance written consent of Seller. If, in breach of this, any such use occurs, Seller (and its parent, affiliates, suppliers and subcontractors) disclaims all liability for any nuclear or other damage, injury or contamination, and, in addition to any other rights of Seller, Buyer shall indemnify and hold Seller (and its parent, affiliates, suppliers and subcontractors) harmless against all such liability.

18. Export Control. Seller's obligations are conditioned upon Buyer's compliance with all applicable trade control laws and regulations including those of the United States, European Union, and United Nations. Additionally, Buyer shall not sell, distribute, disclose, release or otherwise transfer any item or technical data provided under this agreement to: (i) any country designated as a "State Sponsor of Terrorism" by the U.S. Department of State including, for this Agreement, the countries of North Korea (ii) any entity located in, or owned by an entity located in, a "State Sponsor of Terrorism" country, North Korea, (iii) the region of Crimea, Donetsk People's Republic (DNR), Luhansk People's Republic (LNR), Kherson, Zaporizhzhia regions of Ukraine or (iv) any person or entity listed on the "Entity List" or "Denied Persons List", the list of "Specifically Designated Nationals and Blocked Persons" maintained by any other applicable prohibited party list, such as those provided by the US, EU and United Nations. The Buyer hereby certifies that the work, technical data, software or other information or assistance furnished by the Seller or its Affiliates under this contract will not be used in the design, development, production, stockpiling or use of chemical, biological or nuclear weapons either by the Buyer or by any entity acting on the Buyer's behalf.

If the applicable trade control laws and regulations designate any person or entity involved in business activity between [and/or including] the Buyer and Seller, the obligations of the Parties to comply with all applicable trade control laws and regulations shall survive any termination or discharge of any other contract obligations, and the parties will work towards achieving compliance or will terminate the agreement and work to effect a mutually agreeable and orderly process for such termination and/or winding down the business activity.

19. Changes. Each Party may at any time propose changes in the schedule or scope of Equipment or Services. All changes to the Equipment or Services shall be subject to mutual agreement via a written change order or variation, which shall only become effective once signed by both Parties. The scope, Agreement price, schedule, and other provisions will be equitably adjusted to reflect additional costs or obligations incurred by Seller resulting from a change, after Seller's proposal date, in Buyer's site-specific requirements or procedures, or in industry specifications, codes, standards, applicable laws or regulations. It shall be acceptable and not considered a change if Seller delivers Equipment (including Equipment replacement under warranty) that bears a different, superseding or new part or version number compared to the part or version number listed in the Agreement, provided that in no circumstance shall this affect any other of Seller's obligations including those set forth in article 6.

20. Conflicts; Survival, Assignment. If there is any conflict between this Agreement and any written proposal or quotation provided by Seller, then the terms and conditions set forth in this Agreement shall prevail. If any term or condition of this Agreement or any accompanying terms and conditions are held invalid or illegal, then such terms and conditions shall be reformed to be made legal or valid, or deleted, but the remaining terms and conditions shall remain in full force and effect, and this Agreement shall be interpreted and implemented in a manner which best fulfils Parties' intended agreement. Those provisions which by their nature remain applicable after termination shall survive the termination of this Agreement for any reason. Seller may assign or novate its rights and obligations under the Agreement, in whole or in part, to any of its affiliates or may assign any of its accounts receivable under this Agreement to any party without Buyer's consent, and the Buyer hereby agrees, by signing this Agreement, to such assignment and to execute any document that may be necessary to complete Seller's assignment or novation. This Agreement shall not otherwise be assigned by either Party without the other Party's prior written consent, and any assignment without such consent shall be void.

Seller may (i) manufacture and source the Equipment and any part thereof globally in the country or countries of its choosing; and (ii) subcontract portions of the Services, so long as Seller remains responsible for such.

21. No third party beneficiary. Except as specifically set forth in the article entitled "Limitations on Liability" and "No Nuclear Use", this Agreement is not intended to, and does not,

give to any person who is not a party to this Agreement any rights to enforce any provisions contained in this Agreement.

22. Entire Agreement. This Agreement embodies the entire agreement between Buyer and Seller and supersedes any previous documents, correspondence or agreements between them. No modification, amendment, revision, waiver, or other change shall be binding on either Party unless agreed in writing by the Party's authorized representative. Any oral or written representation, warranty, course of dealing, or trade usage not specified herein shall not be binding on either Party. Each Party agrees that it has not relied on, or been induced by, any representations of the other Party not contained in this Agreement

Additional clauses

***** Insurance.** Buyer shall maintain all risk property and boiler and machinery breakdown insurance covering the full replacement value of Buyer's site, systems and related equipment, together with business interruption coverage, which includes a waiver of subrogation in favour of Seller and its affiliates. Prior to commencement of any work under this Agreement, and not less than annually thereafter during the term of this Agreement, Buyer shall deliver to Seller a certificate(s) of insurance and copy of waiver of subrogation endorsement evidencing that the foregoing insurance is in full force and effect. Seller shall maintain types and amounts of insurance against loss or damage and such other risks as customarily insured against by businesses whose operations are comparable to those of the Seller. Seller shall not be obliged to add Buyer or any other third party as an additional insured under Seller's insurance policies.	
***** Inspection and Factory Tests.** Seller will apply its normal quality control procedures in manufacturing the Equipment. Seller shall attempt to accommodate requests by Buyer to witness Seller's factory tests of Equipment, subject to appropriate access restrictions, if such witnessing can be arranged without delaying the work.	
***** Change control.** Buyer shall notify Seller immediately upon any change in ownership of more than fifty per cent (50%) of Buyer's voting rights or of any controlling interest in Buyer. If Buyer fails to do so or Seller objects to the change, Seller may (a) terminate the Agreement, (b) require Buyer to provide adequate assurance of performance (including but not limited to payment), and/or (c) put in place special controls regarding Seller's Confidential Information.	

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	RESOLUTION - A Resolution of Eagle Mountain City, Utah, Approving the 2025 Municipal Wastewater Planning Program Annual Report.
ITEM TYPE:	Resolution
FISCAL IMPACT:	N/A
APPLICANT:	Eagle Mountain City

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	N/A

PUBLIC HEARING
No

PREPARED BY
Mack Straw, Public Utilities Manager

PRESENTED BY
Mack Straw

RECOMMENDATION:
Staff recommends that the City Council approve a Resolution of Eagle Mountain City, Utah, Approving the 2025 Municipal Wastewater Planning Program Annual Report.

BACKGROUND:
The Municipal Wastewater Planning Program (MWPP) uses an annual survey to assist Eagle Mountain City in evaluating the collection system and treatment plant. The survey assesses and summarizes the technical, operational, and financial conditions of these facilities.

The Municipal Wastewater Planning Program (MWPP) uses an annual survey to assist Eagle Mountain City in evaluating the collection system and treatment plant. The purpose of MWPP is to help communities understand these business operations better and to help identify and resolve potential problem areas before they become serious and costly.

At the beginning of each year, the Division of Water Quality distributes the MWPP survey to over 200 municipalities and districts. These utilities compile the necessary financial, operations, performance, and compliance information requested from the previous year and report their completed surveys to their governing council or board and to the Division.

The Division uses the results from the MWPP in its permitting and assistance programs, including:

- Utah Sewer Management Program Annual Report
- Utah Wastewater Operator Certification Program
- Wastewater Financial Assistance Program
- Water Quality Board Financial Sustainability Assessments
- Financial Needs Report to EPA and Congress

ITEMS FOR CONSIDERATION:
N/A

PLANNING COMMISSION ACTION/RECOMMENDATION:
N/A

ATTACHMENTS:
1. Resolution
2. MWPP Survey - 2026

RESOLUTION NO. R- -2026

A RESOLUTION OF EAGLE MOUNTAIN CITY, UTAH, APPROVING THE 2025 MUNICIPAL WASTEWATER PLANNING PROGRAM ANNUAL REPORT

PREAMBLE

WHEREAS, Utah Administrative Code requires political subdivisions that receive assistance for a wastewater project annually in the Municipal Wastewater Planning Program; and

WHEREAS, Eagle Mountain City desires to approve the 2025 Municipal Wastewater Planning Program Annual Report, as prepared in Exhibit A.

NOW THEREFORE, BE IT RESOLVED by the City Council of Eagle Mountain City, Utah as follows:

1. The 2025 Municipal Wastewater Planning Program Annual Report, as attached hereto as Exhibit A, is hereby approved.

2. This Resolution shall be effective upon its first publication or posting.

ADOPTED by the City Council of Eagle Mountain City, Utah, this 21st day of April, 2026.

EAGLE MOUNTAIN CITY, UTAH

_____
Jared Gray, Mayor

ATTEST:

_____
Lacie A. Messerly
City Recorder

CERTIFICATION

The above Resolution was adopted by the City Council of Eagle Mountain City, Utah on the 21st day of April, 2026.

Those voting yes:	Those voting no:	Those excused:	Those abstaining:
☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark
☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish
☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting
☐ Rich Wood	☐ Rich Wood	☐ Rich Wood	☐ Rich Wood
☐ Brett Wright	☐ Brett Wright	☐ Brett Wright	☐ Brett Wright

_____

Lacie A. Messerly
City Recorder

Exhibit A

Outlook

Thanks for filling out this form: Full MWPP Survey - 2026

From Forms Response Receipts <forms-receipts-noreply@google.com>
Date Mon 4/13/2026 1:04 PM
To Brody Kinder <bkinder@eaglemountain.gov>

This sender is trusted.

Google Forms

Thanks for filling out this form: Full MWPP Survey - 2026

You're receiving this email because you filled out the following form using your email address. **This form is owned by State of Utah.** Make sure you recognize and trust this form before copying or clicking on any links. If it looks suspicious, **report it**.

Here's what was received.

Full MWPP Survey - 2026

Municipal Wastewater Planning Program survey for the year 2025.

Email *

bkinder@eaglemountain.gov

Section I: General Information

Note: This questionnaire has been compiled for your benefit to assist you in evaluating the technical and financial needs of your wastewater systems. If you received financial assistance from the Water Quality Board, annual submittal of this report is a condition of the assistance. Please answer questions as accurately as possible to give the best evaluation of your facility. If you need assistance please send an email to wqinfodata@utah.gov and we will contact you as soon as possible. You may also visit our Frequently Asked Questions page

What is the name of the Facility? *

Eagle Mountain City

What is the Name of the person responsible for this organization? *

Benjamin Reeves

What is the Title of the person responsible for this organization? *

City Manager

What is the Email Address for the person responsible for this organization? *

breeves@eaglemountain.gov

What is the Phone number for the person responsible for this organization? *

8017896603

Please identify the Facility Location? *

Please provide either Longitude and Latitude, address, or a written description of the location (with area or point).

2515 North Pony Express Parkway, Eagle Mountain, UT 84005

Are you a federal facility?

A federal facility is a military base, a national park, or a facility associated with a federal government organization (e.g., BLM, Forest Service, etc.)

- ○ Yes
- ◉ No

Financial Evaluation Section

As you begin this survey you must keep in mind which part of the wastewater system that you represent, unless you represent it all (e.g., collections, treatment, or both). If you only represent the collection system

please respond to each question thinking only of collection system data as you proceed through this survey. The same goes for treatment and both. If you get a question that does not apply to the part of the system which you represent then leave it unanswered. However, please try to answer as many questions as you possibly can.

This section is completed by:

Erin Hart

Are sewer revenues maintained in a dedicated purpose enterprise/district account?

- (●) Yes
- ( ) No

Are you collecting 95% or more of your anticipated sewer revenue?

- (●) Yes
- ( ) No

Are Debt Service Reserve Fund requirements being met?

- (●) Yes
- ( ) No

Where are sewer revenues maintained?

- ( ) General Fund
- ( ) Combined Utilities Fund
- (•) Other

What was the average MONTHLY User Charge for 2025?

$58.69

Do you have a water and/or sewer customer assistance program (CAP)?

- (•) Yes
- ( ) No

Are property taxes or other assessments applied to the sewer systems?

- ( ) Yes
- (•) No

What is the yearly amount of revenue that you receive from these taxes?

N/A

Are sewer revenues sufficient to cover operations & maintenance costs, and repair & replacement costs (OM&R) at this time?

- (●) Yes
- ( ) No

Are projected sewer revenues sufficient to cover operation & maintenance, and repair and replacement costs for the next five years?

- (●) Yes
- ( ) No

Does the sewer system have sufficient staff to provide proper operation & maintenance, and repair and replacement?

- (●) Yes
- ( ) No

Has a repair and replacement sinking fund been established for the sewer system?

- ( ) Yes

- [x] No

Is the repair & replacement sinking fund sufficient to meet anticipated needs?

- [ ] Yes
- [ ] No

Are sewer revenues sufficient to cover all costs of current capital improvements projects?

- [x] Yes
- [ ] No

Has a Capital Improvements Reserve Fund been established to provide for anticipated capital improvement projects?

- [ ] Yes
- [x] No

Are projected Capital Improvements Reserve Funds sufficient for the next five years?

- [ ] Yes

- [x] No

Are projected Capital Improvements Reserve Funds sufficient for the next ten years?

- [ ] Yes
- [x] No

Are projected Capital Improvements Reserve Funds sufficient for the next twenty years?

- [ ] Yes
- [x] No

Have you completed a rate study within the last five years?

- [x] Yes
- [ ] No

Do you charge Impact fees?

- [x] Yes

- [ ] No

If you charged Impact Fees, how much were they? =

If not a flat fee, use total collected impact fees for the year divided by the total number of entities who paid fees that year.

$4,665 per ERU

Have you completed an impact fee study in accordance with UCA 11-36a-3 within the last five years?

- [x] Yes
- [ ] No

Do you maintain a Plan of Operations?

- [x] Yes
- [ ] No

Have you updated your Capital Facility Plan within the last five years?

- [x] Yes
- [ ] No

In what year was the Capital Facility Plan last updated?

2024

Do you use an Asset Management system for your sewer systems?

- (●) Yes
- ( ) No

Do you know the total replacement cost of your total sewer system capital assets?

- ( ) Yes
- (●) No

Replacement Cost =

unknown

Do you fund sewer system capital improvements annually with sewer revenues at 2% or more of the total replacement cost?

- ( ) Yes

- [x] No

What is the sewer/treatment system annual asset renewal cost as a percentage of its total replacement cost?

unknown

Describe the Asset Management System. Check all that apply:

- [x] Spreadsheet
- [x] GPS
- [x] Accounting Software
- [x] Specialized Software

What is the 2025 Capital Assets Cumulative Depreciation for your facility?

$24,800,000.00

What is the 2025 Capital Assets Book Value?

Book Value = (total cost) - (accumulated depreciation)

$38,622,949.96

Cost of projected capital improvements - Please enter a valid numerical value - 2025?

$2,765,384.00

Cost of projected capital improvements - Please enter a valid numerical value - 2026 through 2030?

$209,457,000.00

Cost of projected capital improvements - Please enter a valid numerical value - 2031 through 2035?

unknown

Cost of projected capital improvements - Please enter a valid numerical value - 2036 through 2040?

unknown

Cost of projected capital improvements - Please enter a valid numerical value - 2041 through 2045?

unknown

Purpose of Capital Improvements - 2025? Check all that apply.

- [ ] Replace/Restore
- [x] New Technology
- [x] Increased Capacity

Purpose of projected Capital Improvements - 2026 through 2030? - Check all that apply.

- [ ] Replace/Restore
- [x] New Technology
- [x] Increased Capacity

Purpose of projected Capital Improvements - 2031 through 2035 Check all that apply.?

- [ ] Replace/Restore

- [ ] New Technology
- [ ] Increased Capacity

Purpose of projected Capital Improvements - 2036 through 2040? - Check all that apply.

- [ ] Replace/Restore
- [ ] New Technology
- [ ] Increased Capacity

Purpose of projected Capital Improvements from 2041 through 2045? - Check all that apply.

- [ ] Replace/Restore
- [ ] New Technology
- [ ] Increased Capacity

To the best of my knowledge, the Financial Evaluation section is completed and accurate.

- (•) True

- [ ] False

Do you have a collection system? *

- [x] Yes
- [ ] No

Collection System

Including piping and lift stations.

This form is completed by [name]?

The person completing this form may receive Continuing Education Units (CEUs).

Mack Straw, Brody Kinder, Matthew Banks

Part I: SYSTEM DESCRIPTION

Please answer the following questions regarding SYSTEM DESCRIPTION.

What is the largest diameter pipe in the collection system?

Please enter the diameter in inches.

42

What is the average depth of the collection system?

Please enter the depth in feet.

10

What is the total length of sewer pipe in the collection system?

Please enter the length in miles.

201

How many lift/pump stations are there in the collection system?

10

What is the largest capacity lift/pump station in the collection system?

Please enter the design capacity in gpm.

2000 GPM @ 40 FT of Head

Do seasonal daily peak flows exceed the average peak daily flow by 100 percent or more?

- ( ) Yes
- (•) No

What year was your collection system first constructed?

This can be an approximate guess if you really are not sure.

1998

In what year was the largest diameter sewer pipe in the collection system constructed, replaced or renewed?

If more than one, cite the oldest.

2020

Part II: DISCHARGES

Please answer the following questions regarding DISCHARGES.

How many days last year was there a sewage bypass, overflow or basement flooding in the system due to rain or snowmelt?

0

How many days last year was there a sewage bypass, overflow or basement flooding due to equipment failure, except plugged laterals?

2

Sanitary Sewer Overflow (SSO)

Class 1 - a Significant SSO means a SSO backup that is not caused by a private lateral obstruction or problem that:
(a) affects more than five private structures;
(b) affects one or more public, commercial or industrial structure(s);
(c) may result in a public health risk to the general public;
(d) has a spill volume that exceeds 5,000 gallons, excluding those in single private structures; or
(e) discharges to Waters of the State.

Class 2 - a Non-Significant SSO means a SSO or backup that is not caused by a private lateral obstruction or problem that does not meet the Class 1 SSO criteria

How many Class 1 SSOs were there in Calendar year 2025?

1

How many Class 2 SSOs were there in Calendar year 2025?

1

Please indicate what caused the SSO(s) in the previous 2 questions.

A private lift stations force main was broken and leaking around the lift stations wet well. Sewer main line obstructed by new construction debris caused a backup into a resident's basement.

Please specify whether the SSOs were caused by contract or tributary community, etc.

Both.

Part III: NEW DEVELOPMENT

Please answer the following questions regarding NEW DEVELOPMENT.

Did an industry or other development enter the community or expand production in the past two years, such that flow or wastewater loadings to the sewerage system increased by 10% or more?

- (●) Yes
- ( ) No

Are new developments (industrial, commercial, or residential) anticipated in the next 2 - 3 years that will increase flow or BOD5 loadings to the sewerage system by 25% or more?

- [x] Yes
- [ ] No

What is the number of new commercial/industrial connections in 2025?

10

What is the number of new residential sewer connections added in 2025?

864

How many equivalent residential connections are served?

12798

Part IV: OPERATOR CERTIFICATION

Please answer the following questions regarding OPERATOR CERTIFICATION.

How many collection system operators do you employ?

5

What is the approximate population served?

76695

State of Utah Administrative Rules requires all public system operators considered to be in Direct Responsible Charge (DRC) to be appropriately certified at leaset at the Facility's Grade. List the designated Chief Operator/DRC for the Collection System by: First and Last Name, Grade, and email.

Grades: SLS17-1, Grade I, Grade II, Grade III, and Grade IV.

Brody Kinder, Grade IV, bkinder@eaglemountain.gov,

Please list all other wastewater collection system operators with DRC responsibilities in the field, by name and certification grade. Please separate names and certification grade for each operator by commas.

Grades: SLS17-1, Grade I, Grade II, Grade III, and Grade IV.

Matt Banks, Grade IV, mbanks@eaglemountain.gov

Please list all other wastewater collection system operators by name and certification grade. Please separate names and certification grades for each operator by commas.

Grades: SLS17-1, Grade I, Grade II, Grade III, and Grade IV.

Collections Operators: Jason Carter, Grade IV, Dallan Harris, Grade IV, Corey Christensen, Grade I, Cade Koozer, No Grade

Is/are your collection DRC operator(s) currently certified at the appropriate grade for this facility?

- (●) Yes
- ( ) No

Part V: FACILITY MAINTENANCE

Please answer the following questions regarding FACILITY MAINTENANCE.

Have you implemented a preventative maintenance program for your collection system?

- (●) Yes
- ( ) No

Have you updated the collection system operations and maintenance manual within the past 5 years?

- (●) Yes
- ( ) No

Do you have a written emergency response plan for sewer systems?

- (●) Yes
- ( ) No

Do you have a written safety plan for sewer systems?

- (●) Yes
- ( ) No

Is the entire collections system TV inspected at least every 5 years?

- ( ) Yes
- (●) No

Is at least 85% of the collections system mapped in GIS?

- (●) Yes
- ( ) No

Part VI: SSMP EVALUATION

Please answer the following questions regarding SSMP EVALUATION.

Have you completed a Sewer System Management Plan (SSMP)?

- (●) Yes
- ( ) No

Has the SSMP been adopted by the permittees governing body at a public meeting?

- (●) Yes
- ( ) No

Has the completed SSMP been public noticed?

- (●) Yes
- ( ) No

USMP Public Notice Date

Date of public notice?

MM DD YYYY

04 / 18 / 2023

Continue 1

During the annual assessment of the SSMP, were any adjustments needed based on the performance of the plan?

- ○ Yes
- ◉ No

What adjustments were made to the SSMP (i.e. line cleaning, CCTV inspections, manhole inspections, and/or SSO events)?

N/A

During 2025, was any part of the SSMP audited as part of the five year audit?

- ○ Yes
- ◉ No

If yes, what part of the SSMP was audited and were changes made to the SSMP as a result of the audit?

N/A

Have you completed a System Evaluation and Capacity Assurance Plan (SECAP) as defined by the Utah Sewer Management Plan?

- (●) Yes
- ( ) No

Does the collection system have more than 2,000 connections?

- (●) Yes
- ( ) No

Has a fats, oil, and grease (FOG) or fats, oil, sand, and grease program been developed by the collection system?

- (●) Yes
- ( ) No

Part VII: NARRATIVE EVALUATION

Please answer the following questions regarding NARRATIVE EVALUATION.

Describe the physical condition of the sewerage system: (lift stations, etc. included)

The overall condition of the system is in good operation. We have 5 EMC operated lift stations that are all in good standing with one needing some minor repairs. We have 5 private lift stations currently run by private companies (HOA)

What sewerage system capital improvements does the utility need to implement in the next 10 years?

Sections of our concrete outfall line will need CIPP in the near future.

What sewerage system problems, other than plugging, have you had over the last year?

A check valve one the discharge line is malfunctioning. A grinder failed and needed some parts replaced. A private lift station had a discharge piping issue.

Is your utility currently preparing or updating its capital facilities plan?

- (●) Yes
- ( ) No

Does the municipality/district pay for the continuing education expenses of operators?

- (●) 100%
- ( ) Partially

- ○ Does not pay

Is there a written policy regarding continued education and training for wastewater operators?

- ◉ Yes
- ○ No

Do you have any additional comments?

NO

To the best of my knowledge, the Collections System section is completed and accurate

- ◉ True
- ○ False

Wastewater Treatment Options

You have either just completed or just bypassed questions about a Collection System. If this section was bypassed by mistake, in the next question you will have the option to return to the questions on a Collection System. If you are good with the progress up to now, next you will determine what kind of Wastewater Treatment you have, or you can choose NO Wastewater Treatment.

What kind of wastewater treatment do you have in your wastewater treatment system?

- (●) Mechanical Plant
- ( ) Discharging Lagoon
- ( ) Non-Discharging Lagoon
- ( ) No Treatment of Wastewater
- ( ) Collections (go back to Collections)

Mechanical Plant

Form completed by [name]?

The person completing this form may receive Continuing Education Units (CEUs).

Mack Straw, Brody Kinder, Matthew Banks

Part I: INFLUENT INFORMATION

Please answer the following questions regarding INFLUENT INFORMATION.

What is the design basis or rated capacity for average daily flow in MGD?

2.4

What is the design basis or rated capacity for average daily BOD loading in lb/day?

7,405

What is the design basis or rated capacity for average daily TSS loading in lb/day?

4,203

What was the 2025 average daily flow in MGD?

1.42

What was the 2025 average daily loading for BOD in lb/day?

3059

What was the 2025 average daily loading for TSS in lb/day?

2614

What is the percent of capacity used by the 2025 average daily flow?

59.3%

What is the percent of capacity used by the 2025 average daily BOD load?

40.9%

What is the percent of capacity used by the 2025 average daily TSS?

60.3%

Part II: EFFLUENT INFORMATION

Please answer the following questions regarding EFFLUENT INFORMATION.

How many Notices of Violations (NOVs) did you receive for this facility in 2025?

0

How many days in the past year was there a bypass or overflow of wastewater at the facility due to high flows?

0

Part III: FACILITY AGE

Please answer the following questions regarding FACILITY AGE.

In what year was your HEADWORKS evaluated?

2023

In what year was your HEADWORKS most recently constructed, upgraded, or renewed?

2023

What is the age of your HEADWORKS?

2 years

In what year was your PRIMARY TREATMENT evaluated?

N/A

In what year was your PRIMARY TREATMENT constructed, upgraded or renewed?

N/A

What is the age of your PRIMARY TREATMENT?

N/A

In what year was your SECONDARY TREATMENT evaluated?

2024

In what year was your SECONDARY TREATMENT constructed, upgraded or renewed?

2022

What is the age of your SECONDARY TREATMENT?

3 years

In what year was your TERTIARY TREATMENT evaluated?

N/A

In what year was your TERTIARY TREATMENT constructed, upgraded or renewed?

N/A

What is the age of your TERTIARY TREATMENT?

N/A

In what year was your DISINFECTION evaluated?

2023

In what year was your DISINFECTION constructed, upgraded or renewed?

2022

What is the age of your DISINFECTION?

4 years

In what year was your SOLIDS HANDLING evaluated?

2023

In what year was your SOLIDS HANDLING constructed, upgraded or renewed?

2022

What is the age of your SOLIDS HANDLING?

4 years

In what year was your LAND APPLICATION/DISPOSAL evaluated?

N/A

In what year was your LAND APPLICATION/DISPOSAL constructed, upgraded or renewed?

N/A

What is the age of your LAND APPLICATION/DISPOSAL?

N/A

Part IV: DISCHARGES

Please answer the following questions regarding DISCHARGES.

How many days in the last year was there a bypass or overflow of wastewater at the facility due to equipment failure?

1

Part V: BIOSOLIDS HANDLING

Please answer the following questions regarding BIOSOLIDS HANDLING.

Biosolids disposal (check all that apply)

- [x] Landfill
- [ ] Land Application

☐ Give Away/Other Distribution

Part VI: NEW DEVELOPMENT

Please answer the following questions regarding NEW DEVELOPMENT.

Number of new commercial/industrial connections in the last year?

7

Number of new residential sewer connectins added in the last year?

835

Equivalent residential connections served?

6468

Part VII: OPERATOR CERTIFICATION

How many treatment system operators do you employ?

6

State of Utah Administrative Rules requires all public system operators considered to be in Direct Responsible Charge (DRC) to be appropriately certified at least at the Facility's Grade. List the designated Chief Operator/DRC for the Treatment System by: First and Last Name, Grade, and email.

Grades: SLS17-1, Grade I, Grade II, Grade III, and Grade IV.

Brody Kinder, Grade IV, bkinder@eaglemountain.gov

Please list all other wastewater treatment system operators with DRC responsibilities in the field, by name and certification grade. Please separate names and certification grade for each operator by commas.

Grades: SLS17-1, Grade I, Grade II, Grade III, and Grade IV.

Matt Banks, Grade IV, mbanks@eaglemountain.gov

Please list all other wastewater treatment operators by name and certification grade. Please separate names and certification grades for each operator by commas.

Grades: SLS17-1, Grade I, Grade II, Grade III, and Grade IV.

Matthew Powell, Grade II, Fred Garbett, No Cert, Gabe Gepford, No Cert, Ty Herring, No Cert

Is/are your DRC operator(s) currently certified at the appropriate grade for this facility?

- (●) Yes
- ( ) No

Part VIII: FACILITY MAINTENANCE

Please answer the following questions regarding FACILITY MAINTENANCE.

Have you implemented a written preventative maintenance program for your treatment system?

- (●) Yes
- ( ) No

Have you updated the treatment system operations and maintenance manual within the past 5 years?

- (●) Yes
- ( ) No

Please identify (below) the types of treatment equipment and processes installed at your facility.

Indicate as many as you need.

- [x] Screens
- [x] Grit Removal
- [ ] Primary Clarifier
- [ ] Imhoff Tanks
- [ ] Fixed Film Reactor
- [x] Activated Sludge
- [ ] Aerobic Suspended Growth Variations
- [ ] Anaerobic Suspended Growth Variations
- [ ] Physical-Chemical Systems for Organic Removal w/o Secondary Treatment
- [ ] Physical-Chemical Systems for Organic Rimoval Following Secondary Treatment
- [ ] Membrane Filtration
- [x] Suspended-Growth Nitrification and Denitrification
- [ ] Air Stripping
- [ ] Phosphorus Removal - Chemical
- [ ] Phosphorus Removal - Biological
- [ ] Ion Exchange
- [ ] Reverse Osmosis
- [ ] Media Filtration

- [ ] Dissolved Air Flotation
- [ ] Micro Screens
- [x] Chlorine Disinfection
- [ ] UV Disinfection
- [x] Effluent Use/Reuse

To the best of my knowledge, the Mechanical Plant section is comleted and accurate.

- (•) True
- ( ) False

Adopt & Sign

I have reviewed this report and to the best of my knowledge the information provided in this report is correct. *

- (•) True
- ( ) False

Has this been adopted by the City Council or District Board? *

- ( ) yes
- (•) No

Not Adopted by Council

What date will it be presented to the City Council or District Board? *

MM DD YYYY

04 / 21 / 2026

End of Survey

This is the end of the survey. Please make sure you have submitted your responses for each section. Thank you for your participation.

Also, if you want a copy of your response to this survey you must click the button immediately below and you must do it before you submit the survey.

Create your own Google Form

Does this form look suspicious? Report

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	RESOLUTION/PUBLIC HEARING - A Resolution of Eagle Mountain City, Utah, Considering the Disposal of a Portion of Utah County Parcel #46:536:0430, Designated as "Significant Real Property" Pursuant to EMMC 3.30.060 and 3.30.070.
ITEM TYPE:	Land Disposal
FISCAL IMPACT:	To be determined by City Council
APPLICANT:	Chelsea Lindsay and Chad Vidinhar

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	0.10 (approximately 4,300 square/feet)

PUBLIC HEARING	PREPARED BY	PRESENTED BY
Yes	Lacie Messerly, City Recorder	Lacie Messerly

RECOMMENDATION:
Staff recommends that the City Council deny a Resolution of Eagle Mountain City, Utah, Considering the Disposal of a Portion of Utah County Parcel #46:536:0430, Designated as "Significant Real Property" Pursuant to EMMC 3.30.060 and 3.30.070.

In the event the City Council approves the proposed disposal, staff recommends that the Council consider disposing of the entire parcel rather than a portion thereof, while retaining a utility easement to accommodate any potential future needs. This would include the disposal of parcels #46:865:0114 to the north and 46:491:0332 to the south as they are contiguous to parcel #46:536:0430.

Consistent with recent similar disposals, Staff further recommends establishing the disposal cost. Previous disposals have been approved at $2.07 per square foot. Since the property is a portion of parcel #46:536:0430, a survey will need to be completed to determine the exact acreage and generate a legal description for a deed. The cost of the survey will need to be paid by the applicant.

BACKGROUND:
Purpose
Consideration of the disposal of designated “significant real property” pursuant to EMMC 3.30.060 and 3.30.070. An application was submitted by Chelsea Lindsay and Chad Vidinhar requesting disposal of a portion of Utah County Parcel #46:536:0430. The applicant has executed a written cost acknowledgment per EMMC 3.30.070.

This parcel is a trail corridor located behind lot 424 in Meadow Ranch, Plat 4 and is identified as a pedestrian corridor in Eagle Mountain City's Natural Open Space & Wildlife Habitat Management Plan. This has also been deemed as a safe walking route; however, the trail is not maintained at this time.

Public Notice & Process Compliance

- Written notice of potential disposal was provided to adjoining property owners.
- Notice was published a minimum of 14 days prior to public hearing.
- Public hearing is scheduled per EMMC requirements.

ITEMS FOR CONSIDERATION:
The property was originally owned by the HOA who deeded the property to Eagle Mountain City for a future trail corridor. The trail is not currently being maintained.

Water Requirements: It has been determined by Staff that no additional water would be required with the disposal of this property.

PLANNING COMMISSION ACTION/RECOMMENDATION:
N/A

ATTACHMENTS:
1. Resolution
2. Land Disposal Application
3. City Owned Property Map

RESOLUTION NO. R- -2026

A RESOLUTION OF EAGLE MOUNTAIN CITY, UTAH, APPROVING A PORTION OF UTAH COUNCIL PARCEL #46:536:0430 OF DESIGNATED "SIGNIFICANT REAL PROPERTY", PURSUANT TO EMMC 3.30.060 AND 3.30.070. (CHELSEA LINDSAY & CHAD VIDINHAR)

PREAMBLE

WHEREAS, the City Council of Eagle Mountain City, Utah is a public body with the authority to dispose of real property pursuant to the Eagle Mountain Municipal Code; and

WHEREAS, EMMC 3.30.060 provides the process for the disposal of significant real property, including a requirement for public notice, a public hearing, and evaluation by City staff and departments; and

WHEREAS, the City has received an application to dispose of a portion of Utah County parcel #46:536:0430 to resolve encroachments, align lot boundaries with existing fence lines, and improve lot configurations for adjacent residential properties; and

WHEREAS, all public notice requirements under EMMC 3.30.060 have been met, including mailed notice to adjoining landowners and 14-day publication in accordance with EMMC 3.30.020(B); and

WHEREAS, the City Council held a public hearing on this matter and finds it in the best interest of the City and community to dispose of the Subject Property under the terms described below.

NOW, THEREFORE, be it resolved by the City Council of Eagle Mountain City, Utah, as follows:

1. The City Council hereby authorizes the disposal of Utah County parcel #46:536:0430, as determined and approved by Council, as depicted in Exhibit A.

2. A professional survey shall be conducted to determine final square footage and acre-foot water impacts. The applicants shall prepare and record an amended final plat reflecting the new lot boundaries. All associated costs shall be paid by the applicants.

3. The City shall not guarantee additional water rights to lots affected by the disposal. Applicants are responsible for understanding and complying with current City water policies and any water requirement tier increases resulting from the disposal.

4. The property shall be disposed of through direct sale to the applicants, conditioned on completion of all survey work, payment of required fees, and recording of the amended plat.

5. The purchase price for the property is established at $_____ per square foot, with the total amount determined by the final surveyed area. Payment in full shall be required prior to recordation of the amended plat.

6. All existing utility easements on the property shall be maintained. The applicant shall ensure continued access for construction, operation, maintenance, and repair or utilities as required by the City.

7. This resolution shall become effective immediately upon its passing.

ADOPTED by the City Council of Eagle Mountain City, Utah, this 21st day of April 2026.

EAGLE MOUNTAIN CITY, UTAH

_____
Jared Gray, Mayor

ATTEST:

_____
Lacie A. Messerly
City Recorder

CERTIFICATION

The above Resolution was adopted by the City Council of Eagle Mountain City, Utah on the 21st day of April, 2026.

Those voting yes:	Those voting no:	Those excused:	Those abstaining:
☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark
☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish
☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting
☐ Rich Wood	☐ Rich Wood	☐ Rich Wood	☐ Rich Wood
☐ Brett Wright	☐ Brett Wright	☐ Brett Wright	☐ Brett Wright

_____

Lacie A. Messerly
City Recorder

Exhibit A

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	ORDINANCE/PUBLIC HEARING - An Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code 17.72.040 HVAC Screening for Multi-Family Buildings.
ITEM TYPE:	Development Code Amendment
FISCAL IMPACT:	N/A
APPLICANT:	City-initiated

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	N/A

PUBLIC HEARING	PREPARED BY	PRESENTED BY
Yes	Robert Hobbs, Senior Planner	Robert Hobbs

RECOMMENDATION:
Staff recommends the City Council adopt an Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code 17.72.040 HVAC Screening for Multi-Family Buildings.

BACKGROUND:
Staff was directed to prepare a code amendment to propose more detailed ground-mounted HVAC screening requirements for multi-family residential buildings. That code change draft has been completed and is attached for review.

The draft language incorporates consideration for hiding equipment from multiple view points, controlled screening size/appearance, and clearance for maintenance access. The Planning Commission voted to recommend the drafted changes subject to a handful of revisions which have been incorporated into the attached draft labeled as [the] "Post PC Amendments Version".

ITEMS FOR CONSIDERATION:
The City Council should consider the potential consequences associated with the proposed code changes if adopted. Ordinances pertaining to Development Code Amendments, and processing of the same, may be found in EMMC 17.05.120 & UCA 10-9a-501.

Further, should some form of exception opportunity be afforded via the code draft? The allowance could simply, effectually say that the City Council may approve exceptions to the screening standards during the site plan review process.

PLANNING COMMISSION ACTION/RECOMMENDATION:
Favorable - the Planning Commission unanimously motioned to recommend that the draft amendment be approved subject to the following revisions to the same:

1. That polyethylene material (i.e., that which forms brand fencing like "Simtek" and "Trex" as examples) be added as a materials option.
2. Remove landscaping as a screening [exception] option.
3. The bottom of the screening must be within 6 inches of the ground.
4. All supporting lines and attachments to wall-mounted HVAC units be painted to match the wall color.

The fore-going edits/revisions have been made to the post-PC version of the amendment(s) hereto attached.

ATTACHMENTS:

1. Ordinance
2. Proposed Redlines
3. Post PC Amendments Redlines
4. Presentation

ORDINANCE NO. O- -2026

AN ORDINANCE OF EAGLE MOUNTAIN CITY, UTAH, AMENDING THE EAGLE MOUNTAIN MUNICIPAL CODE SECTION 17.72.040 HVAC SCREENING FOR MULTI-FAMILY BUILDINGS

PREAMBLE

WHEREAS, the City Council of Eagle Mountain City finds that it is in the public interest to amend the Eagle Mountain Municipal Code Section 17.72.040 regarding HVAC screening for multi-family buildings, as described in Exhibit A.

BE IT ORDAINED by the City Council of Eagle Mountain City, Utah:

1. The City Council finds that all required notices, public hearings, and other requirements have been completed for the City Council to consider an amendment to the Eagle Mountain Municipal Code Section 17.72.040 regarding HVAC screening for multi-family buildings, as described in Exhibit A.

2. The amendment described in Exhibit A is hereby approved.

3. This Ordinance shall take effect upon its first posting or publication.

ADOPTED by the City Council of Eagle Mountain City, Utah, this 21st day of April, 2026.

EAGLE MOUNTAIN CITY, UTAH

_____
Jared Gray, Mayor

ATTEST:

_____
Lacie A. Messerly
City Recorder

CERTIFICATION

The above ordinance was adopted by the City Council of Eagle Mountain City on the 21st day of April, 2026.

Those voting yes:	Those voting no:	Those excused:	Those abstaining:
☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark
☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish
☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting
☐ Rich Wood	☐ Rich Wood	☐ Rich Wood	☐ Rich Wood
☐ Brett Wright	☐ Brett Wright	☐ Brett Wright	☐ Brett Wright

_____

Lacie A. Messerly
City Recorder

Posted on _____ by _____.

Exhibit A

Chapter 17.72
COMMERCIAL AND MULTIFAMILY DESIGN STANDARDS

Sections:

17.72.010 What this chapter does.
17.72.020 Purpose.
17.72.030 Definitions.
17.72.040 Commercial Design Standards.
17.72.050 Commercial Site Design Standards.
17.72.060 Commercial Architectural Standards.
17.72.070 Multi-Family Design Standards.
17.72.080 Multi-Family Site Design.
17.72.090 Multi-Family Architectural Standards.
17.72.100 Appendix A: Commercial Downtown Diagrams.
17.72.110 Appendix B: Commercial Neighborhood Diagrams.
17.72.120 Appendix C: Commercial Community & Regional Diagrams.
17.72.130 Appendix D: Business Park Diagrams.
17.72.140 Appendix E: Multi-Family Diagrams.
17.72.150 Appendix F: Commercial Zoning Addition.

17.72.040 Architectural standards.

~~L. Mechanical Equipment. All mechanical equipment shall be screened so as not to be visible from any public or private streets. Screens shall be aesthetically incorporated into the design of the building and shall conform to the color and materials of the primary building. Screening includes walls, landscaping, parapet walls, or a combination. All electrical service equipment should be painted to match the wall color or screened to blend with the surrounding terrain.~~

L. Mechanical Equipment.

1. Ground mounted: Shall have a screen wall compliant with the following standards:

a. View block: Shall be a L-shaped, sight-obscuring screen placed against the equipment pad, set such that one side/face is parallel to the property's frontage from which the condenser units may be viewed and the other side facing the closest side (or street side as relevant), property line.

Illustration:

b. Height of screen(s): No less nor taller than 6” above the height of the highest mechanical unit being hidden with the bottom most board/slats/paneling being no closer than 6” to the ground; and,

c. Length/width of screen(s): No less than the width of any unit, or units set together, plus 18” to each end/side; and,

d. Screen gap to unit(s): No closer, nor farther away, than allowed by adopted building code and the equipment manufacturer(s) specification(s) as required for access to the unit(s) – whichever is more restrictive, or, 18” (save where power cord and supply/return lines are located). The “side’ of the unit(s) where those lines/cord connect to the condenser(s) shall remain unscreened and readily accessible for maintenance purposes; and,

e. Aesthetics: Screens shall be made of either vinyl or wood, painted or stained to match the primary color of the building(s) which they serve.

Exception: The City Council may authorize the use/planting of a landscape screen (i.e., hedge) in lieu of a material view block for the purpose of screening. Where shrubs are used, minimum sizing at planting shall be 5 gallons.

2. Wall mounted: (A) unit(s) shall be painted to match the wall color to which they attached.

Chapter 17.72
COMMERCIAL AND MULTIFAMILY DESIGN STANDARDS

Sections:

17.72.010 What this chapter does.
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L. Mechanical Equipment.

1. Ground mounted: Shall have a screen wall compliant with the following standards:

a. View block: Shall be a L-shaped, sight-obscuring screen placed against the equipment pad, set such that one side/face is parallel to the property's frontage from which the condenser units may be viewed and the other side facing the closest side (or street side as relevant), property line.

Illustration:

b. Height of screen(s): No less nor taller than 6” above the height of the highest mechanical unit being hidden with the bottom most board/slats/paneling being no higher than 6” off the ground if a gap is left at the bottom of the screen; and,

c. Length/width of screen(s): No less than the width of any unit, or units set together, plus 18” to each end/side; and,

d. Screen gap to unit(s): No closer, nor farther away, than allowed by adopted building code and the equipment manufacturer(s) specification(s) as required for access to the unit(s) – whichever is more restrictive, or, 18” (save where power cord and supply/return lines are located). The “side’ of the unit(s) where those lines/cord connect to the condenser(s) shall remain unscreened and readily accessible for maintenance purposes; and,

e. Aesthetics: Screens shall be made of either vinyl, polyethylene (e.g., “Simtek”, “Trex” or similar brand) or wood, pre-colored, painted or stained to match the primary color of the building(s) which they serve.

2. Wall mounted: (A) unit(s) piping/wiring/lines shall be painted up to the meter in in the same color as the wall to which they are attached.

Chapter 17.72
COMMERCIAL AND MULTIFAMILY DESIGN STANDARDS

Sections:

17.72.010 What this chapter does.
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L. Mechanical Equipment.

1. Ground mounted: Shall have a screen wall compliant with the following standards:

side/face is closest side

a. View block: Shall be a L-shaped, sight-obscuring screen placed against the equipment pad, set such that one parallel to the property's frontage from which the condenser units may be viewed and the other side facing the (or street side as relevant), property line.

Illustration:

b. Height of screen(s): No less nor taller than 6” above the height of the highest mechanical unit being hidden with the bottom most board/slats/paneling being no closer than 6” to the ground; and,

c. Length/width of screen(s): No less than the width of any unit, or units set together, plus 18” to each end/side; and,

d. Screen gap to unit(s): No closer, nor farther away, than allowed by adopted building code and the equipment manufacturer(s) specification(s) as required for access to the unit(s) – whichever is more restrictive, or, 18” (save where power cord and supply/return lines are located). The “side’ of the unit(s) where those lines/cord connect to the condenser(s) shall remain unscreened and readily accessible for maintenance purposes; and,

e. Aesthetics: Screens shall be made of either vinyl or wood, painted or stained to match the primary color of the building(s) which they serve.

Exception: The City Council may authorize the use/planting of a landscape screen (i.e., hedge) in lieu of a material view block for the purpose of screening. Where shrubs are used, minimum sizing at planting shall be 5 gallons.

2. Wall mounted: (A) unit(s) shall be painted to match the wall color to which they attached.

VS. (post PC form):

Illustration:

the bottom b. Height of screen(s): No less nor taller than 6” above the height of the highest mechanical unit being hidden with most board/slats/paneling being no higher than 6” off the ground if a gap is left at the bottom of the screen; and,

c. Length/width of screen(s): No less than the width of any unit, or units set together, plus 18” to each end/side; and,

where power condenser(s) shall d. Screen gap to unit(s): No closer, nor farther away, than allowed by adopted building code and the equipment manufacturer(s) specification(s) as required for access to the unit(s) – whichever is more restrictive, or, 18” (save cord and supply/return lines are located). The “side’ of the unit(s) where those lines/cord connect to the remain unscreened and readily accessible for maintenance purposes; and,

pre-colored, e. Aesthetics: Screens shall be made of either vinyl, polyethylene (e.g., “Simtek”, “Trex” or similar brand) or wood, painted or stained to match the primary color of the building(s) which they serve.

which they 2. Wall mounted: (A) unit(s) piping/wiring/lines shall be painted up to the meter in in the same color as the wall to are attached.

Question: Should some form of CC approvable exception request opportunity exist (via site plan review/approval)?

	EAGLE MOUNTAIN CITY **CITY COUNCIL MEETING** **APRIL 21, 2026**
TITLE:	ORDINANCE - An Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code 17.60 and 17.10 regarding Fencing.
ITEM TYPE:	Development Code Amendment
FISCAL IMPACT:	N/A
APPLICANT:	Eagle Mountain Resident, Katie Elliott

CURRENT GENERAL PLAN DESIGNATION & ZONE	ACREAGE
N/A	N/A

PUBLIC HEARING
Yes

PREPARED BY
Mickie Mills, Planner

PRESENTED BY
Mickie Mills

RECOMMENDATION:
Staff recommends that the City Council deny the Ordinance of Eagle Mountain City, Utah, Amending the Eagle Mountain Municipal Code 17.60 and 17.10 regarding Fencing.

BACKGROUND:
This code amendment was requested by Eagle Mountain City resident, Katie Elliott. It adds “pre-weathered weathering steel (ASTM A606-4/A588 steel)” as an approved material type for residential perimeter fencing and adds a definition for “pre-weathered weathering steel (ASTM A606-4/A588 steel).” Corten steel is a brand name for weathering steel. The applicant is willing to modify the provided code language to limit its installation near concrete or other areas where lack of maintenance may cause clean-up or enforcement issues.

This item was initially brought forth to City Council on March 3, 2026. During the meeting, concerns about the aesthetics were raised. Council Member Wood raised concern about all the different styles across the City, and the difficulty with maintaining the fence and enforcing the specifics. Council Member Clark suggested a fencing plan similar to the existing animal management plans. Council Member Wright expressed concern about the rusting and proposed adding mitigation measures to the code and bring it back to a work session. Council Member Huish recommended providing two or three specific options to allow in the code, with consideration of the existing neighbors.

Mayor Gray recommended a Council Member or two meet with staff and the applicant outside the meeting, then return with proposed changes. After requesting feedback, the applicant and staff met with Council Member Wright who offered several mitigation measures to be included.

After being tabled, the applicant met with staff and Council Member Wright for collaboration on mitigation measures. Those measures can be found in the attached documentation and a brief summary is included in the Items for Consideration section.

A public hearing was completed at the City Council meeting on March 3, 2026.

ITEMS FOR CONSIDERATION:
A brief summary of what we added is below.

Pre-Weathered Weathering Steel Installation Requirements:

- Material must be pre-weathered ASTM A606-4 or A588 Steel
- Not installed adjacent to or abutting any City concrete or other material(s) that could be stained; including but not limited to sidewalks, sport courts, or drive lanes
- A drip edge or rock basin is required when installed near concrete
- Must be re-sealed annually

The City's General fencing/screen provisions can be found in EMMC 17.60120.

PLANNING COMMISSION ACTION/RECOMMENDATION:
Planning Commission forwarded a negative recommendation to the City Council.

ATTACHMENTS:
1. Ordinance
2. Clean
3. Redlines
4. Presentation

ORDINANCE NO. O- -2026

AN ORDINANCE OF EAGLE MOUNTAIN CITY, UTAH, AMENDING THE EAGLE MOUNTAIN MUNICIPAL CODE SECTION 17.60 AND SECTION 17.10 REGARDING FENCING

PREAMBLE

WHEREAS, the City Council of Eagle Mountain City finds that it is in the public interest to amend the Eagle Mountain Municipal Code Section 17.60 and Section 17.10 regarding Fencing, as described in Exhibit A.

BE IT ORDAINED by the City Council of Eagle Mountain City, Utah:

1. The City Council finds that all required notices, public hearings, and other requirements have been completed for the City Council to consider an amendment to the Eagle Mountain Municipal Code Section 17.60 and Section 17.10 regarding Fencing, as described in Exhibit A.

2. The amendment described in Exhibit A is hereby approved.

3. This Ordinance shall take effect upon its first posting or publication.

ADOPTED by the City Council of Eagle Mountain City, Utah, this 21st day of April, 2026.

EAGLE MOUNTAIN CITY, UTAH

_____
Jared Gray, Mayor

ATTEST:

_____
Lacie A. Messerly
City Recorder

CERTIFICATION

The above ordinance was adopted by the City Council of Eagle Mountain City on the 21st day of April, 2026.

Those voting yes:	Those voting no:	Those excused:	Those abstaining:
☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark	☐ Melissa Clark
☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish	☐ Zachory Huish
☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting	☐ Craig Whiting
☐ Rich Wood	☐ Rich Wood	☐ Rich Wood	☐ Rich Wood
☐ Brett Wright	☐ Brett Wright	☐ Brett Wright	☐ Brett Wright

_____

Lacie A. Messerly
City Recorder

Posted on _____ by _____.

Exhibit A

Resident Initiated Fence Code Amendment

PLGL-26-2

Proposed Code Language

> **17.60.120 General fencing/screening provisions.**

A. The standards in this section shall apply universally to fencing, walls, and screens in all zones unless specified otherwise. Various fence types are defined in EMMC 17.10.030. A fence permit or authorization via city site plan approval shall be required by the city to sanction the placement of a fence or wall or privacy screen.

Property owners should only install fencing on their property. If the property lines are not clearly marked, the city encourages the property owner(s) to consider having a surveyor determine property line locations and mark the same. Fence or wall height is measured from either: (1) the height of finished grade of the property whereupon a fence lies or to which it pertains, to the top of the fence or wall; or (2) from the height of the grade of a commercial or industrial building/parking pad where such is at a higher-grade elevation than any abutting residentially zoned or developed property, whichever results in a higher screen.

B. Residential Perimeter Fencing Standards.

1. Material Type(s).

a. Allowed: board (e.g., cedar), vinyl, and/or solid walls (made of decorative concrete or masonry (including brick)), ASTM A606-4 or A588 pre-weathered steel with wood posts, wrought iron or imitation variety thereof, composite material and limited amounts (i.e., less than 80 percent of the overall area of a section of fencing between posts) of black painted hog wire provided all such have top and bottom rails and substantial posts/columns.

i. Pre-Weathered Weathering Steel Installation Requirements:

- Material must be pre-weathered ASTM A606-4 or A588 Steel
- Not installed adjacent to or abutting any City concrete or other material(s) that could stain; including but not limited to sidewalks, sport courts, or drive lanes
- A drip edge or rock basin is required when installed near concrete
- Must be re-sealed annually

b. Composition. Fences shall be constructed such that no more than two materials (i.e., wood or vinyl, etc.) are used throughout and its color(s), pattern, and composition are consistent, save for posts or support columns which may be of different composition or style.

c. Not allowed: chain-link, wire, razor, chain fencing, gabion basket fencing, and/or electric (except as allowed per standards hereafter). Also, fences comprised of, or containing, sheet metal (except pre-weathered ASTM A606-4 or A588 steel installed in accordance with EMMC 17.60.120), OSB, and nontraditional materials/items such as signs, rugs, cardboard, Styrofoam, etc.

Exception(s):

i. Livestock animal enclosure. Barbed wire or wire fences (including electric lines) may be used to create animal enclosures. In such cases, the fence shall not exceed six feet in height and may only be used within/alongside rear yard areas.

ii. Sport court or golf course protection screening. Refer to provisions in subsection (J) of this section.

iii. Electric fences as allowed in accordance with electric fence provisions stated in this section.

2. Height(s).

a. Interior Lots. No fence shall exceed four feet in height in the front yard area of a property. Wing fencing extending from the front corners of a residence to the side property lines may be up to six feet tall. Fencing along the side property lines past the front wall plane of a residence to, and along, the rear property line, including against an alley or service drive, may be up to six feet tall. Fencing that adjoins an alley or service drive shall be required to comply with clear vision triangle standards where applicable.

b. Corner Lots. Same as interior lots save that no fencing over three feet in height shall be within a clear vision triangle. Fencing that adjoins an alley, service drive or driveway shall be required to comply with clear vision triangle standards where applicable.

Exception(s): Sport court fencing or golf course screening shall be exempt from the height regulations of this subsection but may not be used as exterior property fencing/screening.

C. Nonresidential (i.e., Agricultural, Commercial, Industrial, etc.) Perimeter Fence/Wall Materials, Appearance and Maintenance Standards.

1. Material Type(s).

a. Allowed: board (e.g., cedar), vinyl, and/or decorative concrete or masonry (including brick), wrought iron or simulated/imitation version thereof, composite material and limited amounts of painted hog wire provided all such have top and bottom rails and substantial posts/columns.

b. Composition. Fences shall be constructed such that no more than two materials (i.e., wood or vinyl, etc.) are used throughout and its color(s), pattern, and composition are consistent save for posts or support columns which may be of different composition or style.

c. Not allowed: full wire, razor, chained fencing, gabion basket fencing, chain-link fencing, and/or electric screen fencing.

Exception(s): Barbed wire, electrified wire (not fully electrified fences – see subsection H of this section) or full wire fences (e.g., hog wire or similar) shall be allowed:

i. In conjunction with the care and keeping of livestock on property.

ii. On property that has either greenbelt tax status or legal nonconforming status.

iii. For city fencing of conservation easements or other sensitive public or municipal lands, and/or perimeter screening of the city's wildlife corridor.

iv. For city fencing of land for vegetative management purposes (i.e., livestock grazing of open spaces, utility rights-of-way and other areas).

v. Chain-link fencing as specified in this title around industrially zoned properties or monopole cell towers (see subsection (C)(1)(d) of this section).

d. Where chain-link is allowed in industrial zones or in conjunction with monopole cell towers, said fencing:

i. Shall have top rails.

ii. Shall be vinyl coated.

iii. Shall be obscured by a vegetative screen between it and any parking lot or adjoining public street.

iv. Shall not have slats embedded therein.

v. Chain-link mesh shall be flush to the ground.

2. Height(s).

a. Agricultural Zone. Fencing in industrial zones shall not exceed eight feet in height.

b. Commercial Zones. Fencing in commercial zones shall not exceed eight feet in height in any property area.

c. Industrial Zones. Fencing in industrial zones shall not exceed eight feet in height.

D. City Facilities Fencing Standards. Security fencing type/materials and height for public municipal facilities shall be no less than six feet nor higher than eight feet tall and shall be simulated wrought iron. Exception: City fencing installed to preserve conservation easement areas, or the wildlife corridor may be of material type and height as determined appropriate by the city.

E. Walls or Fences as Buffers or Street Screens. Where required, screening walls or fences shall not be less than six feet in height. Required wall installations shall precede issuance of a building permit for a project related to a wall as per EMMC 16.35.090. Masonry or decorative concrete shall be used as a:

1. Buffer. Where and when a commercial use borders a residential or agricultural zone or development. Such wall, fence and landscaping shall be maintained in good condition with no advertising thereon.

2. Refuse Areas. Trash enclosures and other refuse collection areas shall be screened by a solid masonry or decorative concrete wall. Gates shall be (full) metal and sight-obscuring, not made of chain link or chain link with slats.

3. Street Screens. Where and when residential fencing abutting a road identified by the city as a “major” or “minor” “arterial,” or, as a “major” or “minor” “collector” is installed, it shall be of consistent height (not less than six feet), material and color, and be made of stone, masonry or decorative concrete.

Residential subdivisions, business park, commercial, commercial storage, and industrial developments shall install six-foot-tall privacy screening made of durable materials consisting of either stone, masonry or decorative concrete (including precast concrete) along the rear and/or side lot lines of a project that abut(s) an arterial or collector road right-of-way, or one designated as such on the city’s existing future transportation plan.

Developers/builders are required to install privacy screening prior to any building permits being issued in that phase of development that abuts such right-of-way. Property purchasers, at any such time as they desire to install screening along an arterial or collector where such is absent, shall install an acceptable wall.

Exception: In cases where a residential property:

a. Either abuts the Ranches Parkway; or

b. Faces (at an angle within 45 degrees of being parallel) to Ranches Parkway; and

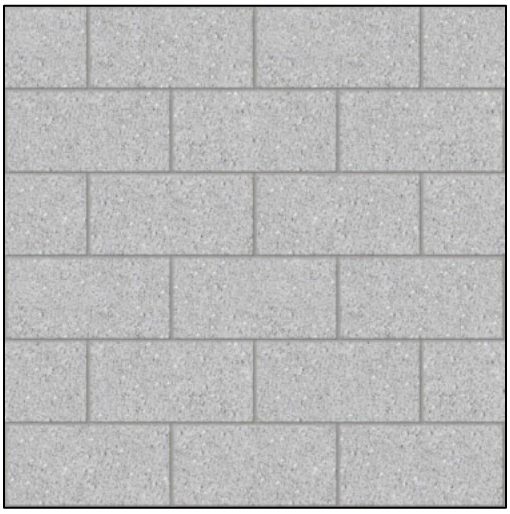
c. Is within 75 feet of the closest Ranches Parkway right-of-way line; and

d. Where and when screening of the property (usually along a rear property line) from the Parkway has not already been installed by a developer/builder prior to occupancy of a house on that property; then

screening installed by that lot's owner shall be a "Monterey Gray" colored wood fence – six feet maximum height.

Note that the foregoing requirement does not pertain to those properties in the Ranches with yards abutting or facing actively used golf course land (i.e., fairways or greens) where wrought iron type fencing is instead required between those yard areas (usually backyards) and the golf course.

Examples of inappropriate concrete and masonry walls styling include:



F. Residential Privacy Screens. Privacy screens on residential properties that serve as view curtains, decorative elements, buffers to neighboring properties, etc., shall be allowed; provided, that:

1. They are treated as accessory structures in terms of allowed height(s), required setback(s) and the need to avoid being placed in or across an easement.

2. If under seven feet in height, neither a fence nor a building permit is, or shall be, required. However, if a privacy screen is [to be] over seven feet in height, a building permit is [first] required.

G. Wall or Fence Location Restrictions.

1. Rights-of-Way. Neither fences nor walls shall be located within any portion of any public right-of-way without written city consent. Written city consent shall consist of an approved right-of-way encroachment agreement/license. If allowed within a public right-of-way, it shall be the duty of the owner of the fence or wall to remove the same at their expense upon notification by the city for any reason deemed sufficient by the city.

2. Easements.

a. Fences may be placed across or in easements.

b. Walls (including retaining types) shall not be allowed to cross or rest within an easement unless approved otherwise by vacating all or a portion of the easement or obtaining an easement release coupled with an encroachment license/agreement from the city.

3. Utility Fixtures. Fire hydrants and utility boxes shall not be fenced into a yard (i.e., trapped). Fencing shall be kept at least three feet from any such fixtures.

4. Utility Meters. Fencing shall not obstruct access to gas, electric, and water meters. If an area of a property with such meters is enclosed by fencing, there shall be an unlocked entrance (e.g., a gate) to allow access to the meter(s).

H. Electric Perimeter/Screen Fences (Fully Electrified Fence). Electric perimeter security fences shall only be allowed in the city as provided in this section, subject to the following standards:

1. IEC Standard 60335-2-76. Unless otherwise specified herein, electric fences shall be constructed or installed in conformance with the specifications set forth in International Electrotechnical Commission (IEC) Standard 60335-2-76.

2. Energizer. The energizer for electric fences must be driven by a commercial storage battery not to exceed 12 volts DC. The storage battery is charged primarily by a solar panel. However, the solar panel may be augmented by a commercial trickle charger.

3. Charge Limit. The electric charge produced by the fence upon contact shall not exceed energizer characteristics set forth in paragraph 22.108 and depicted in Figure 102 of IEC Standard 60335-2-76.

4. Where permitted: Electric fences shall be permitted on any nonresidential outdoor storage area or to secure power plant property.

5. Signage. Electric fences shall be clearly identified with warning signs that read “Warning – Electric Fence” placed at intervals not less than 60 feet apart.

6. Governing Regulations. Electric fences shall otherwise be governed and regulated under burglar alarm regulations and permitted.

7. Violation. It shall be unlawful for any person to install, maintain or operate an electric fence in violation of this section except those fences designed and operated to contain livestock. Those fences shall comply with traditional practice and industry standards applicable to livestock enclosures.

I. Berms and Landscape Screens or Hedges. Berms, landscape screens, including hedges, shall be considered functionally equivalent to fences unless otherwise specified. If used, berms and any planting or fencing atop the same shall be restricted in height equivalent to that allowed for a fence in a given location. This shall not be construed to mean, however, that berms or hedges may be substituted for fencing or walls where fencing or a wall are specifically required to be installed per code.

17.10.030 Definitions.

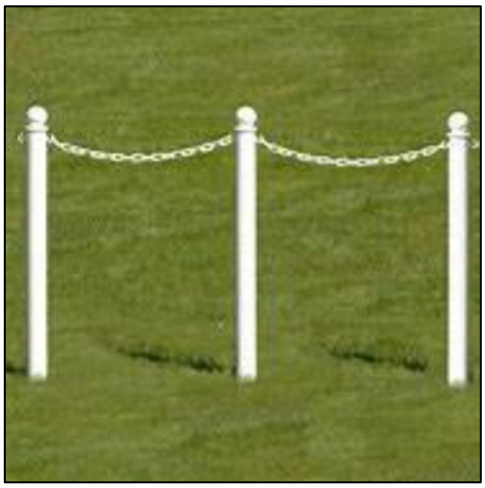
“Fence” means a type of upright linear structure that serves as a barrier and/or boundary and is customarily used to mark a property boundary and/or to control access to/from a property, serve as a sight or protective screen or as a decorative element. Fences are made of varying materials and in varying styles. Common subtypes (with sample pictorial representations) include as follows:

“Board” means a fence that is mainly or wholly comprised of vertically arranged boards (often cedar wood) abutted together in a row.

“Board-on-board” (aka “shadowbox”) means a fence with alternating vertical boards over horizontal structures that give the fence a finished look on both sides.

“Chain-link” or “cyclone” means any fence that is constructed out of some type of woven wire fence, typically with a minimum gauge ranging from nine to 11.

“Chained fencing” means lengths of chain (usually heavy gauge) suspended between support poles/bollard or columns.



“Decorative” means any fence not specifically established to curtail access through or past the same. Decorative fences shall not include any form of chain link material.

“Gabion basket” means a wire mesh wrapped column of rock, usually river rock or similar materials to form an effectual basket.

“Lattice” means an open framework made of strips of wood or similar material overlapped or overlaid in a regular crisscross or decorative pattern.

“Non-site-obscuring” means a fence (e.g., picket, chain-link, solid fence with partial wire or lattice composition) that allows some view through the same.

“Ornamental” means wrought iron, tubular aluminum, or other decorative metal fence.

“Picket” means a fence with in-line boards with gaps between the same. Typically, the gaps are the same width as the boards, and the boards are usually arranged vertically.

“Privacy screen, residential” means a type of **fence** or curtain wall placed on a property (typically along a patio, deck, courtyard, or swimming pool) not as a **fence** but rather a barrier to facilitate enhanced privacy or view screening on a property. Screens in this title are treated as a form of accessory structure instead of a fence and are subject to accessory structure code standards.

“Site-obscuring” means a fence (e.g., board or vinyl) or wall that by its construct inhibits viewing through or past the same.

“Split-rail” means a fence typically featuring two or three cross-members between posts or supports.

“Vinyl” means a fence that is mainly or wholly comprised (typically) of vertically arranged vinyl panels abutted together in a row.

“Pre-weathered weathering steel" or "ASTM A606-4/A588 steel” refers to low-alloy steel manufactured in a manner that accelerates the development of its protective rust-like patina after exposure to weather as defined by Advancing Standards Transforming Markets (ASTM).

Resident Initiated Fence Code Amendment

PLGL-26-2

Proposed Code Language

> **17.60.120 General fencing/screening provisions.**

A. The standards in this section shall apply universally to fencing, walls, and screens in all zones unless specified otherwise. Various fence types are defined in EMMC 17.10.030. A fence permit or authorization via city site plan approval shall be required by the city to sanction the placement of a fence or wall or privacy screen.

Property owners should only install fencing on their property. If the property lines are not clearly marked, the city encourages the property owner(s) to consider having a surveyor determine property line locations and mark the same. Fence or wall height is measured or assessed from either: (1) the height of finished grade of the property whereupon a fence lies or to which it pertains, to the top of the fence or wall; or (2) from the height of the grade of a commercial or industrial building/parking pad where such is at a higher-grade elevation than any abutting residentially zoned or developed property, whichever results in a higher screen.

B. Residential Perimeter Fencing Standards.

1. Material Type(s).

a. Allowed: board (e.g., cedar), vinyl, and/or solid walls (made of decorative concrete or masonry (including brick)), ASTM A606-4 or A588 pre-weathered steel with wood posts, wrought iron or imitation variety thereof, composite material and limited amounts (i.e., less than 80 percent of the overall area of a section of fencing between posts) of black painted hog wire provided all such have top and bottom rails and substantial posts/columns.

i. Pre-Weathered Weathering Steel Installation Requirements:

- Material must be pre-weathered ASTM A606-4 or A588 Steel
- Not installed adjacent to or abutting any City concrete or other material(s) that could be stained; including but not limited to sidewalks, sport courts, or drive lanes
- A drip edge or rock basin is required when installed near concrete
- Must be re-sealed annually

b. Composition. Fences shall be constructed such that no more than two materials (i.e., wood or vinyl, etc.) are used throughout and its color(s), pattern, and composition are consistent, save for posts or support columns which may be of different composition or style.

c. Not allowed: chain-link, wire, razor, chain fencing, gabion basket fencing, and/or electric (except as allowed per standards hereafter). Also, fences comprised of, or containing, sheet metal (except pre-weathered ASTM A606-4 or A588 steel installed in accordance with EMMC 17.60.120), OSB, and nontraditional materials/items such as signs, rugs, cardboard, Styrofoam, etc.

Exception(s):

i. Livestock animal enclosure. Barbed wire or wire fences (including electric lines) may be used to create animal enclosures. In such cases, the fence shall not exceed six feet in height and may only be used within/alongside of rear yard areas.

ii. Sport court or golf course protection screening. Refer to provisions in subsection (J) of this section.

iii. Electric fences as allowed in accordance with electric fence provisions stated in this section.

2. Height(s).

a. Interior Lots. No fence shall exceed four feet in height in the front yard area of a property. Wing fencing extending from the front corners of a residence to the side property lines may be up to six feet tall. Fencing along the side property lines past the front wall plane of a residence to, and along, the rear property line, including against an alley or service drive, may be up to six feet tall. Fencing that adjoins an alley or service drive shall be required to comply with clear vision triangle standards where applicable.

b. Corner Lots. Same as interior lots save that no fencing over three feet in height shall be within a clear vision triangle. Fencing that adjoins an alley, service drive or driveway shall be required to comply with clear vision triangle standards where applicable.

Exception(s): Sport court fencing or golf course screening shall be exempt from the height regulations of this subsection but may not be used as exterior property fencing/screening.

C. Nonresidential (i.e., Agricultural, Commercial, Industrial, etc.) Perimeter Fence/Wall Materials, Appearance and Maintenance Standards.

1. Material Type(s).

a. Allowed: board (e.g., cedar), vinyl, and/or decorative concrete or masonry (including brick), wrought iron or simulated/imitation version thereof, composite material and limited amounts of painted hog wire provided all such have top and bottom rails and substantial posts/columns.

b. Composition. Fences shall be constructed such that no more than two materials (i.e., wood or vinyl, etc.) are used throughout and its color(s), pattern, and composition are consistent save for posts or support columns which may be of different composition or style.

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Exception(s): Barbed wire, electrified wire (not fully electrified fences – see subsection H of this section) or full wire fences (e.g., hog wire or similar) shall be allowed:

i. In conjunction with the care and keeping of livestock on property.

ii. On property that has either greenbelt tax status or legal nonconforming status.

iii. For city fencing of conservation easements or other sensitive public or municipal lands, and/or perimeter screening of the city's wildlife corridor.

iv. For city fencing of land for vegetative management purposes (i.e., livestock grazing of open spaces, utility rights-of-way and other areas).

v. Chain-link fencing as specified in this title around industrially zoned properties or monopole cell towers (see subsection (C)(1)(d) of this section).

d. Where chain-link is allowed in industrial zones or in conjunction with monopole cell towers, said fencing:

i. Shall have top rails.

ii. Shall be vinyl coated.

iii. Shall be obscured by a vegetative screen between it and any parking lot or adjoining public street.

iv. Shall not have slats embedded therein.

v. Chain-link mesh shall be flush to the ground.

2. Height(s).

a. Agricultural Zone. Fencing in industrial zones shall not exceed eight feet in height.

b. Commercial Zones. Fencing in commercial zones shall not exceed eight feet in height in any property area.

c. Industrial Zones. Fencing in industrial zones shall not exceed eight feet in height.

D. City Facilities Fencing Standards. Security fencing type/materials and height for public municipal facilities shall be no less than six feet nor higher than eight feet tall, and shall be simulated wrought iron. Exception: City fencing installed to preserve conservation easement areas, or the wildlife corridor may be of material type and height as determined appropriate by the city.

E. Walls or Fences as Buffers or Street Screens. Where required, screening walls or fences shall not be less than six feet in height. Required wall installations shall precede issuance of a building permit for a project related to a wall as per EMMC 16.35.090. Masonry or decorative concrete shall be used as a:

1. Buffer. Where and when a commercial use borders a residential or agricultural zone or development. Such wall, fence and landscaping shall be maintained in good condition with no advertising thereon.

2. Refuse Areas. Trash enclosures and other refuse collection areas shall be screened by a solid masonry or decorative concrete wall. Gates shall be (full) metal and sight-obscuring, not made of chain link or chain link with slats.

3. Street Screens. Where and when residential fencing abutting a road identified by the city as a “major” or “minor” “arterial,” or, as a “major” or “minor” “collector” is installed, it shall be of consistent height (not less than six feet), material and color, and be made of stone, masonry or decorative concrete.

Residential subdivisions, business park, commercial, commercial storage, and industrial developments shall install six-foot-tall privacy screening made of durable materials consisting of either stone, masonry or decorative concrete (including precast concrete) along the rear and/or side lot lines of a project that abut(s) an arterial or collector road right-of-way, or one designated as such on the city’s existing future transportation plan.

Developers/builders are required to install privacy screening prior to any building permits being issued in that phase of development that abuts such right-of-way. Property purchasers, at any such time as they desire to install screening along an arterial or collector where such is absent, shall install an acceptable wall.

Exception: In cases where a residential property:

a. Either abuts the Ranches Parkway; or

b. Faces (at an angle within 45 degrees of being parallel) to Ranches Parkway; and

c. Is within 75 feet of the closest Ranches Parkway right-of-way line; and

d. Where and when screening of the property (usually along a rear property line) from the Parkway has not already been installed by a developer/builder prior to occupancy of a house on that property; then

screening installed by that lot's owner shall be a "Monterey Gray" colored wood fence – six feet maximum height.

Note that the foregoing requirement does not pertain to those properties in the Ranches with yards abutting or facing actively used golf course land (i.e., fairways or greens) where wrought iron type fencing is instead required between those yard areas (usually backyards) and the golf course.

Examples of inappropriate concrete and masonry walls styling include:

F. Residential Privacy Screens. Privacy screens on residential properties that serve as view curtains, decorative elements, buffers to neighboring properties, etc., shall be allowed; provided, that:

1. They are treated as accessory structures in terms of allowed height(s), required setback(s) and the need to avoid being placed in or across an easement.

2. If under seven feet in height, neither a fence nor a building permit is, or shall be, required. However, if a privacy screen is [to be] over seven feet in height, a building permit is [first] required.

G. Wall or Fence Location Restrictions.

1. Rights-of-Way. Neither fences nor walls shall be located within any portion of any public right-of-way without written city consent. Written city consent shall consist of an approved right-of-way encroachment agreement/license. If allowed within a public right-of-way, it shall be the duty of the owner of the fence or wall to remove the same at their expense upon notification by the city for any reason deemed sufficient by the city.

2. Easements.

a. Fences may be placed across or in easements.

b. Walls (including retaining types) shall not be allowed to cross or rest within an easement unless approved otherwise by vacating all or a portion of the easement or obtaining an easement release coupled with an encroachment license/agreement from the city.

3. Utility Fixtures. Fire hydrants and utility boxes shall not be fenced into a yard (i.e., trapped). Fencing shall be kept at least three feet from any such fixtures.

4. Utility Meters. Fencing shall not obstruct access to gas, electric, and water meters. If an area of a property with such meters is enclosed by fencing, there shall be an unlocked entrance (e.g., a gate) to allow access to the meter(s).

H. Electric Perimeter/Screen Fences (Fully Electrified Fence). Electric perimeter security fences shall only be allowed in the city as provided in this section, subject to the following standards:

1. IEC Standard 60335-2-76. Unless otherwise specified herein, electric fences shall be constructed or installed in conformance with the specifications set forth in International Electrotechnical Commission (IEC) Standard 60335-2-76.

2. Energizer. The energizer for electric fences must be driven by a commercial storage battery not to exceed 12 volts DC. The storage battery is charged primarily by a solar panel. However, the solar panel may be augmented by a commercial trickle charger.

3. Charge Limit. The electric charge produced by the fence upon contact shall not exceed energizer characteristics set forth in paragraph 22.108 and depicted in Figure 102 of IEC Standard 60335-2-76.

4. Where permitted: Electric fences shall be permitted on any nonresidential outdoor storage area or to secure power plant property.

5. Signage. Electric fences shall be clearly identified with warning signs that read “Warning – Electric Fence” placed at intervals not less than 60 feet apart.

6. Governing Regulations. Electric fences shall otherwise be governed and regulated under burglar alarm regulations and permitted as such.

7. Violation. It shall be unlawful for any person to install, maintain or operate an electric fence in violation of this section save those fences designed and operated to contain livestock. Those fences shall comply with traditional practice and industry standards applicable to livestock enclosure.

I. Berms and Landscape Screens or Hedges. Berms, landscape screens, including hedges, shall be considered functionally equivalent to fences unless otherwise specified. If used, berms and any planting or fencing atop the same shall be restricted in height equivalent to that allowed for a fence in a given location. This shall not be construed to mean, however, that berms or hedges may be substituted for fencing or walls where fencing or a wall are specifically required to be installed per code.

17.10.030 Definitions.

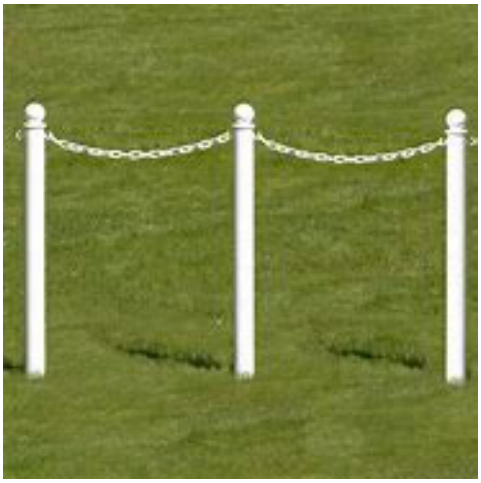
"Fence" means a type of upright linear structure that serves as a barrier and/or boundary and is customarily used to mark a property boundary and/or to control access to/from a property, serve as a sight or protective screen or as a decorative element. Fences are made of varying materials and in varying styles. Common subtypes (with sample pictorial representations) include as follows:

"Board" means a fence that is mainly or wholly comprised of vertically arranged boards (often cedar wood) abutted together in a row.

"Board-on-board" (aka "shadowbox") means a fence with alternating vertical boards over horizontal structures that give the fence a finished look on both sides.

“Chain-link” or “cyclone” means any fence that is constructed out of some type of woven wire fence, typically with a minimum gauge ranging from nine to 11.

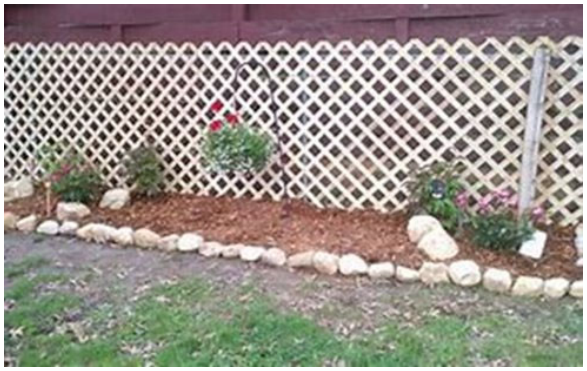
“Chained fencing” means lengths of chain (usually heavy gauge) suspended between support poles/bollard or columns.



“Decorative” means any fence not specifically established to curtail access through or past the same. Decorative fences shall not include any form of chain link material.

“Gabion basket” means a wire mesh wrapped column of rock, usually river rock or similar materials to form an effectual basket.

“Lattice” means an open framework made of strips of wood or similar material overlapped or overlaid in a regular crisscross or decorative pattern.



“Non-site-obscuring” means a fence (e.g., picket, chain-link, solid fence with partial wire or lattice composition) that allows some view through the same.

“Ornamental” means wrought iron, tubular aluminum, or other decorative metal fence.

“Picket” means a fence with in-line boards with gaps between the same. Typically, the gaps are the same width as the boards and the boards are usually arranged vertically.

“Privacy screen, residential” means a type of fence or curtain wall placed on a property (typically along a patio, deck, courtyard, or swimming pool) not as a fence but rather a barrier to facilitate enhanced privacy or view screening on a property. Screens in this title are treated as a form of accessory structure instead of a fence, and are subject to accessory structure code standards.

“Site-obscuring” means a fence (e.g., board or vinyl) or wall that by its construct inhibits viewing through or past the same.

“Split-rail” means a fence typically featuring two or three cross-members between posts or supports.

“Vinyl” means a fence that is mainly or wholly comprised (typically) of vertically arranged vinyl panels abutted together in a row.

“Pre-weathered weathering steel" or "ASTM A606-4/A588 steel” refers to low-alloy steel manufactured in a manner that accelerates the development of its protective rust-like patina after exposure to weather as defined by Advancing Standards Transforming Markets (ASTM).

City Council Meeting

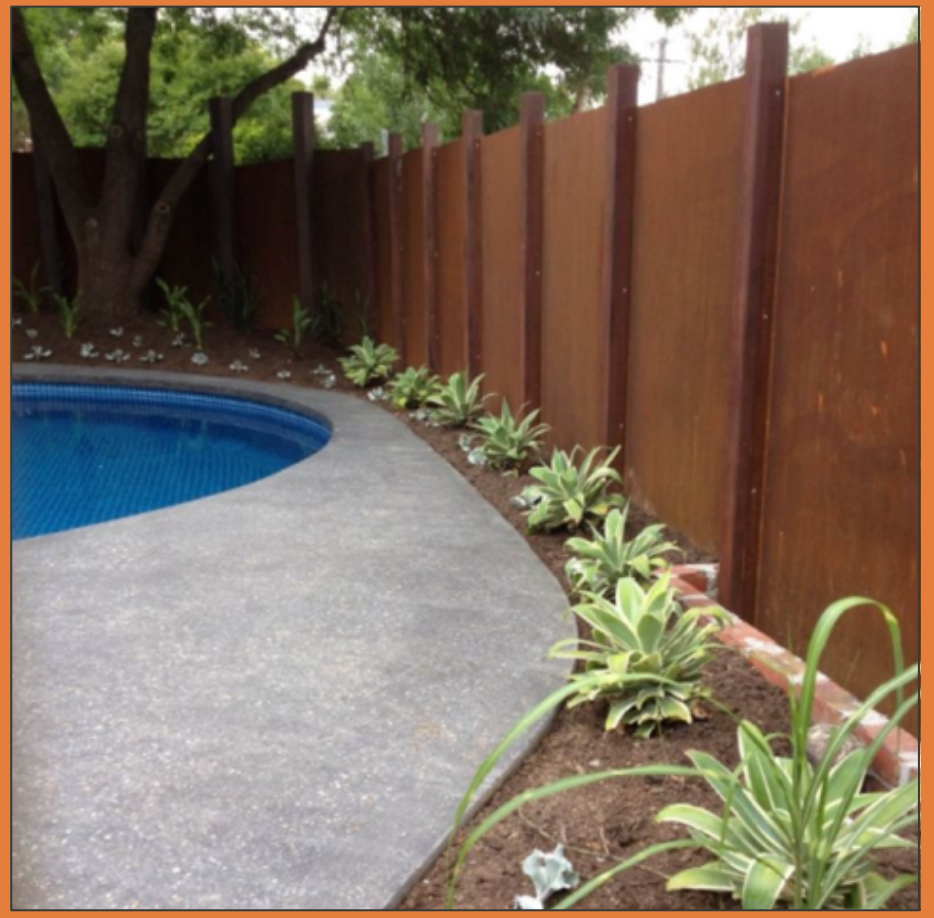
April 21, 2026

7.B
Resident Initiated Fence Code Amendment
Pre-Weathered Weathering Steel

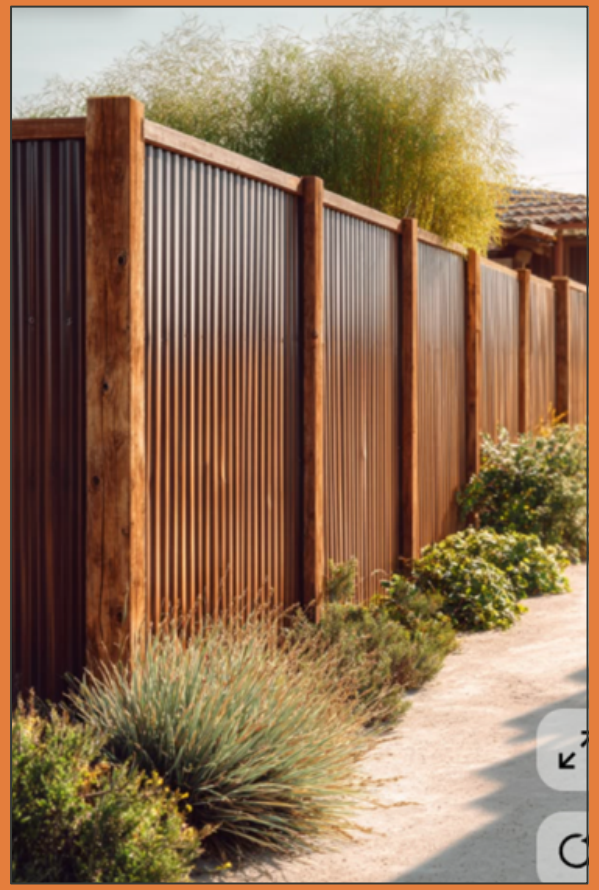
Existing Problematic but Allowed Fencing

Weathering Steel Fencing Examples

Weathering Steel Fencing Examples



Weathering Steel Fencing Examples



Weathering Steel – Material Facts

- Engineered Material:
  - Weathering steel is specifically formulated to oxidize in a controlled manner, forming a protective surface layer that significantly slows further corrosion.
- Corrosion-Resistant Composition:
  - Its composition is designed to enhance corrosion resistance.
- Protective Patina Formation:
  - The steel develops a stable, dark-brown patina that acts as a barrier against moisture and oxygen.
- Longevity:
  - Expected service life of 40–80+ years, depending on environmental conditions.
- Corrosion Behavior:
  - After the initial oxidation phase, the corrosion rate decreases dramatically. Unlike untreated mild steel, it does not “rust through.”
- Maintenance Profile:
  - During the first 6–12 months, surface oxidation (“bleeding”) may occur while the patina develops.
  - Once the protective layer is fully formed (typically 12–24 months), the surface stabilizes and no longer sheds or transfers residue.
  - A clear sealant can be applied initially to prevent runoff during the patina formation phase.
  - After stabilization, little to no ongoing maintenance is required.

17.60.120 General fencing/screening provisions

B. Residential Perimeter Fencing Standards.

1. Material Type(s).

a. Allowed: board (e.g., cedar), vinyl, and/or solid walls (made of decorative concrete or masonry (including brick)), ASTM A606-4 or A588 pre-weathered steel with wood posts, wrought iron or imitation variety thereof, composite material and limited amounts (i.e., less than 80 percent of the overall area of a section of fencing between posts) of black painted hog wire provided all such have top and bottom rails and substantial posts/columns.

1. Pre-Weathered Weathering Steel Installation Requirements:

- Material must be pre-weathered ASTM A606-4 or A588 Steel
- Not installed adjacent to or abutting any City concrete or other material(s) that could be stained; including but not limited to sidewalks, sport courts, or drive lanes
- A drip edge or rock basin is required when installed near concrete
- Must be re-sealed annually

c. Not allowed: chain-link, wire, razor, chain fencing, gabion basket fencing, and/or electric (except as allowed per standards hereafter). Also, fences comprised of, or containing, sheet metal (except pre-weathered ASTM A606-4 or A588 steel installed in accordance with EMMC 17.60.120), OSB, and nontraditional materials/items such as signs, rugs, cardboard, Styrofoam, etc.

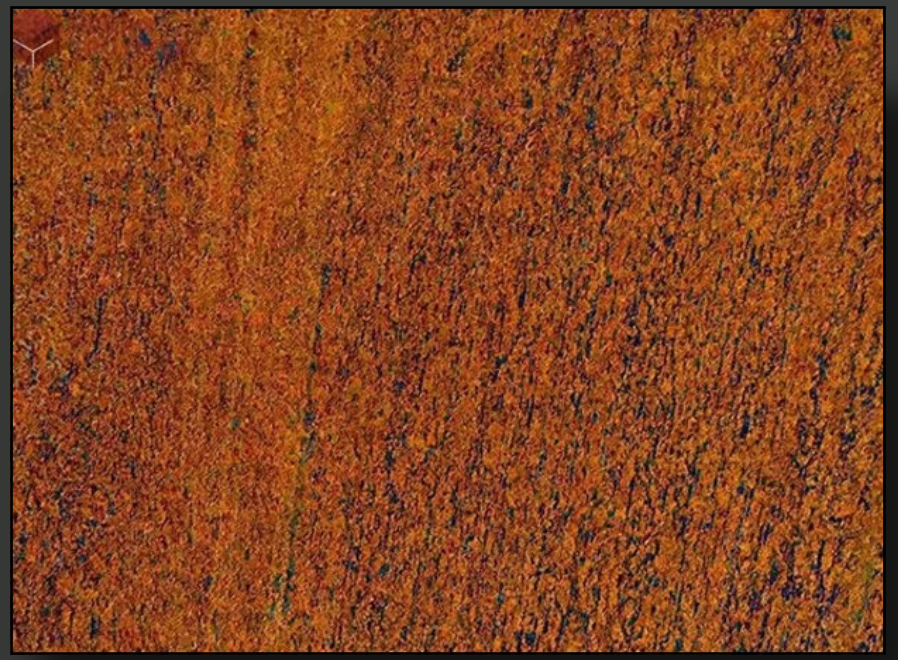
Existing code is in white. Proposed changes are in orange.

17.60.120 General fencing/screening provisions

17.10.030 Definitions

- “Pre-weathered weathering steel" or "ASTM A606-4/A588 steel” refers to low-alloy steel manufactured in a manner that accelerates the development of its protective rust-like patina after exposure to weather as defined by Advancing Standards Transforming Markets (ASTM).

Pre-Weathered Weathering Steel (Corten Steel)



Misinterpreted Weathering Steel Fence Examples

Misinterpreted Weathering Steel Fence Examples

Misinterpreted Weathering Steel Fence Examples

Staff Recommendation

- Our recommendation is to deny the proposed changes.
- Code Enforcement expressed concerns regarding:
  - the aesthetics of such a vastly difference fence appearance compared to what already exists in the City
  - difficulty in enforcing a fence code that requires this degree of specificity
- We cannot verify that any proposed steel fence is made of ASTM A606-4/A588 and not a standard corrugated steel. Verification would require a tensile strength test or a chemical analysis which are not practical.

Upcoming Staff Agenda Items for City Council Information (Tentative)

Development Projects

- PH Spring Run Plaza Preliminary Plat
- PH Sunset Mountain Property Rezone
- PH Flagship Homes Development Agreement

Code Amendments

- PH Enacting Section on Addressing and Street Naming (WS DISC 1/20)
- PH EMMC 17.72 regarding Parking, Drive Throughs and Setback Exceptions
- PH EMMC 17.55 & 17.60 regarding Plant Standards & Land Use Authority

Other Items

- PH Future Land Use Map – General Plan Amendment
- Scenic Mountain HOA - Lift Station Resolution
- WS DISC – E-bikes/motorcycles on Trails
- WS DISC - Eagle Mountain Properties Phase 2, Part 1 - Rezone of 31 Properties (2/3)

Redevelopment Agency

- PH Mid-Valley CRA Project Area Plan & Budget

BUDGET WORK SESSIONS

- 4/28/26 – 3-5pm (before Planning Commission)

Please note all items are tentative and are subject to change.

Updated 4/15/2025 - LM