Water Treatment Plant PFAS and Softening Study

City of Loveland

Ohio

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CITY OF LOVELAND, OHIO

WATER TREATMENT PLANT

PFAS AND SOFTENING STUDY

JUNE 2024

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1. INTRODUCTION

The City of Loveland provides water service to its residents. Water is sourced from three (3) groundwater wells located in Bodley Park along the western bank of the Little Miami River. Treatment consists of fluoridation and chlorination of the groundwater at the well field site. The treated water is then conveyed to ground storage tanks located both west and south of the well field for further distribution to the City's approximately 5,000 customers.

On April 10, 2024, the United States Environmental Protection Agency (USEPA) announced the final National Primary Drinking Water Regulation (NPDWR) for six per- and polyfluoroalkyl substances (PFAS). The NPDWR established legally enforceable maximum levels of PFAS permitted within public drinking water. The City of Loveland has tested raw water from the City's three (3) groundwater wells and PFAS were detected. The primary purpose of this Study is to evaluate effective treatment technologies to reduce PFAS concentrations in the raw water prior to distribution to the public.

To further improve water quality for their customers, the City of Loveland also wants to reduce raw water calcium and magnesium hardness (through treatment processes typically called softening) prior to distribution. This Study will secondarily evaluate incorporating a water softening process upstream of PFAS treatment.

2. EXISTING FACILITIES AND FUTURE NEEDS

2.01 Raw Water Source and Quality

The City of Loveland owns and maintains a total of three (3) groundwater supply wells located in Bodley Park along the western bank of the Little Miami River. Each well is capable of producing approximately 1,300 gallons per minute (gpm) of raw water. Together, the three (3) wells are capable of producing over 5 million gallons of groundwater per day or close to 4 million gallons per day (mgd) with one well out of service. The wells are approximately 85 feet deep and tap into a natural aquifer. The column assembly for each existing vertical turbine well pump extends above grade. The pump discharge and motor are located on an elevated platform to protect against the 100-year flood plain elevation. The wells have been regularly maintained and no noted issues or deficiencies have been identified by the City of Loveland.

Testing data of the raw water has been provided by the City of Loveland to aid in evaluating treatment technologies and in the assembly of this Study. PFAS testing data for all three (3) groundwater wells, Well Nos. 4, 5, and 6, is presented in Table 2-1. The specific constituents provided in Table 2-1 are those constituents that will be regulated in future NPDWRs.

Table 2-1 – Raw Water PFAS Test Data

Constituent	Well Number			Average
	4	5	6	
PFOA (ppt, ng/L)	2.00	2.80	1.20	2.00
PFOS (ppt, ng/L)	14.00	19.00	35.00	22.67
HFPO-DA (GEN X) (ppt, ng/L)	0.00	0.00	0.00	0.00
PFBS (ppt, ng/L)	4.20	4.10	3.20	3.83
PFHxS (ppt, ng/L)	2.10	2.30	1.90	2.10
PFNA (ppt, ng/L)	0.00	0.00	0.00	0.00
Hazard Index	0.24	0.26	0.21	0.24

- Data from Analytical Report dated 7/31/2023 by Eurofins Environmental Testing for the City of Loveland. Samples from all three (3) wells collected on 7/27/2023.

Raw water from the groundwater wells has also been tested historically for both inorganic and organic materials. Test data for Well No. 5 was provided by the City of Loveland. Table 2-2

presents water chemistry parameters that specifically impact softening design and include pH, hardness, alkalinity, iron, manganese, magnesium, and total dissolved solids. Total organic carbon (TOC) is also noted in Table 2-2 and represents the amount of natural organic matter in the source water.

Table 2-2 – Raw Water Inorganic and Organic Data

Parameter	Test Sample Date		Average
	10/5/2021	6/21/2023	
pH	7.30	7.25	7.28
Hardness (mg/L) as $CaCO_3$	316	349	332.5
Alkalinity (mg/L) as $CaCO_3$	291	314	302.5
Iron (mg/L)	ND	ND	ND
Manganese (mg/L)	ND	ND	ND
Magnesium (mg/L)	21.6	26.5	24.1
Total Dissolved Solids (mg/L)	414	442	428
Total Organic Carbon (mg/L)	ND	ND	ND

- Data from Ohio EPA Ground Water Quality Results for samples taken on 10/5/2021 and 6/21/2023 from Well No. 5.
- ND = Non Detect

The US and Ohio Environmental Protection Agencies (EPA) set restrictions and guidelines for concentrations of chemical constituents in water for public consumption. These are known as primary (required) and secondary (advised guideline) maximum contaminant levels (MCLs). The parameters presented in Table 2-2 are regulated as follows:

- **pH**: The acceptable pH range for potable water is 6.5 to 8.5. The raw water data indicates that the pH is within acceptable range.
- **Hardness**: The Ohio EPA does not require public utilities to soften water and there is no primary or secondary MCL for hardness. The decision to soften water is left up to the operating facility based on cost and customer preference. Generally, water with a hardness of 0-75 mg/L $CaCO_3$ is considered soft, water with a hardness of 75-150 mg/L $CaCO_3$ is considered moderately soft, water with a hardness of 150-300 mg/L $CaCO_3$ is considered hard, and water over 300 mg/L $CaCO_3$ is considered very hard. Based on the raw water data, Loveland's water is very hard.

- **Alkalinity**: Alkalinity is the capacity of the water to neutralize acids and is not a significant parameter from a potability standpoint, but is routinely measured. It is more significant for process control when a coagulant is used for the treatment process. There is no primary or secondary MCL for alkalinity.
- **Iron**: Classified as a secondary MCL with a limit of 0.3 mg/L. Based on Loveland's raw water data, iron is non-detectable in the source water.
- **Manganese**: Also classified as a secondary MCL with a limit of 0.05 mg/L. Manganese is non-detectable in the source water based on test data.

The above parameters play a role in determining the feasibility of a softening process. Generally, ion exchange is an effective softening process if total dissolved solids concentrations are under 1,000 mg/L; however, concentrations less than or equal to 500 mg/L are preferred. Per Recommended Standards for Water Works (Ten States Standards), concentrations of iron, manganese, or a combination of the two should not exceed 0.3 mg/L in the water influent to the ion exchange process. Additionally, turbidity should be less than 5 units. Should any of the above parameters be exceeded, pre-treatment upstream of the softening process is required.

A parameter that is becoming increasingly significant from a regulatory standpoint is the amount of organic matter contained in the source water supplies, which is measured as total organic carbon (TOC). Organic compounds in the water react with chlorine added during treatment to form trihalomethanes. Trihalomethanes consist of a group of four chemical compounds. The MCL for the total of the four chemical compounds, referred to as total trihalomethanes (TTHM), is 0.08 mg/L. The presence of organic compounds in the raw water can also impact PFAS treatment. Granular activated carbon (GAC) is one method of removing PFAS. GAC also removes other organics from the raw water, which could be a benefit. The detriment is that the presence of TOC will reduce the time to breakthrough of the GAC media, thereby increasing the number of media changeouts and overall operational costs for PFAS treatment. Based on provided test data of the raw water, TOCs were not detected. As such, potential issues resulting from the presence of TOCs in the source water supplies are not expected.

As noted in Section 1, the USEPA announced the final NPDWR for PFAS on April 10, 2024. Per the final NPDWR, the USEPA has established legally enforceable MCLs for six PFAS in drinking water. Perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS), Perfluorononanoic acid (PFNA), and hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX Chemicals) will each have an MCL as individual

contaminants. Additionally, PFAS mixtures containing at least two or more of PFHxS, PFNA, HFPO-DA, and perfluorobutane sulfonic acid (PFBS) will have an MCL as a PFAS mixture (calculated as a Hazard Index). In addition to legally enforceable MCLs, the EPA established health-based, non-enforceable Maximum Contaminant Level Goals (MCLGs) for these six PFAS. Table 2-3 provides the USEPA's final MCLs and MCLGs for PFAS compounds.

Table 2-3 – USEPA Final PFAS Levels

Compound	Final MCL (Enforceable Level)	Final MCLG
PFOA	4.0 ppt, ng/L	Zero
PFOS	4.0 ppt, ng/L	Zero
PFHxS	10.0 ppt, ng/L	10.0 ppt, ng/L
PFNA	10.0 ppt, ng/L	10.0 ppt, ng/L
HFPO-DA (commonly referred to as GenX Chemicals)	10.0 ppt, ng/L	10.0 ppt, ng/L
Mixtures Containing Two or More of PFHxS, PFNA, HFPO-DA, and PFBS	1.0 (unitless) Hazard Index	1.0 (unitless) Hazard Index

- Based on USEPA final PFAS National Primary Drinking Water Regulation announced April 10, 2024.

The final NPDWR also requires:

- Public water systems must monitor for these PFAS and have three years to complete initial monitoring (by 2027), followed by ongoing compliance monitoring. Water systems must also provide the public with information on the levels of these PFAS in their drinking water beginning in 2027.
- Public water systems have five years (by 2029) to implement solutions that reduce these PFAS if monitoring shows that drinking water levels exceed these MCLs.
- Beginning in five years (2029), public water systems that have PFAS in drinking water which violates one or more of these MCLs must take action to reduce levels of these PFAS in their drinking water and must provide notification to the public of the violation.

2.02 Water Treatment Plant

Treatment of Loveland's water currently consists of fluoridation and chlorination of the groundwater at the well field site prior to distribution. The treated water is then conveyed to ground storage tanks located both west and south of the well field site.

A treatment and maintenance building is located in the southwest corner of the well field site in Bodley Park. The original treatment building was constructed in the mid-1970s. The small treatment building houses fluoridation and chlorination chemical feed equipment, the electrical and control gear for the well pumps and chemical feed equipment, an emergency generator, restroom, and laboratory/office area. The maintenance building was added to the treatment building in the late 1970s and includes a 4-bay garage and work area. The third well, Well No. 6, and laboratory improvements were made in the late 1980's.

The City of Loveland currently utilizes a pair of diaphragm metering pumps to inject fluorosilicic acid for fluoridation. Fluorosilicic acid is delivered and stored in 55-gallon drums. Chlorine gas is utilized for chlorination and is delivered and stored in 150-pound chlorine gas cylinders. The chlorine feed equipment, including cylinder scales, booster pumps, and chlorinators are all located in the chlorine feed room. Both chemicals are injected directly into the water mains leaving the well field site in two locations. One injection point is in the southeast corner of the well field site where chemicals are injected into the water main heading to the East ground storage tank and booster station located on Oak Street. The other injection point is in the southwest corner of the well field site where chemicals are injected into the water main heading to the West ground storage tanks and booster station located off Rich Road in Phillips Park. Inline static mixers are located immediately downstream of each injection point.

2.03 Future Needs

As discussed previously, the primary purpose of this Study is to evaluate effective treatment technologies to reduce PFAS concentrations in the raw water prior to distribution to the public. As indicated in Table 2-1, the PFOS level in all wells exceeds the USEPA's final NPDWR for PFAS. The City of Loveland will need to implement PFAS treatment in the future to conform to the USEPA's final NPDWR for PFAS. PFAS treatment alternatives will be evaluated further in Section 3.

Further, test data for the raw water indicates hardness levels over 300 mg/L as $CaCO_3$. As such, Loveland's water is very hard. The City of Loveland should consider adding softening upstream of the PFAS treatment process to further improve the quality of the water supplied to customers. Additionally, softening upstream of PFAS treatment could potentially extend the life of PFAS treatment media by removing competing constituents. Section 4 will present potential softening alternatives for the City of Loveland.

Based on discussion with the City of Loveland, both the softening and PFAS removal processes will be configured in three 1.33 mgd treatment trains, resulting in a firm treatment capacity of 2.66 mgd with one train out of service and a peak treatment capacity of 4.0 mgd through all three (3) trains.

Both PFAS treatment equipment and softening treatment equipment will need to be located indoors. The existing water treatment plant does not have adequate room for the additional equipment. A new treatment building will be required to implement either PFAS treatment or softening. Design considerations for a new water treatment building to house a PFAS treatment process and potentially a softening process will be discussed in Section 5.

3. PFAS TREATMENT ALTERNATIVES

3.01 PFAS Treatment Technologies

As discussed previously, the USEPA announced the final NPDWR for PFAS on April 10, 2024. As a result, implementing treatment specifically for PFAS removal is a relatively new concept. However, the treatment technologies utilized for PFAS removal have been around longer and have historically been utilized in water treatment to remove other contaminants.

Ten States Standards has included a policy statement on per- and polyfluoroalkyl substances. The policy statement identifies the most effective treatment processes to remove PFAS and provides general engineering design parameters for the various treatment technologies specific to PFAS treatment.

In February 2024, the Ohio EPA issued draft PFAS treatment guidance for public feedback and comment. The draft PFAS treatment guidance identifies several centralized treatment methods that have demonstrated the ability to remove PFAS. The draft guidance also requires that a demonstration study be performed for the proposed treatment process and outlines the demonstration study requirements. As such, a demonstration study will be required for the PFAS treatment alternative recommended herein this study to demonstrate removal efficiencies for the specific PFAS present.

Treatment technologies that have demonstrated the ability to remove PFAS from drinking water include:

- Granular Activated Carbon (GAC) Contactors
- Anion Exchange (AX)
- High Pressure Membrane Filtration (HPMF)

A. Granular Activated Carbon (GAC) Contactors

GAC contactors are one treatment technology being widely implemented for PFAS removal. GAC contactors are available as standalone treatment units, packaged treatment skids, and mobilized treatment trailers. For permanent water treatment installations, standalone pressure vessels with GAC media are commonly utilized. The design should

incorporate at least two treatment vessels configured in series. Vessels should operate in a lead/lag configuration to prevent contamination breakthrough and allow for maintenance activities. A minimum contact time of around 10 minutes is recommended to ensure adequate adsorption. GAC with a particle size of 0.5 mm to 0.7 mm and an Iodine Number greater than 850 mg/g has been shown to be most efficient at PFAS removal, specifically PFOS. Systems using GAC do need to be backwashed periodically to loosen the media when increased pressure loss through the system is observed. An initial backwash is also generally completed with new media to condition the GAC and remove fines. Backwash rates and times do not disturb the mass transfer of PFAS in the media. As a result, backwash flow does not contain PFAS and can be disposed of to a nearby sewer.

When using GAC, raw water quality must be evaluated to prevent competition for adsorption with other contaminants which may reduce the effectiveness of treatment and/or expedite time to breakthrough. GAC is generally more effective at removing long-chain PFAS over short-chain PFAS, as long-chain PFAS have a higher affinity for adsorption to carbon. A demonstration study should be performed to confirm removal of the PFAS present.

An important consideration for any PFAS removal process is disposal of PFAS after it is removed from the source water. With GAC contactors, the GAC media is commonly removed from the contactor and replaced once the GAC media reaches breakthrough. The spent media can either be thermally reactivated and reutilized or be incinerated to fully dispose of the spent media and PFAS. Thermal reactivation of the spent GAC media can destroy over 99% of the PFAS. Following thermal reactivation (performed off site), the GAC media can be returned to the contactor and be reutilized.

B. Anion Exchange (AX)

AX is another treatment process capable of removing PFAS. AX resins are being developed specifically to remove PFAS and typically include both positively charged exchange sites and a porous structure for increase adsorption. Like GAC, standalone pressure vessels filled with AX resin media are typically utilized. Vessels should operate in a lead/lag configuration to prevent contamination breakthrough and allow for maintenance activities. With AX systems, minimum contact times down to 2 minutes can provide

adequate PFAS adsorption. AX systems do not require backwashing and subsequently do not create waste flow that requires disposal.

AX resins are single use media. Once the media reaches breakthrough, it must be removed and replaced with new media. The media is either disposed of in a landfill (no PFAS destruction) or incinerated to destroy both the media and PFAS. Either disposal option is costly, especially when added to the high cost of the new AX resin that must be installed in place of the spent media.

Raw water quality must also be evaluated when considering AX treatment. The efficiency of treatment is reduced in the presence of organics, total dissolved solids, and minerals which can all clog the resin. Competition with common anions can also affect treatment efficiency.

C. High Pressure Membrane Filtration (HPMF)

HPMF is the third technology capable of removing PFAS. There are two types of HPMF, including nanofiltration (NF) and reverse osmosis (RO). RO has shown to have the higher removal efficiency for PFAS compared to NF. Research has shown that RO is over 90% effective at removing a wide range of PFAS chain lengths and can be combined with GAC to achieve higher removal rates. HPMF treatment has a few operational drawbacks. First, pretreatment is often required to prevent fouling of the membrane. Due to HPMF's effectiveness at removing constituents in the water, post-treatment mineral addition is typically needed for stabilization of the water prior to distribution. HPMF also creates a waste stream containing the PFAS removed from the process water. It is challenging to find an acceptable means to dispose of or treat the reject water (the waste stream can be upwards of 20%) produced by the process due the presence of PFAS.

Due to the operational issues, specifically concerns with finding an acceptable means to dispose of the PFAS containing reject water, HPMF is not a feasible treatment technology for Loveland's water treatment plant. Both GAC and AX treatment technology will be considered further for Loveland's water treatment plant.

3.02 Granular Activated Carbon (GAC) and Anion Exchange (AX) Alternative Evaluation

Both GAC and AX treatment processes are feasible alternatives for PFAS removal at the Loveland water treatment plant. There are, however, advantages and disadvantages to both technologies that need to be considered when selecting the best alternative. Costs, both capital and operational, should also be strongly considered and evaluated.

Calgon Carbon Corporation (Calgon) manufactures both GAC and AX PFAS treatment systems and has installed more than 180 vessels using both GAC and AX resin media to treat PFAS contaminated drinking water across the United States. Calgon was contacted to aid with the assembly of this Study. Raw water test data provided by the City of Loveland was furnished to Calgon to assemble preliminary design proposals for both a GAC treatment system and an AX treatment system. Preliminary Design Criteria for both systems is summarized in the following Table 3-1 and Table 3-2. Detailed proposals provided by Calgon are included in Appendix B.

As indicated on Table 3-1 and Table 3-2, both GAC and AX will require a total of three systems, each with two, 12-foot diameter vessels operating in lead/lag. The footprint dimensions for each system is the same; however, the GAC systems are taller (26.6' vs. 18.5'). This increased height for the GAC system is a result of the additional media volume needed to provide the required empty bed contact time. For the GAC system, each vessel will contain 40,000 pounds (1,308 cubic feet) of media to provide 10.6 minutes of contact time at peak flow rates. For the AX system, 459 cubic feet of media will be contained in each vessel to provide 3.7 minutes of contact time at peak flows. Both contact times exceed the minimum recommended contact times noted previously in this Study for both GAC and AX media.

The average number of media changeouts that are estimated per year for both systems are similar. Due to the higher media volume requirement for GAC, the total volume of GAC media usage per year is anticipated to be around 3-times higher. However, the cost for GAC media is significantly lower than the cost for AX resin media, especially when disposal costs for AX resin media are included. Using Calgon's provided information, costs for GAC range from $2.00 per pound to $2.60 per pound ($61 per cubic foot to $80 per cubic foot) depending on whether reactivated GAC or virgin GAC is utilized. This cost includes disposal and freight. For AX media, the cost for the media is $385 per cubic foot, plus an additional $50 per cubic foot to landfill spent media or $150 per cubic foot to incinerate spent media. Annual estimated media costs assuming an average of 2.0

mgd of treatment range from $100,000 to $130,000 for GAC and $240,000 to $290,000 for AX resin media.

Table 3-1 – Preliminary Design Criteria – GAC Treatment System

Purpose	PFAS Removal
Type / Treatment Media	GAC
System	Model 12-40 Adsorber System (12' Dia. Vessels)
System Dimensions (L x W x H)	31.5' x 13.4' x 26.6'
Number of Systems	3
Number of Vessels per System	2 (Lead/Lag)
Total Number of Treatment Vessels	6
Peak Daily Flow	4 MGD (2,778 gpm)
Firm Treatment Capacity	2.67 MGD (1,854 gpm)
Average Daily Treatment	2 MGD (1,389 gpm)
Flow Rate per System (Peak / Average)	926 gpm / 463 gpm
Media per Vessel	40,000 lbs.
GAC Bulk Weight/Density	30.6 lb./CF
Bed Volume per Vessel (CF / Gallons)	1,308 CF / 9,789 gallons
Empty Bed Contact Time (Peak / Average)	10.6 minutes / 21.1 minutes
Hydraulic Loading Rate (Peak / Average)	8.2 gpm/ft^2 / 4.1 gpm/ft^2
Treatment Rate (Peak / Average)	5.68 bed volumes/hr. / 2.84 bed volumes/hr.
Estimated Bed Life	60,000 bed volumes
Bed Life (Peak / Average)	14.68 months / 29.36 months
Estimated Media Changeouts per Year (Peak / Average)	2.45 / 1.23
Annual Estimated Media Usage (Peak / Average)	98,000 lbs. / 49,000 lbs. (3,202 CF / 1,601 CF)

- Design criteria based on Calgon Carbon Corporation preliminary design proposal.

Table 3-2 – Preliminary Design Criteria – AX Treatment System

Purpose	PFAS Removal
Type / Treatment Media	Anion Exchange Resin Media
System	Model 12 Exchanger System (12' Dia. Vessels)
System Dimensions (L x W x H)	31.5' x 13.4' x 18.5'
Number of Systems	3
Number of Vessels per System	2 (Lead/Lag)
Total Number of Treatment Vessels	6
Peak Daily Flow	4 MGD (2,778 gpm)
Firm Treatment Capacity	2.67 MGD (1,854 gpm)
Average Daily Treatment	2 MGD (1,389 gpm)
Flow Rate per System (Peak / Average)	926 gpm / 463 gpm
Media per Vessel	459 CF
Bed Volume per Vessel (CF / Gallons)	459 CF / 3,433 gallons
Empty Bed Contact Time (Peak / Average)	3.7 minutes / 7.4 minutes
Hydraulic Loading Rate (Peak / Average)	8.2 gpm/ft^2 / 4.1 gpm/ft^2
Treatment Rate (Peak / Average)	16.2 bed volumes/hr. / 8.1 bed volumes/hr.
Estimated Bed Life	180,000 bed volumes
Bed Life (Peak / Average)	15.45 months / 30.90 months
Estimated Media Changeouts per Year (Peak / Average)	2.34 / 1.17
Annual Estimated Media Usage (Peak / Average)	1,074 CF / 537 CF

- Design criteria based on Calgon Carbon Corporation preliminary design proposal.

One of the primary advantages of the GAC treatment system is the cheaper media cost and resulting lower operational cost over the life of the treatment system. GAC media is also more readily available from multiple sources. Handling of spent GAC media and the destruction of PFAS is also cheaper. GAC can be reactivated and reused. During the reactivation process, over 99% of the PFAS contained in the spent media is destroyed. In comparison, AX resin media is more proprietary and available from fewer sources. The media cannot be reactivated or reused and must be disposed of in a landfill or incinerated. PFAS is destroyed in the incineration process. PFAS is not destroyed when the media is disposed of in a landfill and could pose future contamination issues.

GAC media is also less selective than AX resin in terms of removing constituents from the process flow. This can be both a detriment or a benefit depending on the quality of the raw water. GAC is not recommended if the process flow commonly contains organic material which will compete with PFAS and reduce both the effectiveness and breakthrough period of the media. However, if unexpected contamination occurs to the source water, GAC's ability to remove a variety of materials provides an extra layer of protection against contamination in the finished water.

One benefit that AX resin systems have over GAC systems is smaller media volume requirements which allows for smaller vessel sizes. This could be an important consideration if installing PFAS treatment in an existing building. Given that a new building will be required for Loveland's application, space restraints are less of a concern.

Finally, costs, both capital costs and operational costs, are an important consideration when selecting the best PFAS removal process. A 20-year net present worth analysis has been completed to determine which alternative is the most cost effective. A 20-year present worth analysis calculates the total sum which, if invested now at a given rate, would provide enough funds to cover all costs to purchase and operate the treatment process over a 20-year period. Costs that go into a 20-year present worth analysis include:

- **Capital Costs.** Capital costs include the costs to purchase the treatment process equipment as provided in Calgon's preliminary design proposal. Since installation costs and costs to construct ancillary buildings and other required improvements are assumed to be similar for all alternatives, they have been omitted from this analysis.

- **Operational and Maintenance Costs.** For the purposes of this analysis, these costs are limited to the costs associated with replacing and disposing of the media required for each treatment process. Other operational and maintenance costs are assumed to be similar for all alternatives and have been omitted from this analysis.

- **Salvage Value.** This analysis is based on a 20-year period. The service life of the equipment is estimated to be 30 years. Salvage value at the end of the 20-year analysis period is based on straight line depreciation of the equipment.

Table 3-3 – PFAS Treatment Systems 20-Year Net Present Worth Analysis [1]

	Granular Activated Carbon (Virgin)	Granular Activated Carbon (Reactivated)	Anion Exchange Resin Media (Incineration)	Anion Exchange Resin Media (Landfill)
Total Capital Cost - PFAS Treatment System	$2,251,320.00	$2,251,320.00	$2,456,940.00	$2,456,940.00
Capital Cost - Initial Supply of Treatment Media - All Vessels	$624,000.00	$624,000.00	$1,060,290.00	$1,060,290.00
Capital Cost - Treatment Equipment Only	$1,627,320.00	$1,627,320.00	$1,396,650.00	$1,396,650.00
Annual O&M Costs - Media Replacement/Disposal Cost [2]	$130,000.00	$100,000.00	$290,000.00	$240,000.00
Annual O&M Present Worth Cost [3]	$2,026,600.00	$1,559,000.00	$4,520,900.00	$3,741,400.00
Salvage Value of Treatment Equipment [4]	$542,440.00	$542,440.00	$465,550.00	$465,550.00
Salvage Value Present Worth Cost [5]	$331,100.00	$331,100.00	$284,200.00	$284,200.00
Net Present Worth	$3,946,820.00	$3,479,220.00	$6,693,640.00	$5,914,140.00
Increase Compared to Lowest Net Present Worth Alternative	$467,600.00	$0.00	$3,214,420.00	$2,434,920.00

[1] Costs based on 2024 dollars.
[2] Media usage estimated based on 2.0 MGD average daily treatment.
[3] O&M present worth costs based on a uniform series present worth calculation using a 20-year real discount rate of 2.5% per OMB Circular A-94, Appendix C.
[4] Salvage value based on 30-year useful life for treatment equipment and straight-line depreciation.
[5] Salvage value present worth costs based on a present worth calculation using a 20-year real discount rate of 2.5% per OMB Circular A-94, Appendix C.

3.03 Recommended Alternative

From a treatment standpoint, either a GAC treatment process or an AX treatment process will meet the City of Loveland's future needs for PFAS removal. Based on the completed present worth analysis the GAC alternatives provide for a much lower 20-year net present worth cost in comparison to the AX alternatives. This is mostly attributed to the cost of the AX media and costs associated with the disposal of the spent AX media.

Utilizing reactivated GAC provides the lowest cost overall. The reactivation process generally involves removing the spent GAC from the treatment vessels. The spent GAC is then taken to a reactivation facility where it is placed in furnaces that destroy over 99% of the adsorbed PFAS. The reactivated GAC is then returned to the treatment facility where it is placed back into the treatment vessel and reused. Using this approach both minimizes waste from the treatment process and ensures that PFAS removed during treatment is destroyed and poses no future recontamination risk.

GAC treatment provides other added benefits. GAC provides an extra layer of protection against potential source water contamination in that it can remove organics, including volatile organic compounds (VOCs). GAC could potentially be utilized to treat other emerging contaminants that may be regulated in the future, as well.

AX treatment systems do provide for a smaller footprint. Based on Calgon's preliminary design proposal, vessel heights are approximately 8-feet shorter for the systems proposed for Loveland. Since a new treatment building will be required for either alternative, this additional height is not critical.

Because of the cost effectiveness and non-monetary advantages discussed, a GAC treatment process for PFAS removal is the recommended alternative.

A conceptual layout for a new GAC treatment process within a new water treatment building is provided in Appendix A. Estimated construction costs for a new GAC treatment process for PFAS removal, inclusive of a new treatment building and all required ancillary improvements and equipment is provided in Section 6 of this Study. A process schematic for the recommended treatment alternative is also included in Section 6.

4. SOFTENING ALTERNATIVES

4.01 Softening Treatment Technologies

Hardness in water is the sum of the concentrations of multivalent ions, principally calcium and magnesium. The hardness removal process is called "softening". Common technologies utilized to reduce calcium and magnesium hardness from raw water are as follows:

- Ion Exchange Softening.
- Nanofiltration / Membrane Softening
- Lime Softening
- Pellet Softening.

A. Ion Exchange Softening

Ion exchange uses a resin media that exchanges salt (typically sodium chloride in municipal applications) for hardness ions. Little change occurs in the alkalinity or total dissolved solids content of the water in the ion exchange softening process. Ion exchange softening removes most of the raw water hardness. Therefore, some of the raw water is bypassed prior to ion exchange so that the resulting finished water hardness falls within the desired range.

Ion exchange media is installed within pressure vessels (commonly steel or fiberglass) and process flow contacts the resin media as it passes through the vessel. Two or more vessels are commonly installed in rows and interconnected with face piping. This provides redundancy within the treatment process and allows for continued treatment when the media in one of the treatment vessels requires regeneration.

The ion exchange softening process produces a liquid waste stream during backwash and regeneration of the resin media. The waste stream contains calcium and magnesium removed during the treatment process and sodium chloride ions from the salt brine utilized for regeneration. This waste stream is typically discharged into the sewer system.

Ion exchange treatment vessels need to be installed inside a building. Other components required for ion exchange include salt storage and brine makeup facilities, backwash disposal, piping, electrical, controls, and instrumentation.

B. Nanofiltration / Membrane Softening

Nanofiltration is the process of filtering raw water through tightly wound synthetic membranes under high pressure. As the water passes through the membranes, the filtering action removes most of the hardness from the water. Like with ion exchange, some of the raw water is bypassed so finished water hardness falls within the desired range.

Nanofiltration equipment is furnished on pre-engineered skids. Two or more skids are commonly furnished for redundancy. A separate skid-mounted clean-in-place system is also required to annually clean the membrane elements on each skid. Other components required with nanofiltration include chemicals (typically antiscalant, sodium bisulfite, and sodium hydroxide) and chemical storage and feed equipment, waste concentrate disposal facilities, piping, electrical, controls, and instrumentation. A building is required to house all of the nanofiltration and supporting equipment.

C. Lime Softening

The lime softening process involves the direct addition of lime to the process water in large softening tanks to precipitate calcium and magnesium. Consequently, total alkalinity and total dissolved solids are also reduced. The settled lime sludge is withdrawn periodically from the softener tanks and commonly thickened in a lagoon. From there, sludge is disposed of in landfills or farmland. The sludge volume resulting from the process is significant, with about 2.5 tons of sludge produced per one ton of lime applied to the raw water.

The lime softening process requires softener tanks (2 required for redundancy). These tanks are located outdoors and are quite large. Other components include a building to house the dry lime storage silo and hydrating equipment, chemical (typically carbon dioxide tank and feed system), lime sludge settling lagoon, piping, electrical, controls, and instrumentation.

D. Pellet Softening

Contacting chemically conditioned raw water with silica sand is the process for removing calcium-based hardness with pellet softening reactors. The entire process flow is softened by increasing the pH to 9.2 and injecting the process flow into the bottom of a reactor cone. This suspends the silica sand bed and allows calcium hardness to scale onto the sand. There is no bypassing or liquid waste streams with pellet softening. Coated sand is withdrawn periodically from the bottom of the reactors and stored in an onsite bin to dewater. The sand can then be used as structural fill. Clean silica sand is added to the top of each reactor to maintain a constant volume of sand in each reactor.

Two or more stainless steel reactor cones are typically provided for redundancy. Other components typically include sand feeding/slurry system, chemical (sodium hydroxide and carbon dioxide storage and feed systems), and spent sand storage bins, piping, electrical, controls, and instrumentation. A building to house the reactors and all components is also required.

Based on preliminary discussions, the City of Loveland wants to evaluate adding ion exchange softening upstream of the PFAS treatment process. As such, ion exchange softening will be considered further for Loveland's water treatment plant.

4.02 Ion Exchange Softening Evaluation

As indicated in Table 2-2, Loveland's raw water has a hardness of over 300 mg/L $CaCO_3$ and is very hard. Many utilities using a softening process have adopted finished water total hardness goals of 120 mg/L $CaCO_3$ to 180 mg/L $CaCO_3$. A target of 120 mg/L $CaCO_3$ will be utilized in this Study.

Incorporating softening at Loveland's water treatment plant will provide several potential benefits for the City and its water customers, including:

- Reduction of dissolved mineral concentrations.
- Prevents build-up of mineral scale inside pipes, fixtures, and hot water heaters.
- Lengthens the life of some appliances.
- Reduces consumption of household cleaning agents and soaps.

- Reduces soap films in sinks, bathtubs, and washing machines.

As discussed previously, raw water quality impacts the feasibility of incorporating ion exchange softening at Loveland's water treatment plant. Generally, ion exchange is an effective softening process for total dissolved solids concentrations up to 1,000 mg/L; however, concentrations less than or equal to 500 mg/L are preferred. Ten States Standards also recommends that concentrations of iron, manganese, or a combination of the two not exceed 0.3 mg/L in the water influent to the ion exchange process. Additionally, turbidity should be less than 5 units. Should any of the above parameters be exceeded, pre-treatment upstream of the softening process is required.

Based on raw water data provided by Loveland for Well No. 5, total dissolved solids concentrations are under 500 mg/L. Neither iron nor manganese was detected in the samples tested. Turbidity data was neither included in the furnished data for Well No. 5 nor could Loveland provide supplemental data to evaluate. For purposes of this study, it is assumed that total dissolved solids, iron, manganese, and turbidity fall within acceptable ranges for use with ion exchange softening and that pressure filters are not required for pretreatment upstream of the softening process. It is recommended that additional testing be performed, inclusive of turbidity, to confirm the above assumptions as the City of Loveland moves forward in planning for a new water treatment plant.

Several ion exchange softening manufacturers were contacted to aid in the assembly of this study. Preliminary design proposals were solicited from each manufacturer and are included in Appendix B. Table 4-1 presents preliminary design criteria based on one manufacturer's preliminary design proposal.

The treatment vessels will be installed in a row and interconnected with face piping inside the new treatment building. Additional components typically furnished as part of the ion exchange softening system include flow meters and electrically actuated system valves for system bypass and regeneration control, headloss pressure gauges, system control panel, salt storage silo and brine maker, and brine delivery and dilution system. An appropriately sized waste equalization basin and pump station will be required to pump backwash and regeneration flow to the nearest sewer.

Table 4-1 – Preliminary Design Criteria – Ion Exchange Softening

Purpose	Hardness Removal
Type / Treatment Media	Cation Exchange Resin Media
Softener Dimensions	12’ Dia. x 9’ Shell Height (Approx. 18’ Total Height)
Number of Softeners / Vessels	3
Peak Daily Flow	4 MGD (2,778 gpm)
Firm Treatment Capacity	2.67 MGD (1,854 gpm)
Design Flow Rate per Softener	1.33 MGD (924 gpm)
Average Daily Flow	2 MGD (1,389 gpm)
Raw Water Hardness	333 mg/L as $CaCO_3$
Target Finish Water Hardness	120 mg/L as $CaCO_3$
Exchange Capacity of Resin	20,000 grains/ft^3
Resin Bed Depth	5 ft
Bypass Rate	36%
Flow Rate through Softener	592 gpm
Softener Area	113.1 ft^2
Softener Loading Rate	5.23 gpm/ft^2
Regeneration Dose	6.0 lb. salt/ ft^3
Number of Regenerations	1.5 per Softener per Day
Salt Required per Regeneration	3,400 lbs.
Salt Usage per Day (at Firm Capacity)	10,000 lbs.
Salt Usage per Day (at Avg. Daily Flow)	7,500 lbs.
Waste Volume per Regeneration	19,200 gallon/regeneration/softener
Waste Volume per Day (at Firm Capacity)	57,600 gallons

- Design criteria based on WesTech’s preliminary design proposal.

4.03 Recommended Alternative

Currently, the Ohio EPA does not require public utilities to soften water and there is no primary or secondary MCL for hardness. Therefore, the City of Loveland is not required to implement a softening process at the water treatment plant. However, the City’s water is very hard and softening would improve the overall water quality for the City’s water customers.

If the City is going to construct a new treatment building for PFAS removal, consideration should be given to including softening if funds are available to cover both the capital and O&M costs associated with a new softening process. At the very least, it is recommended that a new treatment building be designed to readily accommodate a softening process should the City decide to incorporate one in the future.

The conceptual layout for the new treatment building required for PFAS treatment is included in Appendix A. The layout includes ion exchange softening process equipment for the City's reference. Estimated construction and O&M costs to add an ion exchange softening process are provided in Section 6 of this Study. The process schematic included in Section 6 illustrates where the optional softening treatment would be incorporated into the overall water treatment plant process.

5. WATER TREATMENT FACILITY DESIGN CONSIDERATIONS

5.01 New Treatment Building

As previously noted in Section 2, the existing treatment and maintenance building does not have adequate space to accommodate either a new PFAS treatment process or a new softening process. A new treatment building will be required if only a PFAS treatment process or if both PFAS treatment and softening treatment processes are incorporated. Beyond housing the treatment equipment, a new building will need to be designed to account for additional testing and associated laboratory needs, added electrical and control equipment, building mechanical systems and equipment. Additional treatment processes and support facilities will also need to be accounted for in a new building. A conceptual treatment building layout has been assembled and is provided in Appendix A for reference. As illustrated on the conceptual treatment building layout, the new building will generally need to include the following rooms and work areas:

- Treatment Room for PFAS Treatment Equipment, Softening Equipment, Clearwell and Effluent Pumping, and Process Piping.
- Electrical Room
- Laboratory
- Office
- Restroom
- Mechanical Room
- Fluoridation Room
- Chlorination Room

Overall building dimensions are approximately 135 feet by 102 feet with a total of 12,350 square feet of area with inclusion of an ion exchange softening process. The building could be reduced by approximately 2,000 square feet if space for a softening process is omitted. Planning level costs for the proposed building are provided in Section 6 and assume a pre-engineered structural steel building with metal siding and partial CMU masonry exterior façade.

5.02 New Clearwell and Effluent Pumping

Head/pressure loss through the added PFAS and softening treatment processes, piping, and valves are estimated to range from 10 psi (23 feet) to 20 psi (46 feet) based on preliminary headloss assumptions provided by the treatment process equipment manufacturers. Pump curves for the existing well pumps were not available during assembly of this Study; however, it is assumed that the existing well pumps will have inadequate capacity with the added pressure loss through the added treatment processes. A new clearwell and new effluent pumps will likely be necessary to maintain the current pumping capacity to the distribution system and provide adequate head pressure to fill the existing ground storage tanks. The clearwell will also provide contact time following fluoridation and chlorination. For preliminary design, four effluent pumps, each with a capacity of 1 MGD under maximum head conditions have been assumed.

Loveland's source water is groundwater. Per the Groundwater Rule there is no set requirement to practice disinfection or provide a minimum contact time as part of the treatment process like with surface water plants or plants treating groundwater under the direct influence of surface water. At plants treating groundwater, provisions do need to be made for applying disinfectant to the finished water detention basin and water entering the distribution system. Dual clearwells, each sized to provide a contact time of around 15 minutes at a peak flow rate of 4 MGD, have been assumed to ensure the appropriate residual chlorine concentration is provided prior to pumping finished water to the distribution system. The clearwell and pumps will be located inside the proposed treatment building. Costs for the clearwell and effluent pumping are provided in Section 6. Costs for the clearwell have been included in the cost for the new treatment building. Costs for the pumps and valves have been included in the cost for process equipment, materials, and valves.

5.03 Chemical Feed

Currently, the fluoridation and chlorination chemical feed equipment is located in the existing treatment building and the chemicals are fed directly to the distribution piping prior to leaving the well field site. With the proposed treatment improvements, chemicals will need to be fed inside the new treatment building, downstream of the PFAS treatment process and upstream of the proposed clearwell. Due to the change in chemical feed location and the condition of the existing feed systems, it is recommended that new chemical feed systems be provided in the new treatment building.

For this Study, it was assumed that Loveland would continue to use fluorosilicic acid for fluoridation. For chlorination, it was assumed that bulk 12.5% sodium hypochlorite would be utilized due to improved safety over chlorine gas. Separate rooms within the treatment building are required for both chemicals. Equipment required for both fluoridation and chlorination chemical feed systems include a chemical storage tank, day tank, transfer pump, and chemical feed pump skid. The chemical feed pump skid comes pre-piped with valves and two diaphragm metering pumps for redundancy. Current chemical feed dosages and chemical use information were unavailable during assembly of this Study. A fluoride dose of 1.0 mg/L and a chlorine dose of 2.0 mg/L were assumed for sizing of equipment and estimating operational costs. The costs for the new chemical feed equipment have been included in the cost for the process equipment, materials, and valves included in Section 6.

5.04 Waste Equalization Basin and Pump Station

Residuals and waste from the treatment plant will need to be disposed of in the nearest sanitary sewer. For the Loveland water treatment plant site, the nearest sanitary sewer is located approximately 2,200 feet southwest along Fallis Road. A new pump station and force main will be required to pump waste flow to the sanitary sewer. Both the PFAS treatment process and ion exchange softening process generate large volumes of flow at high rates during backwash and regeneration cycles. A waste equalization basin will also be required to capture the large volumes of waste flow. The pump station will subsequently need to be sized to both empty the equalization basin within a reasonable time period following each backwash cycle and convey flow at a rate that does not exceed the capacity of the downstream gravity sewer. For both PFAS treatment and ion exchange softening, peak backwash rates will approach 700 gpm. Total volume of backwash and regeneration flow will be approximately 20,000 gallons per cycle. Preliminary waste equalization basin size is recommended to be 50,000 gallons. This will provide adequate capacity should two backwash cycles occur in succession. Preliminary pump sizing provides for 175 gpm at approximately 52 feet of total dynamic head through a 4-inch force main to the nearest sanitary sewer. This will empty 20,000 gallons of waste flow from the equalization basin in approximately 2 hours. Both the waste equalization basin and pump station will be located exterior to the treatment building. The estimated cost for the waste equalization and pump station is provided in Section 6.

5.05 Site Improvements and Site Piping

Site improvements to construct the new water treatment plant will be required. The base flood elevation at the water treatment plant site is 592'. Based on record drawings, existing grade for most of the well field site and proposed location for the new treatment building is below this flood elevation. As such, the site will require extensive fill to raise the treatment building above flood elevation.

Site piping improvements will be necessary to reroute raw water from the existing wells to the new treatment building. Finish water pipe will be required to convey water from the treatment building to the existing distribution piping to the ground storage tanks. Waste piping will be required to convey waste flow to the new equalization basin. Finally, approximately 2,200 feet of 4-inch waste force main will be required to convey waste flow from the new pump station to the nearest sanitary sewer located along Fallis Road.

Site electrical improvements will include a new electrical service to the new treatment building. The City has indicated that a buried service is preferred to the existing overhead service. Site electrical to the existing well pumps will also need to be rerouted to accommodate the new treatment building and site improvements. Finally, a new backup emergency generator will be required for the new treatment building.

Other anticipated site improvements include access drives, security fencing, road restoration following construction of the waste force main, gas utility service, and finish grading and seeding.

The estimated costs for site and site piping improvements are provided in Section 6.

6. RECOMMENDED PROJECT

6.01 Summary of Recommended Improvements

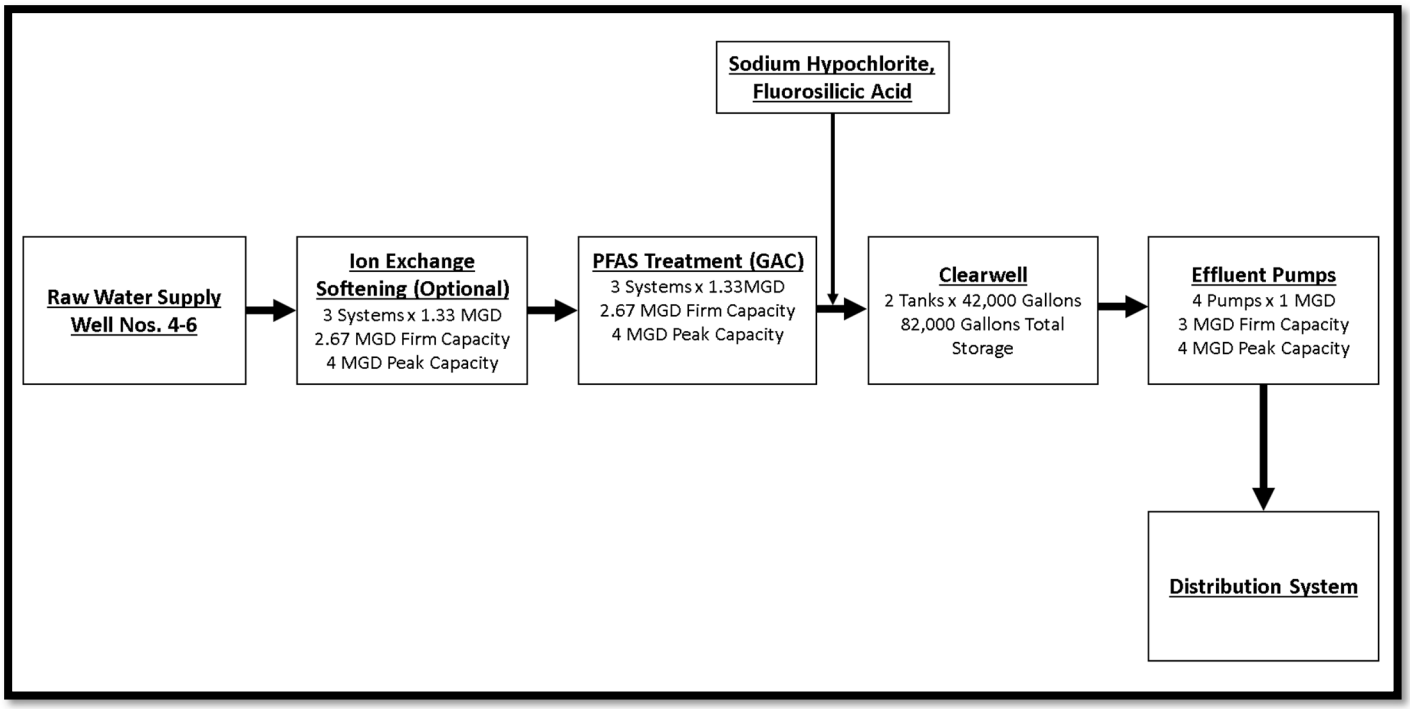
To summarize, the recommended scope for the water treatment plant improvements includes:

- New GAC PFAS Treatment Process
- New Fluoridation and Chlorination Chemical Feed Systems
- New Clearwell with New Effluent Pumps
- New Treatment Building to House New Treatment Processes.
- New Waste Equalization Basin and Pump Station
- Site Piping and Site Improvements

A new ion exchange softening process could also be incorporated into the new treatment building at the City's discretion.

The process flow schematic for the proposed water treatment plant improvements is shown on Figure 6-1.

Figure 6-1 – Proposed Process Flow Schematic



Exhibits illustrating a conceptual building layout and a conceptual site layout are included in Appendix A. The conceptual building layout and sizing includes the optional ion exchange softening process for the City's reference, as noted previously. The building could be reduced by approximately 2,000 square feet if space for a softening process is omitted.

Preliminary equipment proposals solicited from various manufacturers to aid in the assembly of this Study are included in Appendix B for reference. Proposals for both GAC and AX media PFAS treatment systems, ion exchange softening treatment systems, fluoridation and chlorination chemical feed systems, effluent pumps, and waste pumps are included.

6.02 Estimated Construction and OM&R Costs

A planning level construction cost estimate has been assembled for the recommended water treatment plant improvements and is presented in Table 6-1. As shown, the total planning level construction cost estimate to construct a new treatment building with PFAS treatment is $17,477,240.00. The estimated additional cost to incorporate optional ion exchange softening is $5,019,080.00 resulting in an estimated total cost of $22,496,320.00 for a new water treatment plant with both softening and PFAS treatment.

Annual operation, maintenance, and replacement (OM&R) costs have also been estimated. Table 6-2 presents the estimated annual OM&R costs for a new treatment building inclusive of PFAS treatment only. Total OM&R costs for a new treatment building with PFAS treatment are estimated to be $399,000.00 annually. This cost does not include existing water treatment plant operational costs associated with the well pumps and labor. Table 6-3 shows the additional annual OM&R costs for the optional ion exchange softening treatment process. OM&R costs associated with the optional ion exchange softening treatment process are estimated to be $205,000.00 annually. Total annual OM&R costs for a new treatment facility with both softening and PFAS removal are estimated to be $604,000.00.

Table 6-1 – Planning Level Construction Cost Estimate

New Water Treatment Building with PFAS Treatment Costs	
Item	**Planning Level Cost**
Civil / Site Improvements	$1,763,000.00
Site Piping Improvements	$734,000.00
New Treatment Building	$2,630,000.00
Process Equipment, Materials, and Valves	$4,941,000.00
Interior Piping	$337,000.00
Waste Equalization and Pump Station	$358,000.00
Electrical, Instrumentation, and Controls	$3,681,000.00
Subtotal	$14,444,000.00
General Conditions (10%)	$1,444,400.00
Planning Level Contingency (10%)	$1,588,840.00
Total Planning Level Estimated Construction Cost	$17,477,240.00
Additional Ion Exchange Softening Costs	
Item	**Planning Level Cost**
Civil / Site Improvements	$39,000.00
New Treatment Building	$406,000.00
Process Equipment, Materials, and Valves	$2,936,000.00
Interior Piping	$75,000.00
Electrical, Instrumentation, and Controls	$692,000.00
Subtotal	$4,148,000.00
General Conditions (10%)	$414,800.00
Planning Level Contingency (10%)	$456,280.00
Total Planning Level Estimated Construction Cost	$5,019,080.00
New Water Treatment Building with PFAS Treatment and Ion Exchange Softening Costs	
Total Planning Level Estimated Construction Cost	$22,496,320.00

- All costs based on 2024 dollars.
- Planning level cost estimate assembled to an AACE Class 4 level of accuracy.
- Costs include 15% contractor overhead and profit and 5% market/inflation escalation.

Table 6-2 – Estimated Annual OM&R Costs – New Treatment Building with PFAS Treatment

OM&R Cost Item	Annual Estimated OM&R Cost [1]
GAC Media Replacement [2]	$100,000.00
Chemical Costs [3]	$46,000.00
Labor [4]	N/A
Electric Power [5]	$141,000.00
Laboratory [6]	$47,000.00
Maintenance and Repair[7]	$17,000.00
Equipment Replacement [8]	$48,000.00
Total Annual OM&R Costs	$399,000.00

[1] All costs based on 2024 dollars.

[2] Based on 2.0 MGD average daily treatment resulting in an average of 1.3 GAC media changeouts per year.

[3] Based on 2.0 MGD average daily treatment using sodium hypochlorite and fluorosilicic acid.

[4] Existing Cost.

[5] Based on $0.15/kWH and 2.0 MGD average daily treatment with proposed effluent pumps, waste pumps, chemical feed pumps, HVAC equipment, and general building electrical. Does not include electrical costs to operate existing well pumps which is an existing cost.

[6] Costs for additional PFAS testing. Assumes 13 tests per month at $300 per test.

[7] Assumes 2% of equipment costs annually for effluent pumps, waste pumps, chemical feed equipment, HVAC equipment, actuators, instrumentation, SCADA, and control panels.

[8] Assumes 20-year replacement for effluent pumps, HVAC equipment, actuators, instrumentation, SCADA, and control panels. Assumes 15-year replacement for waste pumps and chemical feed equipment.

Table 6-3 – Estimated Additional Annual OM&R Costs – Ion Exchange Softening

OM&R Cost Item	Annual Estimated OM&R Cost [1]
Resin Replacement [2]	$25,000.00
Salt Costs [3]	$146,000.00
Labor [4]	N/A
Electric Power [5]	$17,000.00
Laboratory [6]	$6,000.00
Maintenance and Repair [7]	$3,000.00
Equipment Replacement [8]	$8,000.00
Total Annual OM&R Costs	$205,000.00

[1] All costs based on 2024 dollars.

[2] Assumes replacement of ion exchange media every 8 years.

[3] Based on 2.0 MGD average daily treatment and estimated 4 tons of salt usage per day.

[4] Existing Cost.

[5] Based on $0.15/kWH and 2.0 MGD average daily treatment. Added costs for increased waste pump usage, brine transfer pumps, and additional HVAC and general building electrical for increased building size.

[6] Additional testing for softening system monitoring.

[7] Assumes 2% of equipment costs annually for additional softening equipment, actuators, instrumentation, SCADA, and control panels.

[8] Assumes 20-year replacement for softening system actuators, instrumentation, SCADA, and control panels. Assumes 15-year replacement for brine feed pumps and equipment.

APPENDIX A – EXHIBITS

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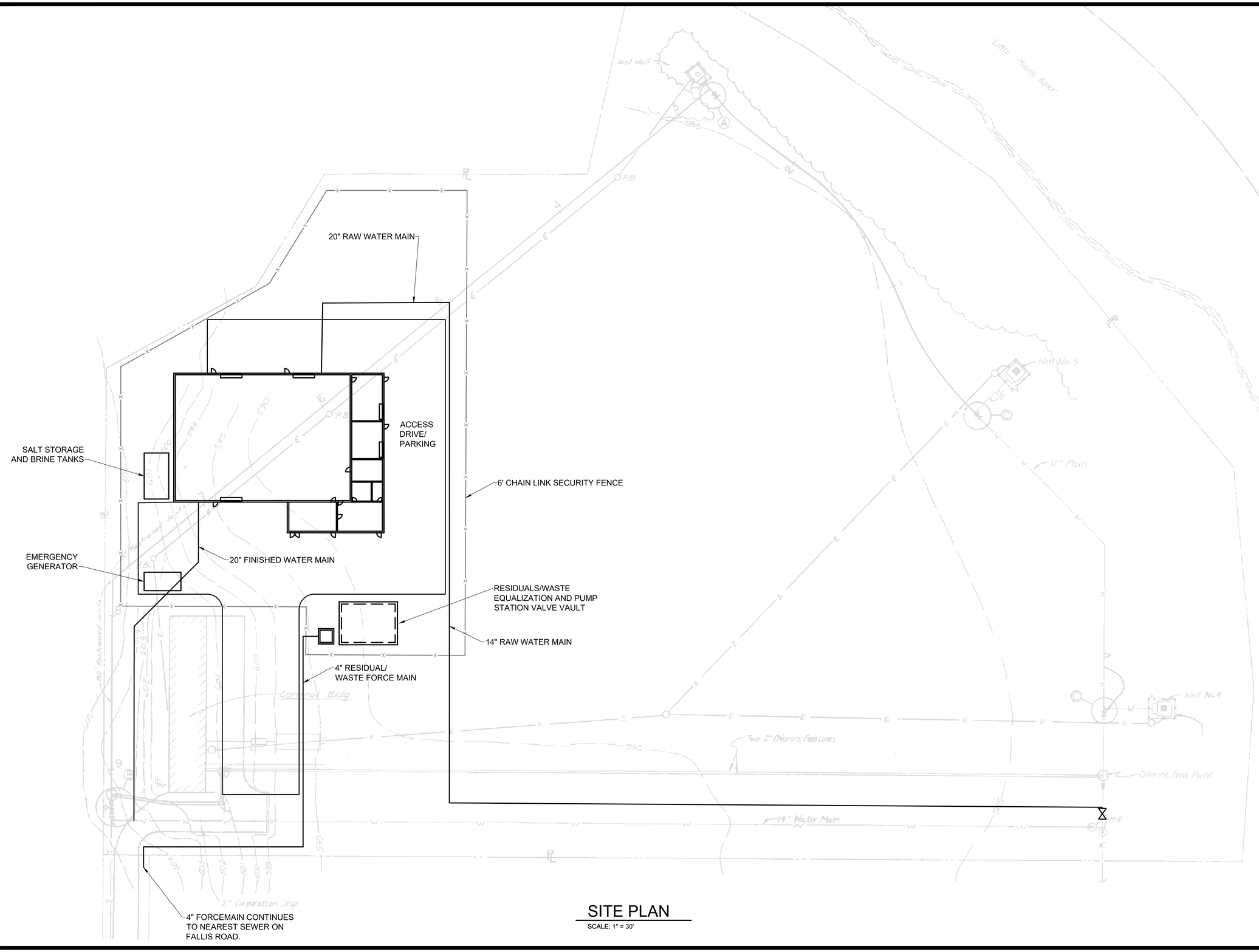

SITE PLAN

SCALE: 1" = 30'

B&N burgessniple.com
525 VINE STREET, SUITE 1300 CINCINNATI, OHIO 45202

CITY OF LOVELAND
WATER TREATMENT PLANT
PFAS REMOVAL AND SOFTENING STUDY

NO:	DESCRIPTION	DATE
	REVISIONS	

JOB NO:	PR61822
DATE:	APRIL 2024
DESIGNED BY:	
DRAWN BY:	CLB
CHECKED BY:	
APPROVED BY:	
SCALE:	AS NOTED

SITE PLAN

1 OF 2

SHEET: 1 OF 2

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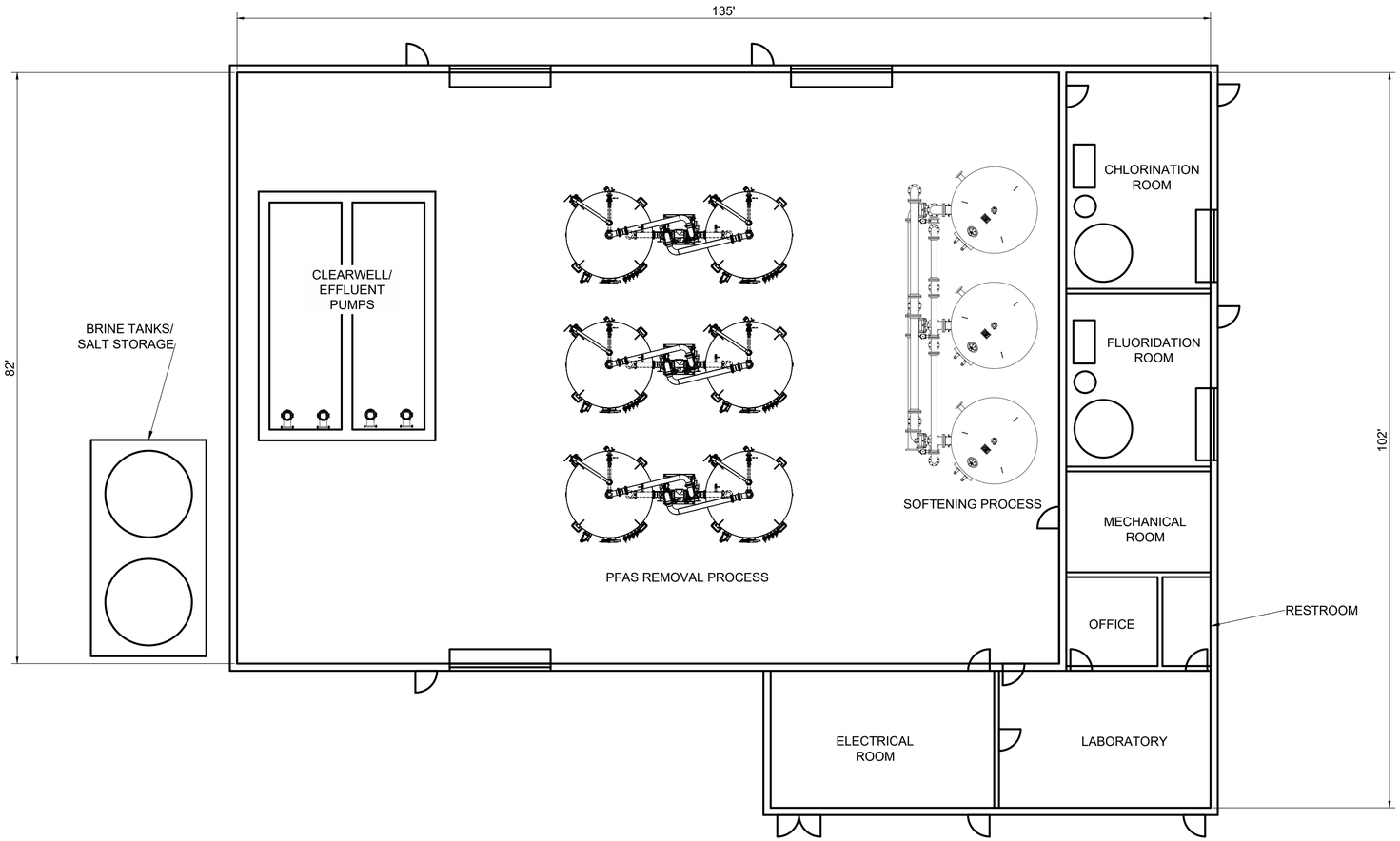


BUILDING PLAN

SCALE: 1" = 10'

B&N burgessniple.com
525 VINE STREET,
SUITE 1300
CINCINNATI, OHIO 45202

CITY OF LOVELAND
WATER TREATMENT PLANT
PFAS REMOVAL AND SOFTENING STUDY

NO:	DESCRIPTION REVISIONS	DATE

JOB NO:	PR61822
DATE:	APRIL 2024
DESIGNED BY:	
DRAWN BY:	CLB
CHECKED BY:	
APPROVED BY:	
SCALE:	AS NOTED

BUILDING PLAN

2 OF 2

SHEET: 2 OF 2

APPENDIX B- PRELIMINARY EQUIPMENT PROPOSALS

PFAS TREATMENT SYSTEM PROPOSALS

Josh Harner P.E.
Burgess and Nipple Inc
318 Main St
Suite 502
Evansville, In 47708

February 19, 2024

Re: Calgon Budgetary Proposal Loveland OH

Dear Mr. Harner:

We are pleased to present Calgon Carbon Corporation's (CCC) budgetary proposal for the Loveland OH PFAS evaluation. Our experience in PFAS treatment systems spans more than 15 years, making CCC the most capable manufacturer and service provider in the industry.

Pricing Summary

DWC/NSF certified systems (4 MGD with one train out of service 3 MGD)

Carbon

(3) Model 1240 Systems internal cone loaded with F400 Carbon 240,000 lbs of Carbon	$2,251,320.00
(3) Model 12 IX systems loaded with CalRes 2301 resin	$2,456,940.00

Calgon Carbon takes pride in contributing to our client's success by managing and delivering large, complex drinking water systems. Since the US EPA announced the Health Advisory Limit in 2016, CCC has installed more than 180 vessels to treat PFAS contaminated drinking water, both carbon and resin. Our equipment and resin is being used in Colorado at one of the largest operational ion exchange PFAS treatment site in the world, consisting of 14 large pressure vessels filled with CCC's CalRes 2301 IX resin. We recently secured another large IX PFAS project in New Jersey and Massachusetts. Additionally, we have two large PFAS plants starting in mid 2024 in Southern California again utilizing our CalRes 2301. While these plants will utilize CCC's CalRes 2301 resin, we continue to look at other resins through piloting across the US.

As the number one supplier of PFAS treatment systems in the world, there is no company in the industry that can match Calgon Carbon's experience, expertise, and production capabilities. Thank you for the opportunity to provide this proposal – should you have any questions about its contents, feel free to contact me at any time.

EXECUTIVE SUMMARY

Calgon Carbon has taken a unique approach to the perchlorate and PFAS removal market. Unlike other companies that utilize manufacturers' resin, Calgon Carbon screens and designs new and improved resins. During the testing process, we work to develop and produce resins specific to Calgon Carbon. Our resins are not sold by others but are manufactured to our specifications and have been proven to maintain the design flow rate after installation. **Our CalRes 2301 resin, as recommended for this project, is a macroporous**

resin, which means the resin has a harder shell, allows larger molecules to enter the bead and has transport sites within the resin to allow for better performance in low ppt applications as compared to gel resins. The harder shell also resists compression at higher flows which can be an issue with gel resins. Should the resin become contaminated with bacteria, the CalRes 2301 can withstand chlorine disinfection - gel resins cannot.

Comments on the Internal Cone:

The internal cone underdrain allows for 15% better media utilization than the external underdrain. Over the life of the project this can be a significant savings in operational costs. Our internal cone systems are Drinking Water Certified and NSF approved. See attached documentation on the media utilization of the internal cone vs the external cone.

Our field service personnel have been handling IX resins for both perchlorate and PFAS applications for many years. We have demonstrated success in the market, empowered by R&D and technical know-how and years of experience in equipment design, media, and fabrication, which makes CCC the most proficient company to fulfill your requirements.
Thank you and let us know if you have any questions.

Sincerely,

Charles Drewry

Calgon Carbon Corporation
Drinking Water Solutions
National Sales Manager ISEP/IX Technologies
352-467-0103

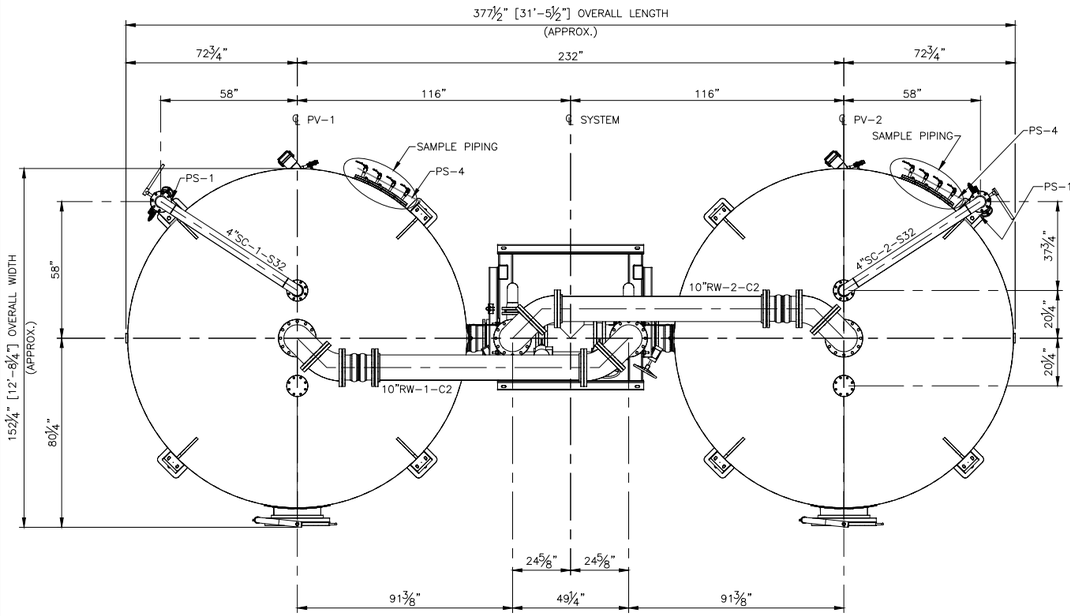
Charles.Drewry@kuraray.com

Sarah Urtz

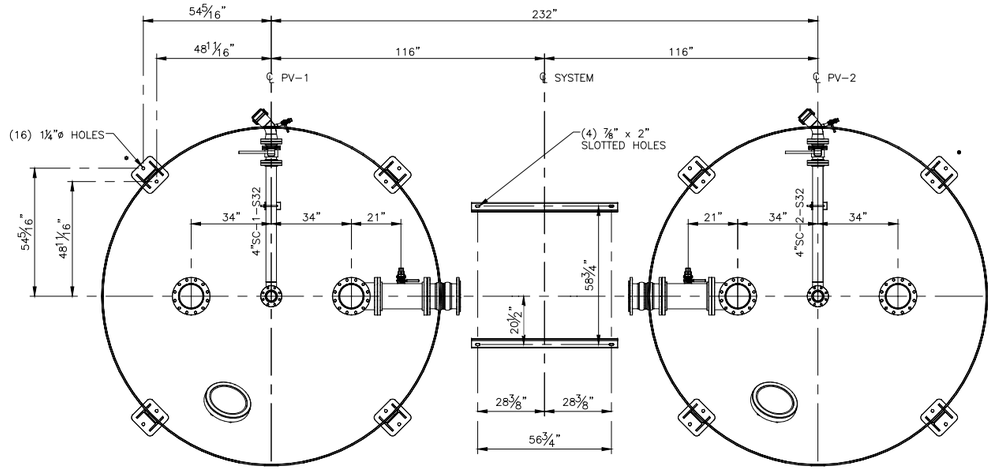
Calgon Carbon Corporation
Drinking Water Solutions
Carbon Technical Service Representative

Loveland OH	GAC (virgin)	GAC (CMR)	IX - Incineration	IX - Landfill
System Flow Rate (MGD)	4.0	4.0	4.0	4.0
System Flowrate (gpm)	2,776	2,776	2,776	2,776
Equipment Size Recommendation	12	12	12	12
Number of Systems	3	3	2	2
Flow Rate Per System (GPM)	925	925	1,388	1,388
Media Per Vessel (lb GAC / CF IX)	40,000	40,000	459	459
GAC BW and Drained Density (lb/CF)	30.6	30.6		
Bed Volume (Gallons, approx.)	9,789	9,789	3,430	3,430
Empty Bed Contact Time Per Vessel (min)	10.6	10.6	2.5	2.5
Hydraulic Loading Rate (gpm/sq.ft.)	8.2	8.2	12.3	12.3
Treatment Rate (BV/HR)	5.7	5.7	24.3	24.3
Daily Volume Treated Per System (Gallons)	1,332,480	1,332,480	1,998,720	1,998,720
Estimated Life (Bed Volumes)	60,000	60,000	180,000	180,000
Bed Life (Months)	14.5	14.5	10.2	10.2
Total Number of Changeouts Per Year	2.5	2.5	2.4	2.4
Annual Media Usage (lbs GAC / CF IX)	99,371	99,371	1,084	1,084
Media Cost - $/lb GAC or $/CF IX	$2.60	$2.00	$385	$385
Disposal Cost ($/CF) *with freight*	Included	Included	$150	$50
Cost Per Vessel Changeout	$104,000	$80,000	$245,298	$199,448
Annual Media Cost	$260,000	$200,000	$580,000	$470,000
Upstream Cartidge Filter	N/A	N/A	$50,000	$50,000
Capital Cost Per System (including media)	$750,440	$750,440	$845,545	$845,545
NPV Life (Years)	20	20	20	20
NPV Annual Interest Rate	6%	6%	6%	6%
20-year NPV 6% interest Rate ($M)	$2.98	$2.29	$6.65	$5.39
Total Equipment Capital Cost ($M)	$2.25	$2.25	$1.79	$1.79
Cumulative Present Value ($M)	$5.23	$4.55	$8.44	$7.18
Life Cycle Cost ($/1000 Gallons)	$0.18	$0.16	$0.29	$0.25
Life Cycle Cost ($/acre-ft)	$58	$51	$94	$80

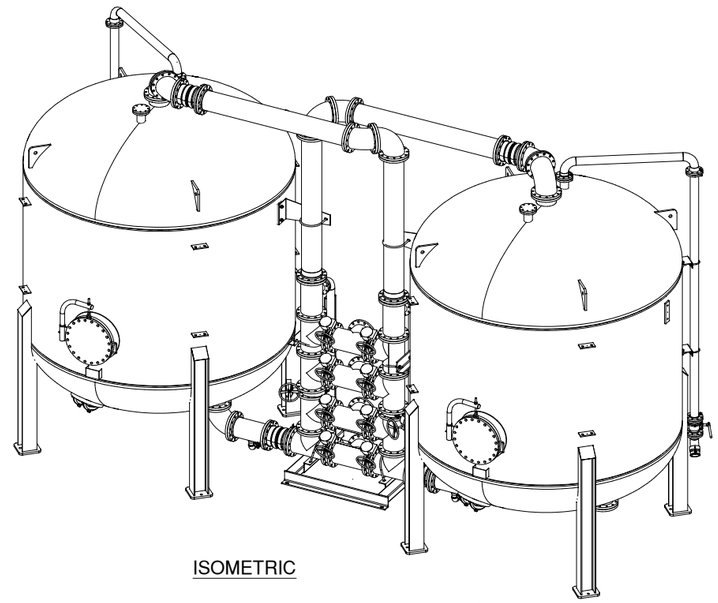
SYSTEM DATA	
DESIGN CONDITIONS	125 PSIG @ 140° F
DESIGN CODE	ASME SECTION VIII DIVISION1
APPROXIMATE WEIGHTS (LB.)	
VESSEL (EMPTY)	20,600
MEDIA (PER VESSEL)	T.B.D
VESSEL (OPERATING)	T.B.D
SYSTEM (EMPTY)	T.B.D
SYSTEM (OPERATING)	T.B.D



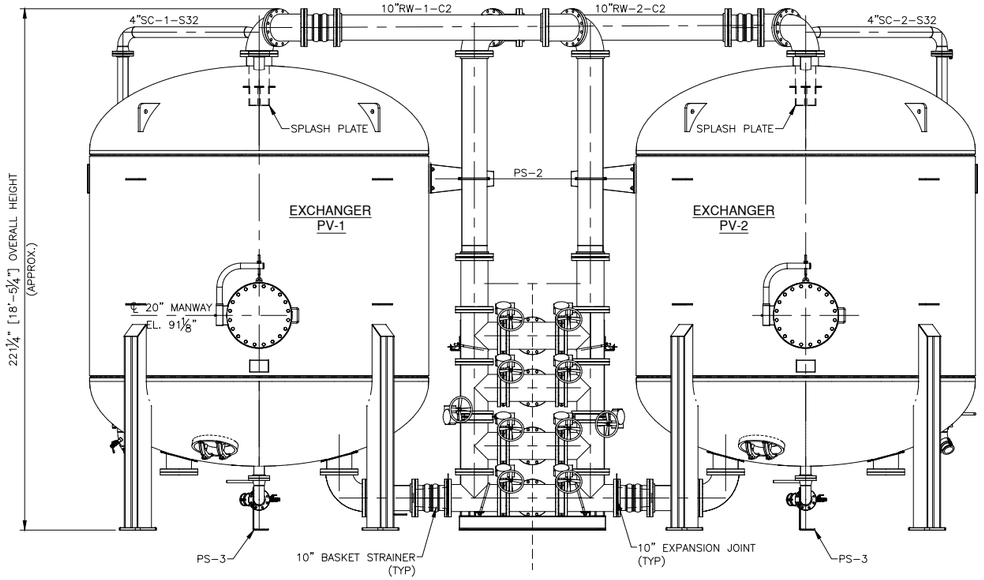
PLAN



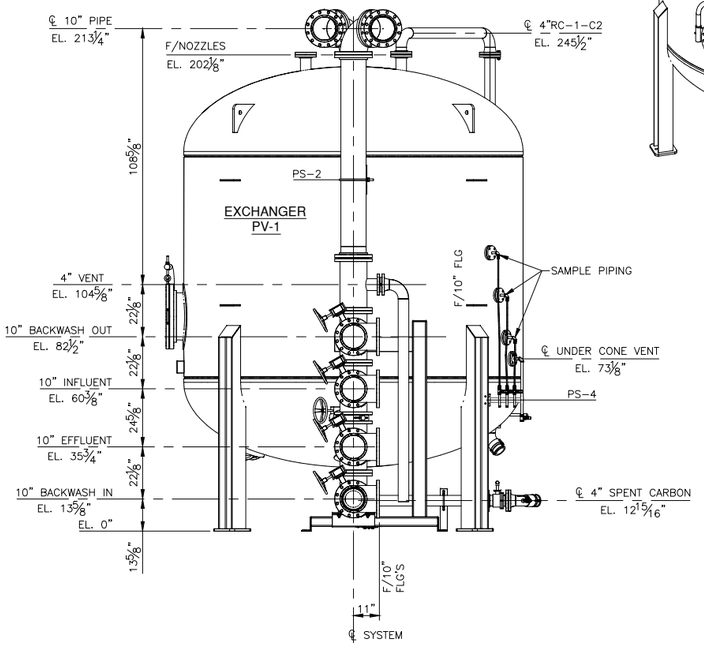
LOWER PLAN



ISOMETRIC



ELEVATION



SECTION A-A

REV	DESCRIPTION	APP	DATE
C			
B			
A			

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/8"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

	NAME	DATE
DRAFTER	SPROWLS	01-27-2021
DESIGNER		
CHECKER		
APPROVAL		

PROJECT No. P-IX-21006

CalgonCarbon
A Kuraray Company

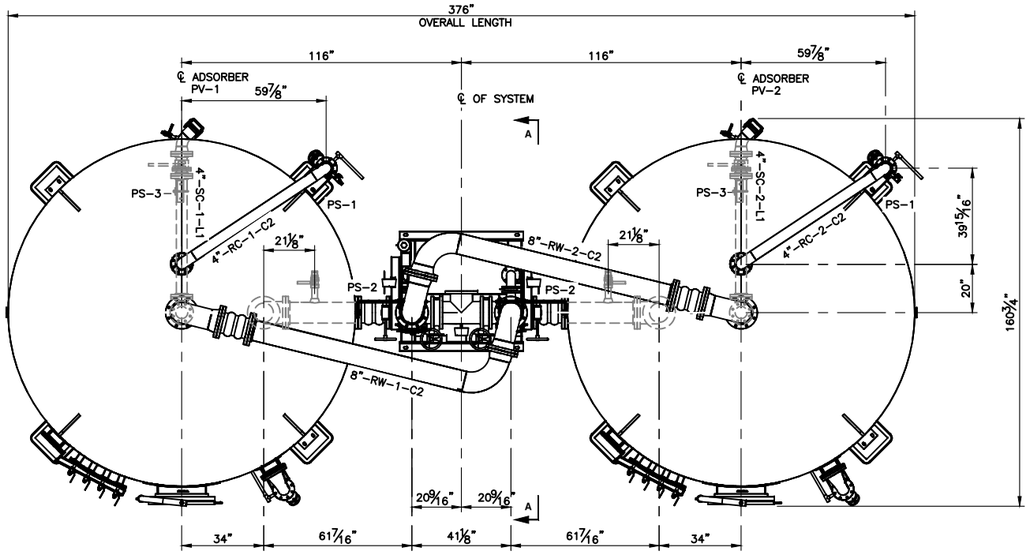
CLIENT
CITY OF ORANGE
ORANGE COUNTY, CA

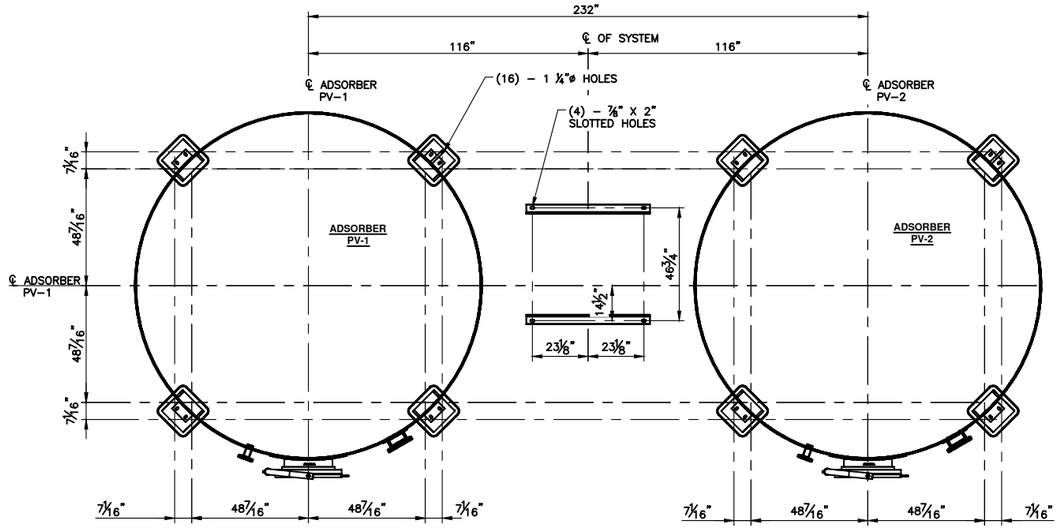
TITLE
MODEL 12 SYSTEM
10" PIPING, INTERNAL CONE
GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	1 OF 1	NONE

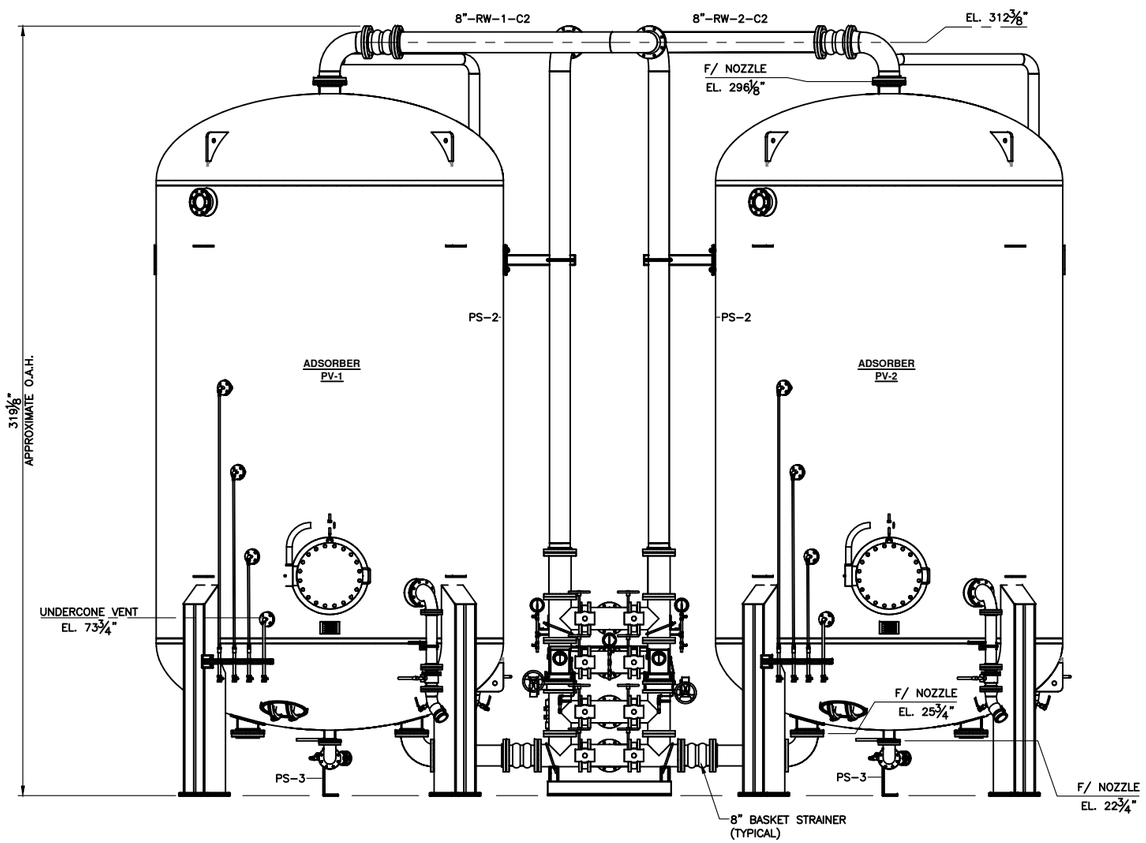
DWG. No. GA-001 REV. A

V:\Proposals\IX-IA\2021\P-IX-21006, City of Orange\Drawings\General Arrangement\GA-001 Model 12 10in.dwg Jan 27, 2021 - 3:29pm

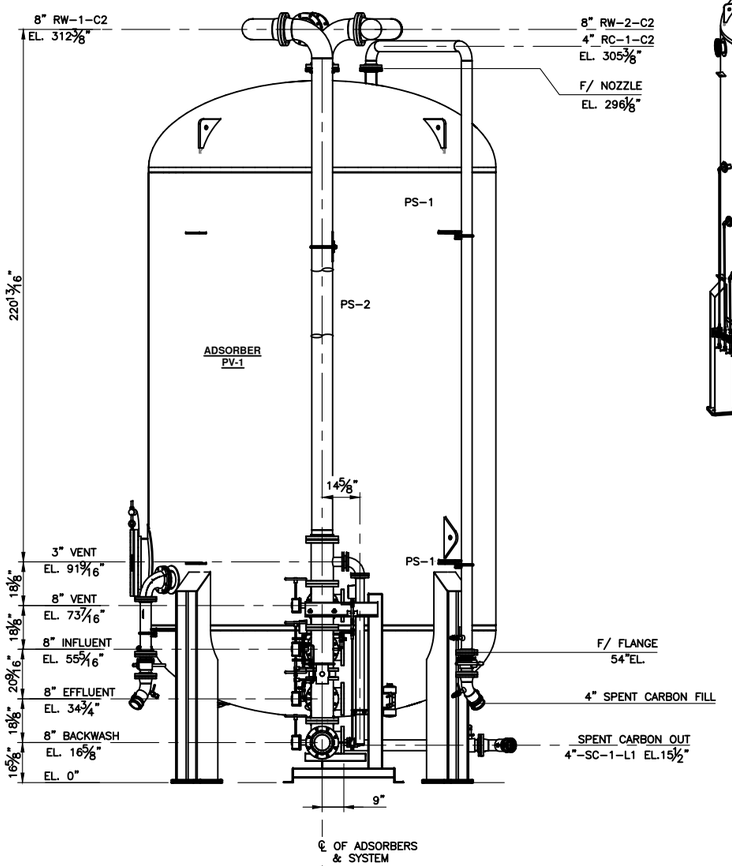




PLAN

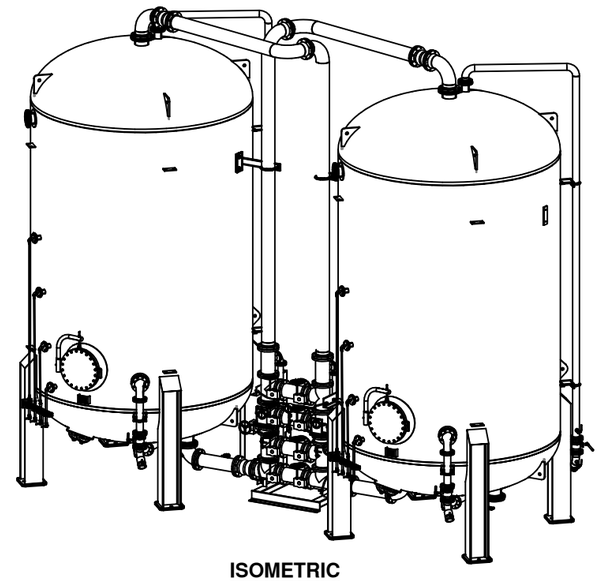


ELEVATION



VIEW A-A

ANCHOR BOLT PLAN



ISOMETRIC

	NAME	DATE
DRAFTER	JGP	6/14/2010
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	STANDARD	

REV	DESCRIPTION	APP	DATE
	REVISIONS		

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CalgonCarbon

CLIENT: STANDARD

TITLE: MODULAR ADSORBER SYSTEM MODEL 12-40, 8" PIPING GENERAL ARRANGEMENT

DWG. Size	SHEET No.	SCALE
D	1 OF 1	NONE

DWG. No. 90110100 REV. B

SALES SPECIFICATION SHEET

FILTRASORB 400

Granular Activated Carbon

Test	Specification		Calgon Carbon Test Method
	Min	Max	
IODINE NUMBER, mg/g	1000	-	TM-4,ASTM D4607
MOISTURE (AS PACKAGED), wt%	-	2	TM-1,ASTM D2867
ABRASION NUMBER	75	-	TM-9,AWWA B604
EFFECTIVE SIZE, mm	0.55	0.75	TM-8,ASTM D2862
UNIFORMITY COEFFICIENT	-	1.9	TM-8,ASTM D2862
FCC - WATER EXTRACTABLE, wt%	-	4	TM-43,FCC
12 US MESH [1.70 mm], wt%	-	5	TM-8,ASTM D2862
< 40 US MESH [0.425 mm] (PAN), wt%	-	4	TM-8,ASTM D2862

Typical Properties:

This product complies with ANSI/AWWA B604 (2012) – Granular Activated Carbon.

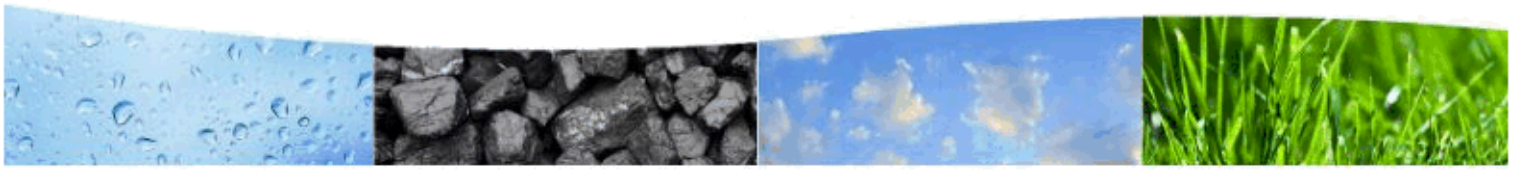
This product complies with the requirements for activated carbon as defined by the Food Chemicals Codex (FCC) (Latest Edition) published by the U.S. Pharmacopeia.

This product is produced under supervision of the Islamic Food and Nutrition Council of America (IFANCA).

This product is prepared under the supervision of the Kashruth Division of the Orthodox Union and is Kosher.

Only products bearing the NSF Mark are Certified to NSF/ANSI/CAN 61 - Drinking Water System Components - Health Effects standard. Certified Products will bear the NSF Mark on packing or documentation shipped with the product.

Calgon Carbon Corporation's activated carbon products are continuously being improved and changes may have taken place since this publication went to press. 12030-10/09/2018



+1 800 422 7266 calgoncarbon.com

CalgonCarbon
A Kuraray Company

CALRES™ 2301

Strong Base Anion Exchange Resin

Calgon Carbon offers a range of proprietary, high quality products under the CalRes brand, including CalRes 2301. This product was designed specifically to remove PFAS (poly-and perfluoroalkyl substances). CalRes 2301 is a selective strong base anion resin that possesses distinctive functionality provided in the chloride form.

APPLICATIONS

- PFAS
  - Groundwater
  - Surface Water
- Industrial/environmental water remediation

DESCRIPTION

CalRes 2301 is a styrene-based polymer resin with tributylamine functional groups which makes it highly selective for PFAS. CalRes 2301 is formulated to be certified to the requirements of NSF/ANSI/CAN 61 for use in municipal water treatment facilities. Only products bearing the NSF Mark are certified to the NSF/ANSI/CAN 61 - Drinking Water System Components - Health Effects standard. Certified Products will bear the NSF/WQA Gold Seal on packaging or documentation shipped with the product.

FEATURES & BENEFITS

- CalRes 2301 has a macroporous structure that allows for increased diffusion rates into the bead enhancing its performance.
- Consistent record of PFAS removal performance
- CalRes 2301 is the only PFAS resin recommended for surface water treatment because it can be disinfected with low levels of chlorine. Alternatively, gel resins will not withstand a chlorine disinfection.
- Calgon Carbon offers large equipment systems and related turnkey field services. Services include resin delivery and installation, as well as spent resin removal and disposal.
- Calgon Carbon has extensive technical support along with ISO 9001 certified quality control.

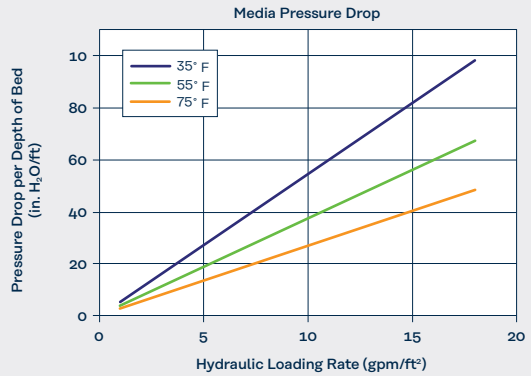
Physical and Chemical Properties

Type	Strong Base Anion (SBA)
Base Structure Polymer	Styrene
Matrix	Macro
Physical Form	Spherical Beads
Ionic Form	Chloride
Total Exchange Capacity	Min: 0.51 eq/L
Water Retention Capacity	48-60 wt%
Particle Size	16 x 50 US MESH
Shipping Weight	40-47 lbs/cf

SAFETY

Before handling or using this product, please consult the current Safety Data Sheet.

Warning: Before using strong oxidizing agent, please consult knowledgeable sources for handling such material as these agents, such as nitric acid, can attack these organic resins under certain conditions and result in a slightly degraded resin up to an explosive reaction. Preferred storage is to be between 0-50C in a dry place.



MEDIA CONDITIONING

Virgin CalRes 2301 resin must be conditioned prior to use to remove any residues from the manufacturing process. Calgon Carbon suggests a conditioning step of up to 40 bed volumes prior to startup. A pre-installation conditioning can be performed by Calgon Carbon at our facilities at the customer's request. Please contact Calgon Carbon for more information about this process or backwashing of the resin.

HUNGERFORD & TERRY, INC.

PREPARED FOR: JOSH HARNER, PE- PROJECT ENGINEER
BURGESS & NIPLE, INC.

PROJECT: TWO (2) 144” DIAMETER PFAS ION EXCHANGE SYSTEMS- LOVELAND, OH

PREPARED BY: CHRISTOPHER RALPH
INSIDE SALES MANAGER

May 14, 2024

Attention: Josh Harner, PE- Project Engineer
Burgess & Niple, Inc.

Reference: Two (2) 144" Diameter PFAS Ion Exchange Systems- Loveland, OH - H&T Budgetary Proposal BDJ72844

In response to your request, Hungerford & Terry, Inc. is pleased to submit the attached Budgetary Proposal BDJ72844 for your consideration. This proposal provides for two (2) train of two 144" diameter anion exchange resin contactors. The contactors are arranged in a lead lag design. System is sized for the treatment of 3 MGD and capable of treating up to 4 MGD.

This proposal is budgetary and is formulated using the available information. The design may be subject to change as more information becomes available. The specifications provided within is intended for securing funding for the project and contains contingency pricing to account for changes that may be necessary as the project progresses. Firm pricing will be available on bid day or upon request per intent to purchase. This proposal is for equipment only and does not offer treatment guarantees at this time.

We very much appreciate the opportunity to submit this proposal and we hope that it meets with your favorable consideration. Should you have any questions or need for additional information, please feel free to contact our local representative at the address and telephone number listed below, or this writer at our home office in Clayton, New Jersey.

Very truly yours,

HUNGERFORD & TERRY, INC.

Christopher Ralph
Inside Sales Manager

J. DWIGHT THOMPSON CO.
Marc Nusser
P.O. Box 505
6847 State Route 128, Suite B
Miamitown, OH 45041
Ph: 513-871-9970
Fax: 513-871-2270
marc@jdtco.com

1. SCOPE OF SUPPLY

Ion Exchange Contactors:

Contactor Tanks:

Four (4) 144 inch OD tanks designed in accordance with the following:

- 100 psi design pressure.
- SA-516 grade 70 carbon steel construction
- ASME code section VIII construction with stamp.
- One (1) 20 inch diameter manway with davit in lower side shell.
- One (1) 14 inch x 18 inch manways, one in top head
- Three (3) 2 inch sample ports.
- Necessary flanged nozzle type connections.
- Four (4) lifting lugs.
- Four (4) structural steel I-beam type support legs under the tank.
- Tank interiors will be white metal sandblasted (SSPC-SP10) and lined with one (1) coat (35-45 mils DFT) of Plasite 4110 epoxy enamel
- Tank exteriors will be commercial sandblasted (SSPC-SP6) and painted with one (1) primer coat (5.0-7.0 mils DFT) of Tnemec Series N69F.

Note:

1. Finish painting of the tank exteriors and carbon steel piping is to be field applied by the contractor.

Tank Internal Distributors:

Four (4) Hub-lateral inlet distributor/waste collectors with schedule 40 304 stainless steel pipe and fittings.

Four (4) Type "H" underdrain header-lateral with drop down 304 stainless steel strainers.

Note:

1. The internals will be installed prior to shipment.

Ion Exchange Resin:

Four (4) 5' beds of PFA694E Anion exchange media

Contactor Exteriors:

Four (4) Valve nest exterior consisting of:

Bray model 3W butterfly valves with handwheel gear operators for:

- Lead inlet
- Lag inlet
- Lag outlet
- Backwash inlet
- Backwash outlet
- Lead outlet

Apco model 143C or equal air/vacuum release valve with threaded cast iron bodies and stainless steel floats for:

- Tank air release

Flow-Tek or equal flanged 316 stainless steel full port ball valves for:

- Resin sluice inlet
- Resin sluice outlet

Flow-Tek or equal series S80 threaded stainless steel ball valves for:

- Air release isolating
- Drain
- Manual vent

Sample Ports:

Twenty (20) Stainless steel sample lines with Flow-Tek or equal series S80 threaded stainless steel ball valves for:

- Contactor inlet and outlets (.25" diameter), 8
- 25% of resin bed depth (.25" diameter), 4.
- 50% of resin bed depth (.25" diameter), 4
- 75% of resin bed depth (.25" diameter), 4

Schedule 10, 304 Stainless Steel System Piping:

Schedule 10, 304 stainless steel pipe and butt weld fittings for:

- Resin slurry inlet and discharge piping.

System Face Piping:

Class 53 CLDI piping. Pipe 2-1/2 inches and smaller schedule 40, 304 stainless steel pipe with 150 lb threaded stainless steel fittings.

Transfer Hose Connectors:

Hose Connectors:

Twelve (12) The resin slurry piping will be fitted with 4 inch quick disconnect manufactured by OPW Dover Kamlock for:

- Resin fill, 4.
- Resin discharge, 4
- Tank drain, 4

Resin Traps:

Four (4) Fabricated with 316 stainless steel with 6 inch flanged connections, body of trap with be 8 inch diameter with a 2 inch site glass, mounted in the effluent line of each filter.

- Resin traps

Pressure Equipment:

Eight (8) Ashcroft model 1279SS pressure gauges for tank inlets and outlets with 4.5 inch diameter dials, and stainless steel bourdon tubes.

Eight (8) Sets of polypropylene supply tubing.

Eight (8) Sets of manual isolating valves.

Eight (8) Sets of sampling valves.

Expansion Joints:

Eight (8) Expansion joints of molded neoprene rubber for:

- Contactor inlet
- Contactor outlet

Flow Equipment:

Four (4) Rosemount or equal 8750WD flowmeters, with 4-20mA output for:

- Contactor inlets

Hungerford and Terry, Inc. Standard Surface Preparation & System Painting:

Lined Tanks:

The interiors of all lined tanks will be sandblasted to near white metal in accordance with SSPC-SP5. Lining will be as specified in the general description of the tanks.

Tank Exteriors:

The exteriors of all steel tanks will be commercial sandblasted in accordance with SSPC-SP6. Painting will be as specified in the general description of the tanks.

Unlined Steel Pipe:

The exteriors surfaces of all unlined steel pipe and fittings shal be cleaned by hand, wirebrushing, or solvent as required and painted with one (1) coat of universal primer.

Misc. Equipment:

The exteriors surfaces of all misc. valves, etc. will be furnished with the manufacturer's standard painting.

Finish Painting:

Finish painting of all equipment furnished by Hungerford & Terry, Inc. is to be field applied by the installation contractor.

Delivery:

All equipment shall be shipped to the jobsite for installation by the Contractor.

2. PRICE SUMMARY

Price: **$1,722,000**

One Million Seven Hundred and Twenty Two Thousand Dollars

F.O.B. Shipping Points: With full motor freight included
Payable in US currency, plus any applicable Municipal, State or Federal Taxes.

Payment Terms:

To be determined

Quote Valid for 30 Days

A copy of the payment bond (if applicable) will be required as part of the credit approval process. Purchaser agrees to make pro rata payments for partial shipments and further agrees that if shipment of material is delayed by any act or omission on part of purchaser, payment shall become due within thirty (30) days after the material is ready for shipment

Shipment:

Applicable freight to location is included in the price of the contract. Logistics of shipment will be advised as project proceeds.

Acceptance by Purchaser

_____

_____

_____

Date_____
By_____

HUNGERFORD & TERRY, INC.

Christopher Ralph, Inside Sales Manager

This proposal is hereby accepted by:
Hungerford & Terry, Inc._ 5-14-24

3. FIELD SERVICE CHARGES

One service technician will be on site for 9 days over 3 trips to assist with media loading and start up.

If additional service is needed, Hungerford & Terry, Inc., will furnish a Field Supervisor at USD-$1,200.00 per weekday of 8 consecutive hours or USD-$150.00 per hour, coinciding with the Purchaser's regular business hours during the normal work week of Monday through Friday including traveling time, plus living and traveling expenses from date of departure from Clayton, NJ, to destination and return. All time in excess of 8 hours shall be charged at 1-1/2 times the daily rate and all traveling and living expenses will be charged at cost. Meal charge is USD-$50.00 per day.

All overtime will be charged at 1-1/2 times the daily rate.

PLEASE NOTE: The Purchaser will be charged for the services of the Field Supervisor at the jobsite when service cannot be rendered because of delay or conditions beyond Hungerford & Terry's control. In cases of undue delay, Hungerford & Terry reserves the right to recall the supervisor.

HUNGERFORD & TERRY, INC.

PER: _____
Christopher Ralph, Inside Sales Representative

DATE: _____

ACCEPTED: _____

PER: _____

TITLE: _____

DATE: _____

4. ADDITIONAL TRAIN FOR 4 MGD

Ion Exchange Contactors:

Contactor Tanks:

Two (2) 144 inch OD tanks designed in accordance with the following:

- 100 psi design pressure.
- SA-516 grade 70 carbon steel construction
- ASME code section VIII construction with stamp.
- One (1) 20 inch diameter manway with davit in lower side shell.
- One (1) 14 inch x 18 inch manways, one in top head
- Three (3) 2 inch sample ports.
- Necessary flanged nozzle type connections.
- Four (4) lifting lugs.
- Four (4) structural steel I-beam type support legs under the tank.
- Tank interiors will be white metal sandblasted (SSPC-SP10) and lined with one (1) coat (35-45 mils DFT) of Plasite 4110 epoxy enamel
- Tank exteriors will be commercial sandblasted (SSPC-SP6) and painted with one (1) primer coat (5.0-7.0 mils DFT) of Tnemec Series N69F.

Note:

1. Finish painting of the tank exteriors and carbon steel piping is to be field applied by the contractor.

Tank Internal Distributors:

Two (2) Hub-lateral inlet distributor/waste collectors with schedule 40 304 stainless steel pipe and fittings.

Two (2) Type "H" underdrain header-lateral with drop down 304 stainless steel strainers.

Note:

1. The internals will be installed prior to shipment.

Ion Exchange Resin:

Two (2) 5' beds of PFA694E Anion exchange media

Contactor Exteriors:

Two (2) Valve nest exterior consisting of:

Bray model 3W butterfly valves with handwheel gear operators for:

- Lead inlet
- Lag inlet
- Lag outlet
- Backwash inlet
- Backwash outlet
- Lead outlet

Apco model 143C or equal air/vacuum release valve with threaded cast iron bodies and stainless steel floats for:

- Tank air release

Flow-Tek or equal flanged 316 stainless steel full port ball valves for:

- Resin sluice inlet
- Resin sluice outlet

Flow-Tek or equal series S80 threaded stainless steel ball valves for:

- Air release isolating
- Drain
- Manual vent

Sample Ports:

Ten (10) Stainless steel sample lines with Flow-Tek or equal series S80 threaded stainless steel ball valves for:

- Contactor inlet and outlets (.25" diameter), 4
- 25% of resin bed depth (.25" diameter), 2
- 50% of resin bed depth (.25" diameter), 2
- 75% of resin bed depth (.25" diameter), 2

Schedule 10, 304 Stainless Steel System Piping:

Schedule 10, 304 stainless steel pipe and butt weld fittings for:

- Resin slurry inlet and discharge piping.

System Face Piping:

Class 53 CLDI piping. Pipe 2-1/2 inches and smaller schedule 40, 304 stainless steel pipe with 150 lb threaded stainless steel fittings.

Transfer Hose Connectors:

Hose Connectors:

Six (6) The resin slurry piping will be fitted with 4 inch quick disconnect manufactured by OPW Dover Kamlock for:

- Resin fill, 2
- Resin discharge, 2
- Tank drain, 2

Resin Traps:

Two (2) Fabricated with 316 stainless steel with 6 inch flanged connections, body of trap with be 8 inch diameter with a 2 inch site glass, mounted in the effluent line of each filter.

- Resin traps

Pressure Equipment:

Four (4) Ashcroft model 1279SS pressure gauges for tank inlets and outlets with 4.5 inch diameter dials, and stainless steel bourdon tubes.

Four (4) Sets of polypropylene supply tubing.

Four (4) Sets of manual isolating valves.

Four (4) Sets of sampling valves.

Expansion Joints:

Four (4) Expansion joints of molded neoprene rubber for:

- Contactor inlet
- Contactor outlet

Flow Equipment:

Two (2) Rosemount or equal 8750WD flowmeters, with 4-20mA output for:

- Contactor inlets

Hungerford and Terry, Inc. Standard Surface Preparation & System Painting:

Lined Tanks:

The interiors of all lined tanks will be sandblasted to near white metal in accordance with SSPC-SP5. Lining will be as specified in the general description of the tanks.

Tank Exteriors:

The exteriors of all steel tanks will be commercial sandblasted in accordance with SSPC-SP6. Painting will be as specified in the general description of the tanks.

Unlined Steel Pipe:

The exteriors surfaces of all unlined steel pipe and fittings shal be cleaned by hand, wirebrushing, or solvent as required and painted with one (1) coat of universal primer.

Misc. Equipment:

The exteriors surfaces of all misc. valves, etc. will be furnished with the manufacturer's standard painting.

Finish Painting:

Finish painting of all equipment furnished by Hungerford & Terry, Inc. is to be field applied by the installation contractor.

Delivery:

All equipment shall be shipped to the jobsite for installation by the Contractor.

Price: $768,000

5. CONDITIONS

Prices are based on present day labor and material costs and subject to revision after thirty days from date of quotation. They do not include any Federal, State, Municipal or other tax or Government charge applicable to the sale, shipment or use of equipment quoted on.

Deliveries are contingent upon strikes, accidents, delays in manufacture and other causes beyond our control.

Any typographical or clerical errors in the prices or specifications are subject to correction.

Order shall be made out to Hungerford & Terry, Inc., Clayton, NJ, and shall be subject to acceptance by us at Clayton, NJ. After acceptance, orders may be cancelled only with our written consent and on terms that will indemnify us against loss. Equipment on material cannot be returned except by special permission and when so returned will be subject to discount.

The Company will, free of charge, replace or repair, after receipt f.o.b. its factory promptly and within one year from shipment by it, any part of equipment which, under normal or proper use proves to be defective in workmanship or material. In no event shall the Company be liable for consequential damages.

The Company shall not be liable for failure to perform or delay in performing any obligation if such failure or delay shall be caused directly or indirectly by invasion, insurrection, riot, war, military authority, or by fire, flood, strike, or labor difficulty or by any other cause, whether of the same or different nature from those enumerated, beyond our reasonable control.

From the time said machinery of apparatus or any part thereof arrives on the premises, and until Hungerford & Terry, Inc., for an amount equal to the unpaid portion of the purchase price of the same; such loss or damage to be payable to Hungerford & Terry, Inc., as its interests may appear. All losses by fire or other casualties for which Hungerford & Terry, Inc., is not indemnified and paid under such policies of insurance, shall be borne by the Purchaser on and after the arrival of said machinery or apparatus, or any part thereof on Purchaser's premises.

The title and right of possession of above described articles shall remain vested in Hungerford & Terry, Inc. until Purchaser shall have made full payment thereof in cash and this right shall not be waived by attachment of said articles to the real estate. Upon Purchaser's failure to make above agreed payments or any part thereof, Hungerford & Terry, Inc. is to retain any and all partial payments which may have been made as liquidated damages, and shall be entitled to take immediate possession of said materials.

This proposal, of which the Conditions of Sale are an integral part, shall not become a contract or become binding until it has been approved and signed by a representative of Hungerford & Terry, Inc. at its home office, Clayton, NJ. Persons signing on behalf of purchaser hereby represent that they are legally authorized to enter into this contract.

HUNGERFORD & TERRY, INC.

PREPARED FOR: JOSH HARNER, PE- PROJECT ENGINEER
BURGESS & NIPLE, INC.

PROJECT: SIX (6) 168” DIAMETER PFAS GRANULAR ACTIVATE CARBON SYSTEMS- LOVELAND, OH

PREPARED BY: CHRISTOPHER RALPH
INSIDE SALES MANAGER

May 14, 2024

Attention: Josh Harner, PE- Project Engineer
Burgess & Niple, Inc.

Reference: Six (6) 168" Diameter PFAS Granular Activated Carbon Systems- Loveland, OH - H&T Budgetary Proposal BDJ72844

In response to your request, Hungerford & Terry, Inc. is pleased to submit the attached Budgetary Proposal BDJ72844 for your consideration. This proposal provides for three (3) train of two 168" diameter granular activated carbon filters. The filters are arranged in a lead lag design. The system is sized for the treatment of 3 MGD and capable of treating up to 4 MGD with an additional train. Pricing for the additional train provided as an alternate.

This proposal is budgetary and is formulated using the available information. The design may be subject to change as more information becomes available. The specifications provided within is intended for securing funding for the project and contains contingency pricing to account for changes that may be necessary as the project progresses. Firm pricing will be available on bid day or upon request per intent to purchase. This proposal is for equipment only and does not offer treatment guarantees at this time.

We very much appreciate the opportunity to submit this proposal and we hope that it meets with your favorable consideration. Should you have any questions or need for additional information, please feel free to contact our local representative at the address and telephone number listed below, or this writer at our home office in Clayton, New Jersey.

Very truly yours,

HUNGERFORD & TERRY, INC.

Christopher Ralph
Inside Sales Manager

J. DWIGHT THOMPSON CO.
Marc Nusser
P.O. Box 505
6847 State Route 128, Suite B
Miamitown, OH 45041
Ph: 513-871-9970
Fax: 513-871-2270
marc@jdtco.com

1. SCOPE OF SUPPLY

GAC Filters:

Six (6) 168 inch OD GAC filter tanks designed in accordance with the following:

- 100 psi design pressure.
- SA-516 grade 70 carbon steel construction
- ASME code section VIII construction with stamp.
- One (1) 20 inch diameter manway with davit in upper side shell.
- One (1) 14 inch x 18 inch manways, one in top head
- Three (3) 2 inch sample ports.
- Necessary flanged nozzle type connections.
- Four (4) lifting lugs.
- Six (6) structural steel I-beam type support legs under the tank.
- Tank interiors will be white metal sandblasted (SSPC-SP10) and lined with one (1) coat (7.0-9.0 mils DFT) of Devoe BAR-RUST 233H epoxy enamel.
- Tank exteriors will be commercial sandblasted (SSPC-SP6) and painted with one (1) primer coat (5.0-7.0 mils DFT) of Tnemec Series N69F.

Note:

1. Finish painting of the filter tank exteriors and all provided piping is to field applied by the contractor.

2. All anchor bolts are part of the foundation equipment and shall be furnished and installed by the equipment installer or contractor.

Tank Internal Distributors:

Six (6) Hub lateral inlet distributor/waste collectors system constructed of schedule 40, 316 stainless steel pipe and fittings, hub will extend down from the top head and include two (2) lateral arms and ending with two (2) upturned elbows.

Six (6) Header lateral underdrain distributors with 316 stainless steel construction with drop down 316 stainless steel strainers.

Note:

1. The inlet distributor / backwash collector and underdrain system shall be installed in the tank prior to shipment.

Filter Exteriors:

Six (6) Valve nest exterior consisting of:

Bray model 3W butterfly valves with handwheel gear operators for:

- Lead inlet
- Lag inlet
- Lag outlet
- Backwash inlet
- Backwash outlet
- Lead outlet

Apco model 143C or equal air/vacuum release valve with threaded cast iron bodies and stainless steel floats for:

- Tank air release

Flow-Tek or equal flanged 316 stainless steel full port ball valves for:

- GAC sluice inlet
- GAC sluice outlet

Flow-Tek or equal series S80 threaded stainless steel ball valves for:

- Air release isolating
- Drain
- Manual vent

Sample Ports:

Thirty (30) Stainless steel sample lines with Flow-Tek or equal series S80 threaded stainless steel ball valves for:

- Filter inlet and outlets (.25" diameter), 12
- 25% of GAC bed depth (.25" diameter), 6 each.
- 50% of GAC bed depth (.25" diameter), 6 each.
- 75% of GAC bed depth (.25" diameter), 6 each.

Granular Activated Carbon

Six (6) 108" Deep beds of coal based GAC designed for the treatment of PFAS. Shipment and loading of media included in price.

System Face Piping:

Stainless Steel Piping:

Schedule 10, 304 stainless steel pipe with 304 stainless steel butt-weld fittings and welded flanges.

GAC Fill and Discharge Piping:

Schedule 40, 304 stainless steel pipe with butt-weld fittings.

Hose Connectors:

Eighteen (18) The resin slurry piping will be fitted with 4 inch quick disconnect manufactured by OPW Dover Kamlock for:

- GAC fill, 6 .
- GAC discharge, 6.
- Tank drain, 6.

Pressure Equipment:

Twelve (12) Ashcroft model 1279SS pressure gauges for tank inlets and outlets with 4.5 inch diameter dials, and stainless steel bourdon tubes.

Eighteen (18) Sets of stainless steel supply tubing.

Eighteen (18) Sets of manual isolating valves.

Eighteen (18)Sets of sampling valves.

Six (6) Rosemount 2051 differential pressure transmitters for :

- GAC differential pressure.

Flow Equipment:

Six (3) Rosemount or equal 8750WD flowmeters, with 4-20mA output for:

- Filter inlets

Shop Fabrication:

All filter tank internal distributors will be completely shop fabricated prior to shipment.

All filter tank exteriors piping will be shop fabricated to the proper lengths as shown on our construction drawings, and will be furnished with all required flanges installed.

All equipment, materials, and valve tree assemblies, will be shipped for jobsite installation by the purchaser unless specifically mentioned above to be installed prior to shipment.

Valve tree is constructed of structural steel, and painted with with two (2) primer coats (10.0-14.0 mils DFT total) of Tnemec Series N69F.

2. PRICE SUMMARY

Price: **$2,592,000**

Two Million Five Hundred and Ninety Two Thousand Dollars

F.O.B. Shipping Points: With full motor freight included
Payable in US currency, plus any applicable Municipal, State or Federal Taxes.

Payment Terms:

To be determined

Quote Valid for 30 Days

A copy of the payment bond (if applicable) will be required as part of the credit approval process. Purchaser agrees to make pro rata payments for partial shipments and further agrees that if shipment of material is delayed by any act or omission on part of purchaser, payment shall become due within thirty (30) days after the material is ready for shipment

Shipment:

Applicable freight to location is included in the price of the contract. Logistics of shipment will be advised as project proceeds.

Acceptance by Purchaser

_____

_____

_____

Date_____
By_____

HUNGERFORD & TERRY, INC.

Christopher Ralph, Inside Sales Manager

This proposal is hereby accepted by:
Hungerford & Terry, Inc._ 5-14-24

3. ALTERNATE SECTION

To increase the flow to 4 MGD please add another train of two filters as described above to the scope of supply.

Price: $848,000

4. FIELD SERVICE CHARGES

One service technician will be on site for 9 days over 3 trips to assist with media loading and start up.

If additional service is needed, Hungerford & Terry, Inc., will furnish a Field Supervisor at USD-$1,200.00 per weekday of 8 consecutive hours or USD-$150.00 per hour, coinciding with the Purchaser's regular business hours during the normal work week of Monday through Friday including traveling time, plus living and traveling expenses from date of departure from Clayton, NJ, to destination and return. All time in excess of 8 hours shall be charged at 1-1/2 times the daily rate and all traveling and living expenses will be charged at cost. Meal charge is USD-$50.00 per day.

All overtime will be charged at 1-1/2 times the daily rate.

PLEASE NOTE: The Purchaser will be charged for the services of the Field Supervisor at the jobsite when service cannot be rendered because of delay or conditions beyond Hungerford & Terry's control. In cases of undue delay, Hungerford & Terry reserves the right to recall the supervisor.

HUNGERFORD & TERRY, INC.

PER: _____
Christopher Ralph, Inside Sales Representative

DATE: _____

ACCEPTED: _____

PER: _____

TITLE: _____

DATE: _____

5. CONDITIONS

Prices are based on present day labor and material costs and subject to revision after thirty days from date of quotation. They do not include any Federal, State, Municipal or other tax or Government charge applicable to the sale, shipment or use of equipment quoted on.

Deliveries are contingent upon strikes, accidents, delays in manufacture and other causes beyond our control.

Any typographical or clerical errors in the prices or specifications are subject to correction.

Order shall be made out to Hungerford & Terry, Inc., Clayton, NJ, and shall be subject to acceptance by us at Clayton, NJ. After acceptance, orders may be cancelled only with our written consent and on terms that will indemnify us against loss. Equipment on material cannot be returned except by special permission and when so returned will be subject to discount.

The Company will, free of charge, replace or repair, after receipt f.o.b. its factory promptly and within one year from shipment by it, any part of equipment which, under normal or proper use proves to be defective in workmanship or material. In no event shall the Company be liable for consequential damages.

The Company shall not be liable for failure to perform or delay in performing any obligation if such failure or delay shall be caused directly or indirectly by invasion, insurrection, riot, war, military authority, or by fire, flood, strike, or labor difficulty or by any other cause, whether of the same or different nature from those enumerated, beyond our reasonable control.

From the time said machinery of apparatus or any part thereof arrives on the premises, and until Hungerford & Terry, Inc., for an amount equal to the unpaid portion of the purchase price of the same; such loss or damage to be payable to Hungerford & Terry, Inc., as its interests may appear. All losses by fire or other casualties for which Hungerford & Terry, Inc., is not indemnified and paid under such policies of insurance, shall be borne by the Purchaser on and after the arrival of said machinery or apparatus, or any part thereof on Purchaser's premises.

The title and right of possession of above described articles shall remain vested in Hungerford & Terry, Inc. until Purchaser shall have made full payment thereof in cash and this right shall not be waived by attachment of said articles to the real estate. Upon Purchaser's failure to make above agreed payments or any part thereof, Hungerford & Terry, Inc. is to retain any and all partial payments which may have been made as liquidated damages, and shall be entitled to take immediate possession of said materials.

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SOFTENING TREATMENT SYSTEM PROPOSALS

Loveland WTP

Ohio

Engineer
Burgess and Niple

Representative
Marty Davidson
B.L. Anderson Inc.
West Chester, Ohio
(513) 899-4746
marty@blanderson.com

Contact
Tom Dumbaugh
tdumbaugh@westech-inc.com

Angie Burke
aburke@westech-inc.com

WesTech®

Proposal Number: 2330236
Friday, February 16, 2024

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Drawings

Technical Proposal

Item A – Three (3) 12 ft dia. Ion Exchange Softening System, Model IEV22B

Design Criteria	
Application	Hardness Removal
Design Flow	2.67 MGD (1,855 gpm)
Peak Flow	4 MGD (2,778 gpm)
Number of Softeners	Three
Size of Each Softener	144 in diameter x 108 in side shell height
Softener Area	113.1 ft^2 per unit
Softener Loading Rate	3.5 – 5.2 gpm/ft^2
Raw Water Hardness	333 mg/L (as $CaCO_3$)
Finished Water Hardness	120 mg/L (as $CaCO_3$)
Inlet Flow Rate to Softeners	1187 – 1777 gpm
Bypass Flow Rate	668 – 1001 gpm
Softener Media Type	Purolite C100E cationic resin
Softener Media Depth	60 in
Backwash Rate	5 gpm/ft^2
Regenerant Dose	6 lbs salt/ft^3 resin
Brine Concentration	2.4 lbs/gallon
Brining Time	15 minutes
Slow Rinse Rate	1.2 gpm/ft^2
Fast Rinse Rate	at service rate

*The design backwash rate listed is based on a temperature of 25 °C. The actual backwash water rate must be adjusted 2% up or down for each degree Celsius difference above or below from design temperature, i.e., above 25 °C increase by 2%, below 25 °C decrease by 2%.

Features and Benefits

Ion Exchange Softeners are an effective, inexpensive and low-maintenance method of reducing hardness from raw water quality. Water is induced in the top side of the vessel and passes through ion exchange resin where unwanted hardness ions (calcium and magnesium) are removed. Once the resin has reached capacity, it is regenerated with salt and placed back in service.

Additional benefits include:

- Consistent water quality with automatic regeneration controls
- Extended service life with high quality non-code constructed tanks, or ASME code tanks.
- Maximized net production while minimizing waste with high capacity ion exchange resin
- Reduced operator attention required with automatic actuated system valves.

Ion Exchange System. Graphic may not entirely represent the system quoted.

Tankage Scope of Supply

Item	Details
Tank dimensions	144 in diameter x 108 in side shell height
Working pressure	100 psi
Test pressure	130 psi
Construction standard	ASME Code with stamp
Influent/Backwash waste connection	8 in
Effluent/Backwash supply connection	8 in
Brine connection	4 in
Air/Vacuum relief connection	1 in
Overdrain	Single point steel
Underdrain	False bottom steel plate with gravel support nozzles
Brine distributor	Header and lateral type co-current regeneration
Manways	(1) 14 in x 18 in elliptical
Tank support	Structural steel legs

Fabrications Scope of Supply

Feature	Quantity	Notes
Filter Front Piping*	1 Lot	Sch. 40 Steel pipe with ductile iron fittings. Pipe sections are flanged by plain end with one flange loose for field welding. Pipe sections shipped loose.
Brine distributor*	3 sets	Header and lateral type co-current regeneration

*Items are shipped loose for field installation into the filter tank by the installing contractor.

Media Scope of Supply

Type	Quantity	Layer Depth	Details	Packaging
Resin	1,697 ft^3	60 in	Purolite C100E Cationic	1-ft^3 bags or super sacks
Gravel	283 ft^3	10 in	3/4” x 1/2” (Bottom 4”) 1/2” x 3/16” (Next 3”) 3/16” x 3/32” (Next 3”)	1-ft^3 bags of super sacks

*Media quantities listed are estimated and may vary after the vessel design has been finalized.

Valves Scope of Supply

Item	Quantity	Size	Type	Operator Type
Influent Valve	3	8 in	Open/Close	Pneumatic
Backwash Waste	3	8 in	Open/Close	Pneumatic with limit stop
Backwash Supply	3	8 in	Open/Close	Pneumatic
Effluent	3	8 in	Modulating	Electro-pneumatic
Slow Rinse	3	4 in	Open/Close	Pneumatic with limit stop
Fast Rinse	3	8 in	Open/Close	Pneumatic with limit stop
Air/Vacuum Release	3	1 in	Automatic	Float actuated
Brine	3	4 in	Open/Close	Pneumatic
Saturated Brine Line	1	4 in	Manual rate set valve	NA
Saturated Brine Line	1	4 in	Check valve	NA
Make-up Water Line	1	4 in	Manual rate set valve	NA
Make-up Water Line	1	4 in	Check valve	NA

All butterfly valves are Bray wafer style with cast iron body, nylon coated disc, EPDM seat and shaft seal. Manually controlled butterfly valves have lever or gear operated handwheel actuators. Automatic butterfly valves have double acting, weatherproof pneumatic cylinder actuators manufactured by Bray.

Air/Vacuum release assemblies for each tank consist of a Val-Matic, or equal, air/vacuum combination release valve and a gate valve for isolation shipped in pieces for field assembly by others.

Master Control Panel Scope of Supply

Feature	Description	Notes
Number of Panels	1	
Housing	NEMA 12	Wall mounted
PLC	Allen Bradley	CompactLogix
OIT	Allen Bradley	10” color touchscreen interface
SCADA Interface		

Instrumentation Scope of Supply

Description	Quantity	Type	Output	Manufacturer
Loss of Head Gauge Assembly	1	3 ½ in gauges with differential pressure switch	Switch, 120 V	WesTech
Effluent/Backwash Supply Flow	3	Size 8 in Magnetic Flow with totalizer	4–20 mA	Endress+Hauser
Brine Meter	1	Size 4 in Magnetic Flow with pulse transmitter	4–20 mA	
Rotameter, Make-up Water Line	1	Vertical, in-line	Scale on housing	King, or equal
Bypass Flow	1	Size 8 in Magnetic Flow with totalizer	4–20 mA	Endress+Hauser

*Copper sensing lines to be provided by the contractor.

Brine Pump Scope of Supply

Quantity	Volume	Pressure	Type	Motor
1	95 gpm	38 ft TDH	Centrifugal	2 hp, 230 V, 60 Hz, 3 ph, TEFC

Air Compressor Scope of Supply

Quantity	Volume	Pressure	Type	Motor
1	4.6 acfm	80 psi	Duplex	1 hp, 480 V, 60 Hz, 3 ph, ODP
Features		**Notes**		
Receiver		60 gallon, ASME Code		
V-Belt Drive		Includes belt guard		
Intake Filter/Silencer Air Filter		Includes spare cartridge		
Automatic Pressure Switches		Included		
Safety Relief Valve		ASME Code		
In-Tank Type Check Valve		Included		
Manual Tank Drain		Included		
Automatic Tank Drain		120V mounted, electronic type		
Air Dryer		120V mounted, refrigerated		
Compressed Air Filter		Includes spare cartridge		
Alternator/Starter Package		Includes 2 Definite Purpose magnetic starters and an alternator mounted between the two starter enclosures. All 3 enclosures are NEMA 1. Each starter will require a separate power source.		
Vibration Isolation Pads		Included		
Standard Paint System		Applied by Manufacturer		

Note

- Automatic tank drain and air dryer require a separate 120 V duplex wall outlet circuit by the electrical subcontractor in an appropriate location. Motor Starter and mounting anchors are not by WesTech Engineering, LLC.

Surface Preparation and Painting Scope of Supply

Location	Notes
Tank Interior	Surface Preparation – Sandblasted to SSPC-SP10/NACE 2 near white blast. Prime Coat – One shop coat of Tnemec Series 21-1255 (Beige) primer (5-7 mils DFT) Stripe Coat – One coat Tnemec Series 21-WH16 (Off-White) primer applied with brush to all weld and hard to reach areas. Finish Coat – One coat of Tnemec Series 21-WH16 (Off-White) finish (5-7 mils DFT) Note: Internal tank coating is applied above the underdrain only
Tank Exterior	Surface Preparation – Sandblasted to SSPC-SP6/ NACE 3 commercial blast. Prime Coat – One shop coat of Tnemec Series 21-1255 (Beige) primer (5-7 mils DFT) Stripe Coat – One coat Tnemec Series 21-WH16 (Off-White) primer applied with brush to all weld and hard to reach areas. Finish Coat – Field applied by others
Piping	Surface Preparation – Prepared per paint manufacturers recommendations. Prime Coat – One shop coat of Tnemec Series 21-1255 (Beige) primer (5-7 mils DFT) Finish Coat – Field applied by others
Tank Legs	The tank legs shall be set in coal tar or asphaltic base mastic compound applied to concrete base pad by others.

Weights

Estimated Shipping Weight/Unit	68,000 lbs
Estimated Operating Weight/Unit	130,000 lbs

WesTech Trips to the Site

Total Trips	Total Days	Includes
3	6	Installation inspection, startup, instruction of plant personnel, and training

Note: Any item not listed above to be furnished by others.

Item B – Four (4) 10 ft dia. Ion Exchange Softening System, Model IEV22B

Design Criteria	
Application	Hardness Removal
Design Flow	2.67 MGD (1,855 gpm)
Peak Flow	4 MGD (2,778 gpm)
Number of Softeners	Four
Size of Each Softener	120 in diameter x 108 in side shell height
Softener Area	78.5 ft^2 per unit
Softener Loading Rate	3.8 – 5.7 gpm/ft^2
Raw Water Hardness	333 mg/L (as $CaCO_3$)
Finished Water Hardness	120 mg/L (as $CaCO_3$)
Inlet Flow Rate to Softeners	1187 – 1777 gpm
Bypass Flow Rate	668 – 1001 gpm
Softener Media Type	Purolite C100E cationic resin
Softener Media Depth	60 in
Backwash Rate	5 gpm/ft^2
Regenerant Dose	6 lbs salt/ft^3 resin
Brine Concentration	2.4 lbs/gallon
Brining Time	15 minutes
Slow Rinse Rate	1.2 gpm/ft^2
Fast Rinse Rate	at service rate

*The design backwash rate listed is based on a temperature of 25 °C. The actual backwash water rate must be adjusted 2% up or down for each degree Celsius difference above or below from design temperature, i.e., above 25 °C increase by 2%, below 25 °C decrease by 2%.

Features and Benefits

Ion Exchange Softeners are an effective, inexpensive and low-maintenance method of reducing hardness from raw water quality. Water is induced in the top side of the vessel and passes through ion exchange resin where unwanted hardness ions (calcium and magnesium) are removed. Once the resin has reached capacity, it is regenerated with salt and placed back in service.

Additional benefits include:

- Consistent water quality with automatic regeneration controls
- Extended service life with high quality non-code constructed tanks, or ASME code tanks.
- Maximized net production while minimizing waste with high capacity ion exchange resin
- Reduced operator attention required with automatic actuated system valves.

Ion Exchange System. Graphic may not entirely represent the system quoted.

Tankage Scope of Supply

Item	Details
Tank dimensions	120 in diameter x 108 in side shell height
Working pressure	100 psi
Test pressure	130 psi
Construction standard	ASME Code with stamp
Influent/Backwash waste connection	6 in
Effluent/Backwash supply connection	6 in
Brine connection	3 in
Air/Vacuum relief connection	1 in
Overdrain	Single point steel
Underdrain	False bottom steel plate with gravel support nozzles
Brine distributor	Header and lateral type co-current regeneration
Manways	(1) 14 in x 18 in elliptical
Tank support	Structural steel legs

Fabrications Scope of Supply

Feature	Quantity	Notes
Filter Front Piping*	1 Lot	Sch. 40 Steel pipe with ductile iron fittings. Pipe sections are flanged by plain end with one flange loose for field welding. Pipe sections shipped loose.
Brine distributor*	4 sets	Header and lateral type co-current regeneration

*Items are shipped loose for field installation into the filter tank by the installing contractor.

Media Scope of Supply

Type	Quantity	Layer Depth	Details	Packaging
Resin	1,570 ft^3	60 in	Purolite C100E Cationic	1-ft^3 bags or super sacks
Gravel	262 ft^3	10 in	3/4” x 1/2” (Bottom 4”) 1/2” x 3/16” (Next 3”) 3/16” x 3/32” (Next 3”)	1-ft^3 bags of super sacks

*Media quantities listed are estimated and may vary after the vessel design has been finalized.

Valves Scope of Supply

Item	Quantity	Size	Type	Operator Type
Influent Valve	4	6 in	Open/Close	Pneumatic
Backwash Waste	4	6 in	Open/Close	Pneumatic with limit stop
Backwash Supply	4	6 in	Open/Close	Pneumatic
Effluent	4	6 in	Modulating	Electro-pneumatic
Slow Rinse	4	3 in	Open/Close	Pneumatic with limit stop
Fast Rinse	4	6 in	Open/Close	Pneumatic with limit stop
Air/Vacuum Release	4	1 in	Automatic	Float actuated
Brine	4	3 in	Open/Close	Pneumatic
Saturated Brine Line	1	3 in	Manual rate set valve	NA
Saturated Brine Line	1	3 in	Check valve	NA
Make-up Water Line	1	3 in	Manual rate set valve	NA
Make-up Water Line	1	3 in	Check valve	NA

All butterfly valves are Bray wafer style with cast iron body, nylon coated disc, EPDM seat and shaft seal. Manually controlled butterfly valves have lever or gear operated handwheel actuators. Automatic butterfly valves have double acting, weatherproof pneumatic cylinder actuators manufactured by Bray.

Air/Vacuum release assemblies for each tank consist of a Val-Matic, or equal, air/vacuum combination release valve and a gate valve for isolation shipped in pieces for field assembly by others.

Master Control Panel Scope of Supply

Feature	Description	Notes
Number of Panels	1	
Housing	NEMA 12	Wall mounted
PLC	Allen Bradley	CompactLogix
OIT	Allen Bradley	10” color touchscreen interface
SCADA Interface		

Instrumentation Scope of Supply

Description	Quantity	Type	Output	Manufacturer
Loss of Head Gauge Assembly	1	3 ½ in gauges with differential pressure switch	Switch, 120 V	WesTech
Effluent/Backwash Supply Flow	4	Size 6 in Magnetic Flow with totalizer	4–20 mA	Endress+Hauser
Brine Meter	1	Size 3 in Magnetic Flow with pulse transmitter	4–20 mA	
Rotameter, Make-up Water Line	1	Vertical, in-line	Scale on housing	King, or equal
Bypass Flow	1	Size 8 in Magnetic Flow with totalizer	4–20 mA	Endress+Hauser

*Copper sensing lines to be provided by the contractor.

Brine Pump Scope of Supply

Quantity	Volume	Pressure	Type	Motor
1	66 gpm	38 ft TDH	Centrifugal	1.5 hp, 230 V, 60 Hz, 3 ph, TEFC

Air Compressor Scope of Supply

Quantity	Volume	Pressure	Type	Motor
1	4.6 acfm	80 psi	Duplex	1 hp, 480 V, 60 Hz, 3 ph, ODP
Features		**Notes**		
Receiver		60 gallon, ASME Code		
V-Belt Drive		Includes belt guard		
Intake Filter/Silencer Air Filter		Includes spare cartridge		
Automatic Pressure Switches		Included		
Safety Relief Valve		ASME Code		
In-Tank Type Check Valve		Included		
Manual Tank Drain		Included		
Automatic Tank Drain		120V mounted, electronic type		
Air Dryer		120V mounted, refrigerated		
Compressed Air Filter		Includes spare cartridge		
Alternator/Starter Package		Includes 2 Definite Purpose magnetic starters and an alternator mounted between the two starter enclosures. All 3 enclosures are NEMA 1. Each starter will require a separate power source.		
Vibration Isolation Pads		Included		
Standard Paint System		Applied by Manufacturer		

Note

- Automatic tank drain and air dryer require a separate 120 V duplex wall outlet circuit by the electrical subcontractor in an appropriate location. Motor Starter and mounting anchors are not by WesTech Engineering, LLC.

Surface Preparation and Painting Scope of Supply

Location	Notes
Tank Interior	Surface Preparation – Sandblasted to SSPC-SP10/NACE 2 near white blast. Prime Coat – One shop coat of Tnemec Series 21-1255 (Beige) primer (5-7 mils DFT) Stripe Coat – One coat Tnemec Series 21-WH16 (Off-White) primer applied with brush to all weld and hard to reach areas. Finish Coat – One coat of Tnemec Series 21-WH16 (Off-White) finish (5-7 mils DFT) Note: Internal tank coating is applied above the underdrain only
Tank Exterior	Surface Preparation – Sandblasted to SSPC-SP6/ NACE 3 commercial blast. Prime Coat – One shop coat of Tnemec Series 21-1255 (Beige) primer (5-7 mils DFT) Stripe Coat – One coat Tnemec Series 21-WH16 (Off-White) primer applied with brush to all weld and hard to reach areas. Finish Coat – Field applied by others
Piping	Surface Preparation – Prepared per paint manufacturers recommendations. Prime Coat – One shop coat of Tnemec Series 21-1255 (Beige) primer (5-7 mils DFT) Finish Coat – Field applied by others
Tank Legs	The tank legs shall be set in coal tar or asphaltic base mastic compound applied to concrete base pad by others.

Weights

Estimated Shipping Weight/Unit	46,000 lbs
Estimated Operating Weight/Unit	85,000 lbs

WesTech Trips to the Site

Total Trips	Total Days	Includes
3	8	Installation inspection, startup, instruction of plant personnel, and training

Note: Any item not listed above to be furnished by others.

Clarifications and Exceptions

General Clarifications

Terms & Conditions: This proposal, including all terms and conditions contained herein, shall become part of any resulting contract or purchase order. Changes to any terms and conditions, including but not limited to submittal and shipment days, payment terms, and escalation clause shall be negotiated at order placement, otherwise the proposal terms and conditions contained herein shall apply.

Paint: If your equipment has paint included in the price, please take note to the following. Primer paints are designed to provide only a minimal protection from the time of application (usually for a period not to exceed 30 days). Therefore, it is imperative that the finish coat be applied within 30 days of shipment on all shop primed surfaces. Without the protection of the final coatings, primer degradation may occur after this period, which in turn may require renewed surface preparation and coating. If it is impractical or impossible to coat primed surfaces within the suggested time frame, WesTech strongly recommends the supply of bare metal, with surface preparation and coating performed in the field. All field surface preparation, field paint, touch-up, and repair to shop painted surfaces are not by WesTech.

Escalation: If between the proposal date and actual procurement and through no fault of the Seller, the relevant cost of labor, material, freight, tariffs, and other Seller costs combined relating to the contract, increase by greater than 2.5% of the overall contract price, then the contract price shall be subject to escalation and increased. Such increase shall be verified by documentation and the amount of contract price escalation shall be calculated as either the actual increased cost to the Seller or, if agreed by the Parties, the equivalent increase of a relevant industry recognized third-party index, and in both cases without any additional profit or margin being added.

USA Tariffs and Current Trade Laws: All prices are based on current USA and North America tariffs and trade laws/agreements at time of bid. Any changes in costs due to USA Tariffs and trade laws/ agreements will be passed through to the purchaser at cost.

The Infrastructure Investment and Jobs Act of 2021 (IIJA) includes potentially significant changes to historical “Buy American” or “American Iron and Steel” (AIS) requirements for federally funded projects, including water-related infrastructure projects as administered by the Environmental Protection Agency (EPA). The IIJA was signed into law on Nov 15, 2021. However the EPA has yet to issue additional information and guidance clarifying the application and interpretation of these changes. Although WesTech makes every effort to source the steel for our equipment and products domestically, not everything is reasonably or commercially available to meet all project specific constraints. Consequently, any proposal or offer for sale by WesTech, including any resulting equipment order, does not guarantee compliance with the Buy American provisions of the Infrastructure Investment and Jobs Act of 2021 at this time.

Ion Exchange Softening System Clarifications

- Availability of equipment components specified may dictate substitutions of equal quality at the discretion of WesTech.

- All hardware is crated and shipped to the jobsite for assembly by the contractor.
- The effluent of all pressure vessels should never be allowed to drop below 10 feet H2O pressure during operation of vessel. Failure to maintain the effluent pressure could result in de-watering the media inside the vessel.

Items not furnished by WesTech

- Unloading of equipment from delivering carrier, protected storage of equipment, installation, supervision of installation
- All underground and interconnecting piping, piping and fittings (not specifically listed), pipe supports, wall inserts or sleeves, Dresser or flexible couplings, hangers, valves (not specifically listed), pneumatic tubing from air compressor to softener batteries, air release piping and valves, sampling lines and sinks, small pressure water supply piping, field work of piping (i.e., drilling and tapping for instrumentation) and flow meters (not specifically listed)
- Walkways, handrails, stairways and ladders
- Finish paint and intermediate field coats, cathodic protection systems
- All chemical feeders, feed lines, start-up chemicals, chemicals, labor and procedures for the disinfection of equipment, laboratory test equipment.
- Structural design, supply and installation of concrete pads, foundations, rebar, anchors, concrete, grout, sealant and sumps
- Motor control center, motor starters, disconnects, electrical wiring and conduit, connection of electrical wiring to terminals within WesTech's control panels, telemetering equipment, level controls and supports for controls.
- All pumps, operating and start-up lubricants.
- Any equipment and service not listed in this proposal.

Exceptions

Not applicable

Commercial Proposal

Proposal Name: Loveland WTP
Proposal Number: 2330236
Friday, February 16, 2024

1. Bidder's Contact Information

Company Name	WesTech Engineering, LLC
Primary Contact Name	Tom Dumbaugh
Phone	(801) 265-1000
Email	tdumbaugh@westech-inc.com
Address: Number/Street	3665 S West Temple
Address: City, State, Zip	Salt Lake City, UT 84115

2. Budget Pricing

Currency: USD

Scope of Supply

A	Three (3) 12 ft dia. Ion Exchange Softening System, Model IEV22B	$1,440,000
B	Four (4) 10 ft dia. Ion Exchange Softening System, Model IEV22B	$1,515,000
	Taxes (sales, use, VAT, IVA, IGV, duties, import fees, etc.)	Not Included

Prices are valid for a period not to exceed 30 days from date of proposal.

Additional Field Service

Daily Rate (Applicable Only to Field Service Not Included in Scope)	$1,350

Pricing does not include field service unless noted in scope of supply, but is available at the daily rate plus expenses. The greater of a two week notice or visa procurement time is required prior to departure date. Our field service policy can be provided upon request for more details.

3. Payment Terms

Purchase Order Acceptance and Contract Execution	10%
Submittals Provided by WesTech	15%
Release for Fabrication	35%
Notification of Ready to Ship	40%

All payments are net 30 days. Partial shipments are allowed. An approved Letter of Credit is required if Incoterms CIF, CFR, DAP, CIP, or CPT are applicable. Payment is required in full for all other Incoterms prior to international shipment. Other terms per WesTech proforma invoice. Please note that the advising bank must be named as: Wells Fargo Bank, International Department, 9000 Flair Drive, 3rd Floor, El Monte, California 91731, USA.

4. Schedule

Submittals, after Purchase Order Acceptance and Contract Execution	8 to 10 weeks
Ready to Ship, after Receipt of Final Submittal Approval	26 to 30 weeks
Estimated Weeks to Ready to Ship	**34 to 40 weeks***

*Customer submittal approval is typically required to proceed with equipment fabrication and is not accounted for in the schedule above. Project schedule will be extended to account for time associated with receipt of customer submittal approval.

5. Freight

Domestic	FOB Shipping Point - Full Freight Allowed to Jobsite (FSP-FFA)	
From	**Final Destination**	**Number of Trucks or Containers**
WesTech Shops	Loveland, OH	TBD

One-Year Warranty

WesTech is meeting a global need for clean water through technology treatment solutions. We are proud that the equipment and systems we design, build, maintain, and operate are making the world a better place and creating a more sustainable environment for future generations.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

Subject to the terms below, WesTech warrants all new equipment manufactured or sold by WesTech Engineering, LLC to be unencumbered and free from defects in material and workmanship, and WesTech will replace or repair, F.O.B. its factories or other location it chooses, any part or parts returned to WesTech which WesTech's examination and analysis determine have failed within the warranty period because of defects in material and workmanship. The warranty period is either, one calendar year immediately following start-up, or eighteen (18) months from when WesTech sent its ready-to-ship notification to the purchaser, whichever expires sooner. All repair or replacement parts qualifying under this warranty shall be free of charge. Purchaser will provide timely written notice to WesTech of any defects it believes should be repaired or replaced under this warranty. WesTech will reject as untimely any warranty defect claim that purchaser submits more than thirty (30) days after the possible warranty defect first occurred. Unless specifically stated otherwise, this warranty does not cover normal wear or consumables. This warranty is not transferable.

This warranty shall be void and shall not apply where the equipment or any part thereof

a) has been dismantled, modified, repaired or connected to other equipment, outside of a WesTech factory, or without WesTech's written approval, or
b) has not been installed in complete adherence to all WesTech's or parts manufacturer's requirements, recommendations, and procedures, or
c) has been subject to misuse, abuse, neglect, or accident, or has not at all times been operated and maintained in strict compliance with all of WesTech's requirements and recommendations therefor, including, but not limited to, the relevant WesTech Operations & Maintenance Manual and any other of WesTech's specified guidelines & procedures, or
d) has been subject to force majeure events; use of chemicals not approved in writing by WesTech; electrical surges; overloading; significant power, water or feed supply fluctuations; or non-compliance with agreed feedwater or chemical volumes, specifications or procedures.

In any case where a part or component of equipment under this warranty is or may be faulty and the component or part is also covered under the warranty of a third party then the purchaser shall provide reasonable assistance to first pursue a claim under the third party warranty before making a claim under this warranty from WesTech. WesTech Engineering, LLC gives no warranty with respect to parts, accessories, or components purchased other than through WesTech. The warranties which apply to such items are those offered by the respective manufacturers.

This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

Terms & Conditions

Terms and Conditions appearing in any order based on this proposal which are inconsistent herewith shall not be binding on WesTech Engineering, LLC The sale and purchase of equipment described herein shall be governed exclusively by the foregoing proposal and the following provisions:

1. SPECIFICATIONS: WesTech Engineering, LLC is furnishing its standard equipment as outlined in the proposal and as will be covered by final approved drawings. The equipment may not be in strict compliance with the Engineer's/Owner's plans, specifications, or addenda as there may be deviations. The equipment will, however, meet the general intention of the mechanical specifications of these documents.

2. ITEMS INCLUDED: This proposal includes only the equipment specified herein and does not include erection, installation, accessories, nor associated materials such as controls, piping, etc., unless specifically listed.

3. PARTIES TO CONTRACT: WesTech Engineering, LLC is not a party to or bound by the terms of any contract between WesTech Engineering, LLC's customer and any other party. WesTech Engineering, LLC's undertakings are limited to those defined in the contract between WesTech Engineering, LLC and its direct customers.

4. PRICE AND DELIVERY: All selling prices quoted are subject to change without notice after 30 days from the date of this proposal unless specified otherwise. Unless otherwise stated, all prices are F.O.B. WesTech Engineering, LLC or its supplier's shipping points. All claims for damage, delay or shortage arising from such equipment shall be made by Purchaser directly against the carrier. When shipments are quoted F.O.B. job site or other designation, Purchaser shall inspect the equipment shipped, notifying WesTech Engineering, LLC of any damage or shortage within forty-eight hours of receipt, and failure to so notify WesTech Engineering, LLC shall constitute acceptance by Purchaser, relieving WesTech Engineering, LLC of any liability for shipping damages or shortages.

5. PAYMENTS: All invoices are net 30 days. Delinquencies are subject to a 1.5 percent service charge per month or the maximum permitted by law, whichever is less on all past due accounts. Pro rata payments are due as shipments are made. If shipments are delayed by the Purchaser, invoices shall be sent on the date when WesTech Engineering, LLC is prepared to make shipment and payment shall become due under standard invoicing terms. If the work to be performed hereunder is delayed by the Purchaser, payments shall be based on the purchase price and percentage of completion. Products held for the Purchaser shall be at the risk and expense of the Purchaser. Unless specifically stated otherwise, prices quoted are for equipment only. These terms are independent of and not contingent upon the time and manner in which the Purchaser receives payment from the owner.

6. PAYMENT TERMS: Credit is subject to acceptance by WesTech Engineering, LLC's Credit Department. If the financial condition of the Purchaser at any time is such as to give WesTech Engineering, LLC, in its judgment, doubt concerning the Purchaser's ability to pay, WesTech Engineering, LLC may require full or partial payment in advance or may suspend any further deliveries or continuance of the work to be performed by the WesTech Engineering, LLC until such payment has been received.

7. ESCALATION: If between the proposal date and actual procurement and through no fault of the Seller, the relevant cost of labor, material, freight, tariffs, and other Seller costs combined relating to the contract, increase by greater than 2.5% of the overall contract price, then the contract price shall be subject to escalation and increased. Such increase shall be verified by documentation and the amount of contract price escalation shall be calculated as either the actual increased cost to the Seller or, if agreed by the Parties, the equivalent increase of a relevant industry recognized third-party index, and in both cases without any additional profit or margin being added.

8. APPROVAL: If approval of equipment submittals by Purchaser or others is required, a condition precedent to WesTech Engineering, LLC supplying any equipment shall be such complete approval.

9. INSTALLATION SUPERVISION: Prices quoted for equipment do not include installation supervision. WesTech Engineering, LLC recommends and will, upon request, make available, at WesTech Engineering, LLC's then current rate, an experienced installation supervisor to act as the Purchaser's employee and agent to supervise installation of the equipment. Purchaser shall at its sole expense furnish all necessary labor equipment, and materials needed for installation.

Responsibility for proper operation of equipment, if not installed by WesTech Engineering, LLC or installed in accordance with WesTech Engineering, LLC's instructions, and inspected and accepted in writing by WesTech Engineering, LLC, rests entirely with Purchaser; and any work performed by WesTech Engineering, LLC personnel in making adjustment or changes must be paid for at WesTech Engineering, LLC's then current per diem rates plus living and traveling expenses.

WesTech Engineering, LLC will supply the safety devices described in this proposal or shown in WesTech Engineering, LLC's drawings furnished as part of this order but excepting these, WesTech Engineering, LLC shall not be required to supply or install any safety devices whether required by law or otherwise. The Purchaser hereby agrees to indemnify and hold harmless WesTech Engineering, LLC from any claims or losses arising due to alleged or actual insufficiency or inadequacy of the safety devices offered or supplied hereunder, whether specified by WesTech Engineering, LLC or Purchaser, and from any damage resulting from the use of the equipment supplied hereunder.

10. ACCEPTANCE OF PRODUCTS: Products will be deemed accepted without any claim by Purchaser unless written notice of non-acceptance is received by WesTech Engineering, LLC within 30 days of delivery if shipped F.O.B. point of shipment, or 48 hours of delivery if shipped F.O.B. point of destination. Such written notice shall not be considered received by WesTech Engineering, LLC unless it is accompanied by all freight bills for said shipment, with Purchaser's notations as to damages, shortages and conditions of equipment, containers, and seals. Non-accepted products are subject to the return policy stated below.

11. TAXES: Any federal, state, or local sales, use or other taxes applicable to this transaction, unless specifically included in the price, shall be for Purchaser's account.

12. TITLE: The equipment specified herein, and any replacements or substitutes therefore shall, regardless of the manner in which affixed to or used in connection with realty, remain the sole and personal property of WesTech Engineering, LLC until the full purchase price has been paid. Purchaser agrees to do all things necessary to protect and maintain WesTech Engineering, LLC's title and interest in and to such equipment; and upon Purchaser's default, WesTech Engineering, LLC may retain as liquidated damages any and all partial payments made and shall be free to enter the premises where such equipment is located and remove the same as its property without prejudice to any further claims on account of damages or loss which WesTech Engineering, LLC may suffer from any cause.

13. INSURANCE: From date of shipment until the invoice is paid in full, Purchaser agrees to provide and maintain at its expense, but for WesTech Engineering, LLC's benefit, adequate insurance including, but not limited

to, builders risk insurance on the equipment against any loss of any nature whatsoever.

14. SHIPMENTS: Any shipment of delivery dates recited represent WesTech Engineering, LLC's best estimate but no liability, direct or indirect, is assumed by WesTech Engineering, LLC for failure to ship or deliver on such dates.

WesTech Engineering, LLC shall have the right to make partial shipments; and invoices covering the same shall be due and payable by Purchaser in accordance with the payment terms thereof. If Purchaser defaults in any payment when due hereunder, WesTech Engineering, LLC may, without incurring any liability therefore to Purchaser or Purchaser's customers, declare all payments immediately due and payable with maximum legal interest thereon from due date of said payment, and at its option, stop all further work and shipments until all past due payments have been made, and/or require that any further deliveries be paid for prior to shipment.

If Purchaser requests postponements of shipments, the purchase price shall be due and payable upon notice from WesTech Engineering, LLC that the equipment is ready for shipment; and thereafter any storage or other charge WesTech Engineering, LLC incurs on account of the equipment shall be for the Purchaser's account.

If delivery is specified at a point other than WesTech Engineering, LLC or its supplier's shipping points, and delivery is postponed or prevented by strike, accident, embargo, or other cause beyond WesTech Engineering, LLC's reasonable control and occurring at a location other than WesTech Engineering, LLC or its supplier's shipping points, WesTech Engineering, LLC assumes no liability in delivery delay. If Purchaser refuses such delivery, WesTech Engineering, LLC may store the equipment at Purchaser's expense. For all purposes of this agreement such tender of delivery or storage shall constitute delivery.

15. WARRANTY: WesTech Engineering LLC warrants equipment it supplies only in accordance with the attached WesTech Warranty. This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

16. PATENTS: WesTech Engineering, LLC agrees that it will, at its own expense, defend all suits or proceedings instituted against Purchaser and pay any award of damages assessed against it in such suits or proceedings, so far as the same are based on any claim that the said equipment or any part thereof constitutes an infringement of any apparatus patent of the United States issued at the date of this Agreement, provided WesTech Engineering, LLC is given prompt notice in writing of the institution or threatened institution of any suit or proceeding and is given full control of the defense, settlement, or compromise of any such action; and Purchaser agrees to give WesTech Engineering, LLC needed information, assistance, and authority to enable WesTech Engineering, LLC so to do. In the event said equipment is held or conceded to infringe such a patent, WesTech Engineering, LLC shall have the right at its sole option and expense to a) modify the equipment to be non-infringing, b) obtain for Purchaser the license to continue using said equipment, or c) accept return of the equipment and refund to the Purchaser the purchase price thereof less a reasonable charge for the use thereof. WesTech Engineering, LLC will reimburse Purchaser for actual out-of-pocket expenses, exclusive of legal fees, incurred in preparing such information and rendering such assistance at WesTech Engineering, LLC's request. The foregoing states the entire liability of WesTech Engineering, LLC, with respect to patent infringement; and except as otherwise agreed to in writing, WesTech Engineering, LLC assumes no responsibility for process patent infringement.

17. SURFACE PREPARATION AND PAINTING: If furnished, shop primer paint is intended to serve only as minimal protective finish. WesTech Engineering, LLC will not be responsible for the condition of primed or finish painted surfaces after equipment leaves its shops. Purchasers are invited to inspect paint in shops for proper preparation and application prior to shipment. WesTech Engineering, LLC assumes no responsibility for field surface preparation or touch-up of shipping damage to paint. Painting of fasteners and other touch-up to painted surfaces will be by Purchaser's painting contractor after mechanism installation.

Motors, gear motors, and other components not manufactured by WesTech Engineering, LLC will be painted with that manufacturer's standard paint system. It is WesTech Engineering, LLC's intention to ship major steel components as soon as fabricated, often before drive, motors, and other manufactured components. Unless Purchaser can ensure that shop primed steel shall be field painted within thirty (30) days after arrival at the job site, WesTech Engineering, LLC encourages the Purchaser to order these components without primer.

WesTech Engineering, LLC's prices are based on paints and surface preparations as outlined in the main body of this proposal. In the event that an alternate paint system is selected, WesTech Engineering, LLC requests that Purchaser's order advise of the paint selection. WesTech Engineering, LLC will then either adjust the price as may be necessary to comply or ship the material unpainted if compliance is not possible due to application problems or environmental controls.

18. CANCELLATION, SUSPENSION, OR DELAY: After acceptance by WesTech Engineering, LLC, this proposal, or Purchaser's order based on this proposal, shall be a firm agreement and is not subject to cancellation, suspension, or delay except upon payment by Purchaser of appropriate charges which shall include all costs incurred by WesTech Engineering, LLC to date of cancellation, suspension, or delay plus a reasonable profit. Additionally, all charges related to storage and/or resumption of work, at WesTech Engineering, LLC's plant or elsewhere, shall be for Purchaser's sole account; and all risks incidental to storage shall be assumed by Purchaser.

19. FORCE MAJEURE: Neither party hereto shall be liable to the other for default or delay in delivery caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, act of government, pandemic, delay of carriers, failure of normal sources of supply, complete or partial shutdown of plant by reason of inability to attain sufficient raw materials or power, and/or other similar contingency beyond the reasonable control of the respective parties. The time for delivery specified herein shall be extended during the continuance of such conditions, or any other cause beyond such party's reasonable control. Escalation resulting from a Force Majeure event shall be equitably adjusted per the escalation policy stated above.

20. RETURN OF PRODUCTS: No products may be returned to WesTech Engineering, LLC without WesTech Engineering, LLC's prior written permission. Said permission may be withheld by WesTech Engineering, LLC at its sole discretion.

21. BACKCHARGES: WesTech Engineering LLC will not approve or accept backcharges for labor, materials, or other costs incurred by Purchaser or others in modification, adjustment, service, or repair of WesTech Engineering LLC furnished materials unless such back charge has been authorized in advance in writing by a WesTech Engineering LLC purchase order, or work requisition signed by WesTech Engineering LLC.

22. INDEMNIFICATION: Purchaser agrees to indemnify WesTech Engineering, LLC from all costs incurred, including but not limited to court costs and reasonable attorney fees, from enforcing any provisions of this contract, including but not limited to breach of contract or costs incurred in collecting monies owed on this contract.

23. ENTIRE AGREEMENT: This proposal expresses the entire agreement between the parties hereto superseding any prior understandings and is not subject to modification except by a writing signed by an authorized officer of each party.

24. MOTORS AND MOTOR DRIVES: In order to avoid shipment delays of WesTech Engineering, LLC equipment, the motor drives may be sent directly to the job site for installation by the equipment installer. Minor fit-up may be required.

25. EXTENDED STORAGE: Extended storage instructions will be part of information provided to shipment. If equipment installation and start-up is delayed more than 30 days, the provisions of the storage instructions must be followed to keep WARRANTY in force.

26. LIABILITY: Professional liability insurance, including but not limited to, errors and omissions insurance, is not included. In any event, liability for errors and omissions shall be limited to the lesser of $100,000 USD or the value of the particular piece of equipment (not the value of the entire order) supplied by WesTech Engineering LLC against which a claim is sought.

27. ARBITRATION NEGOTIATION: Any controversy or claim arising out of or relating to the performance of any contract resulting from this proposal or contract issued, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator(s) may be entered to any court having jurisdiction.

ACCEPTED BY PURCHASER

Customer Name: _____

Customer Address: _____

_____

_____

Contact Name: _____

Contact Phone: _____

Contact Email: _____

Signature: _____

Printed Name: _____

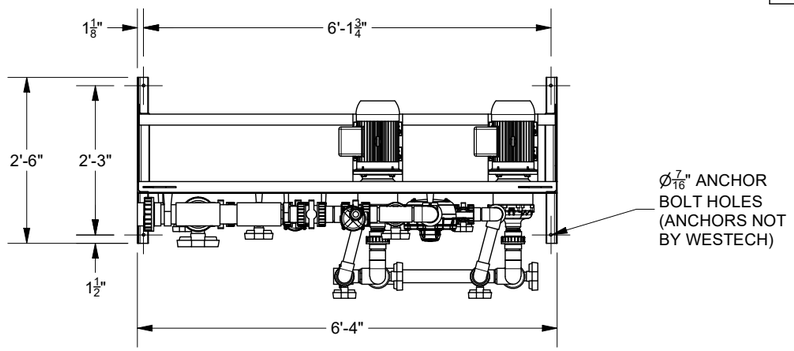
Title: _____

Date: _____

Supplemental Information

Drawings

BILL OF MATERIAL							
PIECE	UNIT QTY	PART NO	DESCRIPTION	MATERIAL	LENGTH	WIDTH	TOTAL WT, LB
10	1	0002235764	BRINE FEED SKID ASSEMBLY				608.8



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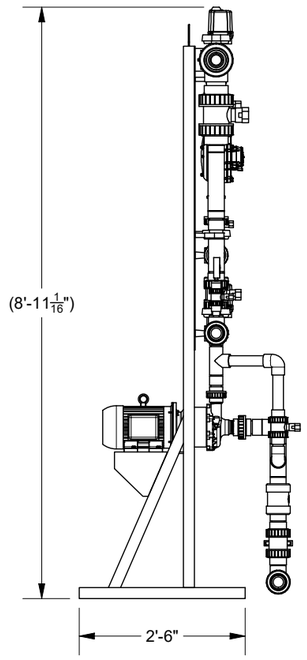

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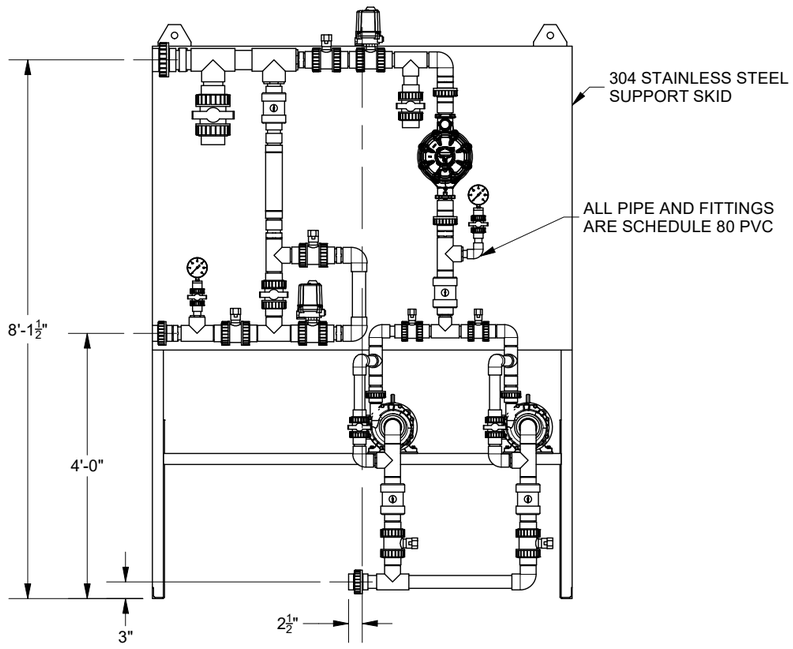
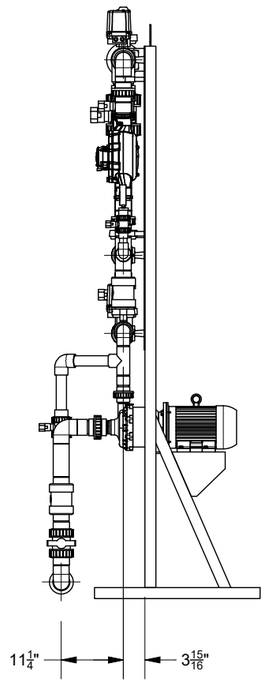


FRONT



RIGHT

NOTES:

1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.

1. ALL PIPE AND FITTINGS ARE SCHEDULE 80 PVC.
2. ANCHORS ARE NOT PROVIDED BY WESTECH.

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE

REFERENCE DOCUMENTS

PREPARED FOR

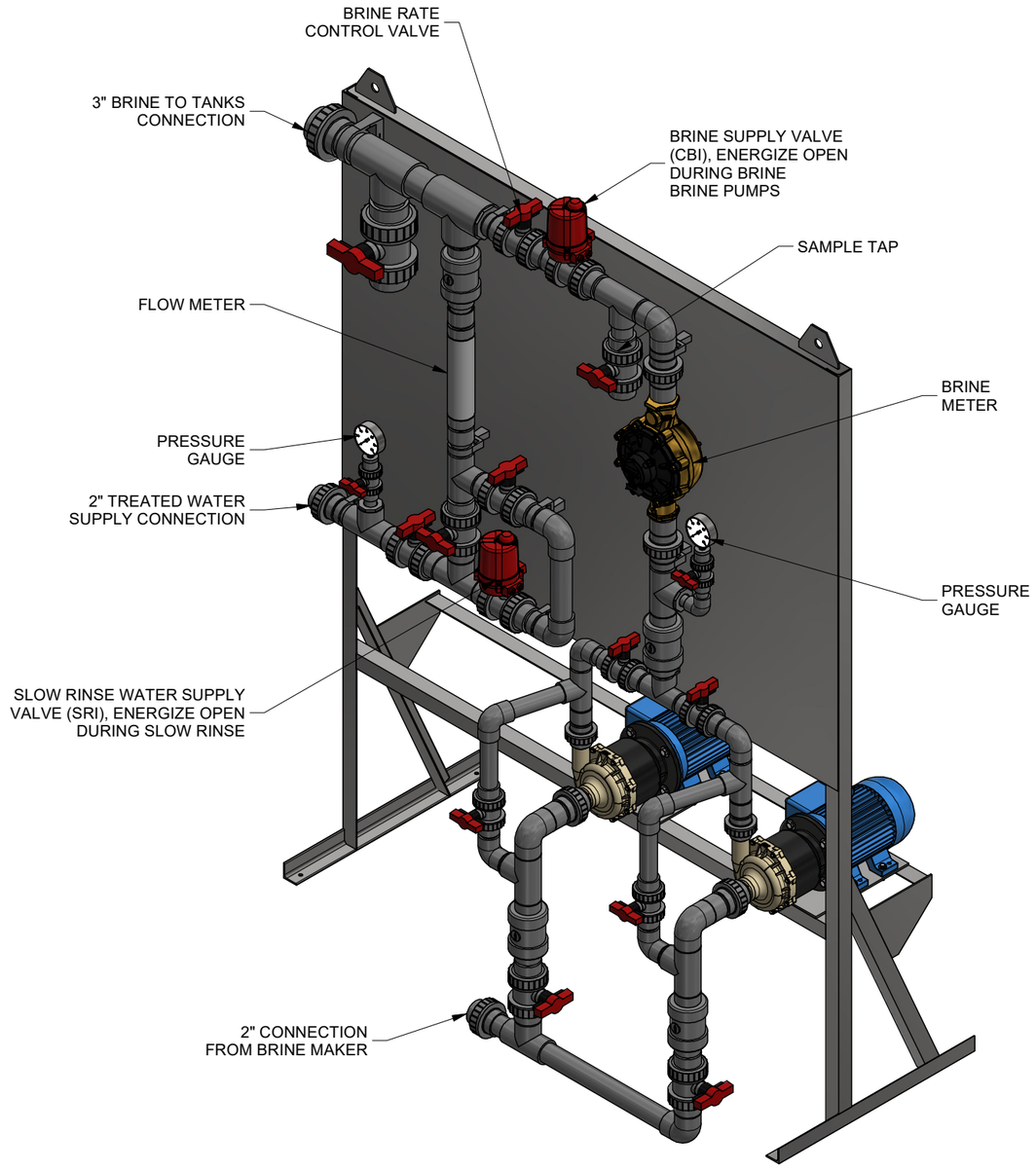
ENGINEER

CONTRACTOR

WESTECH®

TITLE **BRINE FEED SKID COMPONENTS**

DESIGNER	CHECKER	APPROVER	DATE	
BA91	JO48	JO48	2022-03-28	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
24657A	**0002235743**		1 OF 2	-



RIGHT ISOMETRIC

WESTECH®

TITLE **BRINE FEED SKID COMPONENTS**

DESIGNER	CHECKER	APPROVER	DATE	
BA91	JO48	JO48	2022-03-28	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
24657A	**0002235743**		2 OF 2	**-**

HUNGERFORD & TERRY, INC.

PREPARED FOR: JOSH HARNER, PE- PROJECT ENGINEER
BURGESS & NIPLE, INC.

PROJECT: FOUR (4) 120” DIAMETER SOFTENER SYSTEMS WITH REGENERATION EQUIPMENT- LOVELAND, OH

PREPARED BY: CHRISTOPHER RALPH
INSIDE SALES MANAGER

February 28, 2024

Attention: Josh Harner, PE- Project Engineer
Burgess & Niple, Inc.

Reference: Four (4) 120" Diameter Softener Systems with Regeneration Equipment- Loveland, OH - H&T Budgetary Proposal BDJ72844

In response to your request, Hungerford & Terry, Inc. is pleased to submit the attached Budgetary Proposal BDJ72844 for your consideration. This proposal provides for Four (4) 120" diameter softener units with brine equipment. System is sized for the treatment of 3 MGD. An alternate is included to increase treatment to 4 MGD. A redundant unit is included.

This proposal is budgetary and is formulated using the available information. The design may be subject to change as more information becomes available. The specifications provided within is intended for securing funding for the project and contains contingency pricing to account for changes that may be necessary as the project progresses. Firm pricing will be available on bid day or upon request per intent to purchase. This proposal is for equipment only and does not offer treatment guarantees at this time.

We very much appreciate the opportunity to submit this proposal and we hope that it meets with your favorable consideration. Should you have any questions or need for additional information, please feel free to contact our local representative at the address and telephone number listed below, or this writer at our home office in Clayton, New Jersey.

Very truly yours,

HUNGERFORD & TERRY, INC.

Christopher Ralph
Inside Sales Manager

J. DWIGHT THOMPSON CO.
Marc Nusser
P.O. Box 505
6847 State Route 128, Suite B
Miamitown, OH 45041
Ph: 513-871-9970
Fax: 513-871-2270
marc@jdtco.com

1. SCOPE OF SUPPLY

Water Softener System:

Softener Tanks:

Four (4) 120 inch OD x 84 inch straight shell softener tank designed in accordance with the following:

- 100 psi design pressure.
- ASME code section VIII construction with stamp.
- Constructed of A516 GR. 70 carbon steel.
- One (1) 14 inch x 18 inch elliptical manway.
- Necessary flanged pad or nozzle type connections.
- Four (4) lifting lugs.
- Four (4) structural steel I-beam type support legs.
- Tank interiors will be white metal sandblasted (SSPC-SP10) and lined with a Tnemec Series N21 finish coat system.
- Tank exteriors will be commercial sandblasted (SSPC-SP6) and painted with a primer coat of Tnemec Epoxoline II series N69F and finish painted with touchup in field by contractor

Tank Internal Distributors:

Four (4) Header lateral inlet distributor/waste collectors constructed with schedule 80 PVC pipe and lateral arms ending with upturned elbows.

Four (4) Header lateral brine inlet distributor of schedule 80 PVC header and laterals

Four (4) Hub (polypropylene), curved radial lateral (schedule 80 PVC) underdrain distributor. Laterals are wrapped and curved to follow the contour of the tank bottom heads

Notes:

1. The tank inlet and underdrain distributors will be shop installed prior to shipment. The brine inlet distributor is to be field installed by the contractor as the media is placed into the units.

Softener Valve Nest Exterior:

Four (4) Bray Series 3W butterfly control valves with wafer style cast iron bodies, nylon coated discs, metal reinforced EPDM seats, with Bray Series 70 electric actuators, with open/close limit switches for:

- Inlet
- Outlet
- Backwash inlet
- Rinse
- Waste

Flow-Tek series 80 stainless steel ball valves with threaded bodies and manual lever operators for:

- Air vent isolating

Simtech TBB series PVC ball valve with Bray series 70 electric actuator for:

- Brine inlet

Simtech TBB series PVC ball valve with manual lever operator

- Brine isolating
- Tank drain

Apco model 200A or equal automatic air vent valves with threaded cast iron bodies and stainless steel floats for:

- Tank air vent

Media:

Four (4) 12 inches graded gravel support beds, plus bottom head fill.

Four (4) 36 inch beds of Strong Acid Cation resin

Softener Auxiliary Equipment:

Pressure Equipment:

Eight (8) Ashcroft model 1279SS pressure gauges for the tank inlet and outlets with 4.5 inch diameter dials and stainless steel bourdon tubes.

Eight (8) Sets of polypropylene supply tubing.

Eight (8) Sets of manual isolating valves.

Eight (8) Sets of sampling valves.

Flow Equipment:

Seven (7) Rosemount 8750WD magnetic flowmeter with local input transmitter for:

- Softener inlet , 4
- Dilution Water
- Strong Brine
- Bypass

System Face Piping:

Class 53 CLDI piping. Pipe 2-1/2 inches and smaller schedule 40, 304 stainless steel pipe with 150 lb threaded stainless steel fittings.

Brine Piping:

Schedule 80, PVC pipe with socket weld fittings and flanges.

Notes:

1. All pipe supports for the interconnecting piping are to be furnished by the purchaser.

2. All system face and interconnecting piping will be furnished with the required bolts, studs, nuts, and gaskets as follows:

   Bolts: ASTM A193 stainless steel.
   Studs: ASTM A193 stainless steel.
   Nuts: ASTM A194 stainless steel hex.
   Gaskets: Shore A70 or equal, 1/8 inch thick.

Brine Dilution System:

Brine Regeneration System:

Brine Maker:

One (1) Brine Systems inc. filament wound storage/brine measuring tank of fiberglass (1 month capacity), complete with wet scrubber, internal piping, pneumatic salt delivery system, pneumatic dust collection system, automatic liquid level control system including high and low alarm, 12 inch gravel bed, FRP handrail system, freeze protection

Notes:

1. Piping to and from the Brinemaker shall be by others, not H&T.

Brine Maker Valving:

Two (2) Simtech TBB series PVC ball valve with manual lever operator for:

- Tank drain
- Tank discharge isolating

Brine Feed Pump:

Two (2) Magnetic drive centrifugal pump rated 3 phase, 60 hertz, TEFC, 230/460 volt motor of nickel aluminum bronze construction with suction and discharge piping and valves, and discharge pressure gauges.

Notes:

1. Motor staters by others

Brine System Valving:

Four (4) Simtech VB series or equal true union PVC ball valve with manual lever operator for:

- Brine suction isolating 2 ea.
- Pump discharge isolation 2 ea.

Four (4) Simtech VQ series PVC ball check valve for:

- Dilution water
- Strong brine
- Brine pump discharge, 2 ea.

Four (4) Simtech VB series PVC ball valve with Bray series 70 electric actuator for:

- Strong brine
- Brine Dilution Water
- Brine pump discharge, 2 ea.

Two (2) Asahi PVC globe valves for:

- Strong brine rate set
- Dilution water rate set

Softener Blending Controls:

One (1) Bray series 3W wafer butterfly valve with series 70 electric actuator with modulating capabilities with position feedback transmitter for:

- Bypass line

Two (2) Bray series 3W wafer butterfly valves with manual handwheel operators for:

- Bypass inlet isolating
- Bypass outlet isolating

Softener Control Panel:

One (1) NEMA 4 control panel of ANSI 61 gray painted steel construction. Unit to be skid mounted or wall mounted pending final design.

Notes:

1. The Softener Control Panel will be completely shop wired, and tested prior to shipment. The Softener Control Panel shall be mounted by others.
2. All interconnecting wiring, conduit/fittings, and wire terminations between the Softener Control Panel and remotely located electrical equipment are to be furnished and installed by the contractor.
3. The Softener Control Panel will be provided with all I/O programming to control the softeners along with the accessories listed in this proposal. PLC and OIT programming software packages are not included in this proposal.
4. Spare parts for the Softener Control Panel are not included in this proposal.
5. The Softener Control Panel will have a spare RJ-45 port on the Ethernet Switch to communicate with the customer's SCADA System via Ethernet/IP protocol. Contractor to supply Cat 6 cable and connectors as required for interface between the panels.
6. All instrumentation not specifically listed in this proposal shall be by others.
7. H&T will submit our standard electrical drawing package, which includes ladder logic drawings, external and internal panel view drawings, electrical equipment lists, PLC system architecture drawing and electrical wiring diagrams showing both internal/external wiring.
8. All engineering and drafting required for field interconnecting conduit, cable list and sizing, conduit supports and maps of interconnecting electrical installation, conduit and trays shall be supplied by others. All engineering and drafting required for customer's ground grid system shall be by others.
9. Contractor will need to provide power feeds to the Softener Control Panel.
10. All automatic and manual controls, status, and alarms shall be via the OIT screens.

System Software/Programming equipment:

Programming integral to the operation of the equipment supplied by Hungerford & Terry, Inc. will be performed by Hungerford & Terry, Inc. using AB Rockwell RSLogix PLC programming software and Allen Bradley OIT programming software.

Hungerford and Terry, Inc. Standard Surface Preparation & System Painting:

Misc. Equipment:

The exteriors surfaces of all misc. valves, pumps, etc. will be furnished with the manufacturer's standard prime coat painting or standard prime and finish painting.

2. PRICE SUMMARY

Price: **$1,504,000**

One Million Five Hundred and Four Thousand Dollars

F.O.B. Shipping Points: With full motor freight included
Payable in US currency, plus any applicable Municipal, State or Federal Taxes.

Payment Terms:

To be determined

Quote Valid for 30 Days

A copy of the payment bond (if applicable) will be required as part of the credit approval process. Purchaser agrees to make pro rata payments for partial shipments and further agrees that if shipment of material is delayed by any act or omission on part of purchaser, payment shall become due within thirty (30) days after the material is ready for shipment

Shipment:

Applicable freight to location is included in the price of the contract. Logistics of shipment will be advised as project proceeds.

Acceptance by Purchaser

_____

_____

_____

Date_____
By_____

HUNGERFORD & TERRY, INC.

Christopher Ralph, Sales Representative

This proposal is hereby accepted by:
Hungerford & Terry, Inc._ 2-28-24

3. ALTERNATE SECTION

To Increase the size of the system to 4 MGD add below to the price:

Water Softener System:

Softener Tanks:

One (1) 120 inch OD x 84 inch straight shell softener tank designed in accordance with the following:

- 100 psi design pressure.
- ASME code section VIII construction with stamp.
- Constructed of A516 GR. 70 carbon steel.
- One (1) 14 inch x 18 inch elliptical manway.
- Necessary flanged pad or nozzle type connections.
- Four (4) lifting lugs.
- Four (4) structural steel I-beam type support legs.
- Tank interiors will be white metal sandblasted (SSPC-SP10) and lined with a Tnemec Series N21 finish coat system.
- Tank exteriors will be commercial sandblasted (SSPC-SP6) and painted with a primer coat of Tnemec Epoxoline II series N69F and finish painted with touchup in field by contractor

Tank Internal Distributors:

One (1) Header lateral inlet distributor/waste collectors constructed with schedule 80 PVC pipe and lateral arms ending with upturned elbows.

One (1) Header lateral brine inlet distributor of schedule 80 PVC header and laterals

One (1) Hub (polypropylene), curved radial lateral (schedule 80 PVC) underdrain distributor. Laterals are wrapped and curved to follow the contour of the tank bottom heads

Notes:

1. The tank inlet and underdrain distributors will be shop installed prior to shipment. The brine inlet distributor is to be field installed by the contractor as the media is placed into the units.

Softener Valve Nest Exterior:

One (1) Bray Series 3W butterfly control valves with wafer style cast iron bodies, nylon coated discs, metal reinforced EPDM seats, with Bray Series 70 electric actuators, with open/close limit switches for:

- Inlet
- Outlet
- Backwash inlet
- Rinse
- Waste

Flow-Tek series 80 stainless steel ball valves with threaded bodies and manual lever operators for:

- Air vent isolating

Simtech TBB series PVC ball valve with Bray series 70 electric actuator for:

- Brine inlet

Simtech TBB series PVC ball valve with manual lever operator

- Brine isolating
- Tank drain

Apco model 200A or equal automatic air vent valves with threaded cast iron bodies and stainless steel floats for:

- Tank air vent

Media:

One (1) 12 inches graded gravel support beds, plus bottom head fill.

One (1) 36 inch beds of Strong Acid Cation resin

Softener Auxiliary Equipment:

Pressure Equipment:

Six (2) Ashcroft model 1279SS pressure gauges for the tank inlet and outlets with 4.5 inch diameter dials and stainless steel bourdon tubes.

Two (2) Sets of polypropylene supply tubing.

Two (2) Sets of manual isolating valves.

Two (2) Sets of sampling valves.

Flow Equipment:

One (1) Rosemount 8750WD magnetic flowmeter with local input transmitter for:

- Softener inlet , 1

System Piping:

Schedule 80, PVC pipe with socket weld fittings and flanges.

Notes:

1. All pipe supports for the interconnecting piping are to be furnished by the purchaser.

2. All system face and interconnecting piping will be furnished with the required bolts, studs, nuts, and gaskets as follows:

   Bolts: ASTM A193 stainless steel.
   Studs: ASTM A193 stainless steel.
   Nuts: ASTM A194 stainless steel hex.
   Gaskets: Shore A70 or equal, 1/8 inch thick.

3. FIELD SERVICE CHARGES

One service technician will be on site for 9 days over 3 trips to assist with media loading and start up.

If additional service is needed, Hungerford & Terry, Inc., will furnish a Field Supervisor at USD-$1,200.00 per weekday of 8 consecutive hours or USD-$150.00 per hour, coinciding with the Purchaser's regular business hours during the normal work week of Monday through Friday including traveling time, plus living and traveling expenses from date of departure from Clayton, NJ, to destination and return. All time in excess of 8 hours shall be charged at 1-1/2 times the daily rate and all traveling and living expenses will be charged at cost. Meal charge is USD-$50.00 per day.

All overtime will be charged at 1-1/2 times the daily rate.

PLEASE NOTE: The Purchaser will be charged for the services of the Field Supervisor at the jobsite when service cannot be rendered because of delay or conditions beyond Hungerford & Terry's control. In cases of undue delay, Hungerford & Terry reserves the right to recall the supervisor.

HUNGERFORD & TERRY, INC.

PER: _____
Christopher Ralph, Inside Sales Representative

DATE: _____

ACCEPTED: _____

PER: _____

TITLE: _____

DATE: _____

4. CONDITIONS

Prices are based on present day labor and material costs and subject to revision after thirty days from date of quotation. They do not include any Federal, State, Municipal or other tax or Government charge applicable to the sale, shipment or use of equipment quoted on.

Deliveries are contingent upon strikes, accidents, delays in manufacture and other causes beyond our control.

Any typographical or clerical errors in the prices or specifications are subject to correction.

Order shall be made out to Hungerford & Terry, Inc., Clayton, NJ, and shall be subject to acceptance by us at Clayton, NJ. After acceptance, orders may be cancelled only with our written consent and on terms that will indemnify us against loss. Equipment on material cannot be returned except by special permission and when so returned will be subject to discount.

The Company will, free of charge, replace or repair, after receipt f.o.b. its factory promptly and within one year from shipment by it, any part of equipment which, under normal or proper use proves to be defective in workmanship or material. In no event shall the Company be liable for consequential damages.

The Company shall not be liable for failure to perform or delay in performing any obligation if such failure or delay shall be caused directly or indirectly by invasion, insurrection, riot, war, military authority, or by fire, flood, strike, or labor difficulty or by any other cause, whether of the same or different nature from those enumerated, beyond our reasonable control.

From the time said machinery of apparatus or any part thereof arrives on the premises, and until Hungerford & Terry, Inc., for an amount equal to the unpaid portion of the purchase price of the same; such loss or damage to be payable to Hungerford & Terry, Inc., as its interests may appear. All losses by fire or other casualties for which Hungerford & Terry, Inc., is not indemnified and paid under such policies of insurance, shall be borne by the Purchaser on and after the arrival of said machinery or apparatus, or any part thereof on Purchaser's premises.

The title and right of possession of above described articles shall remain vested in Hungerford & Terry, Inc. until Purchaser shall have made full payment thereof in cash and this right shall not be waived by attachment of said articles to the real estate. Upon Purchaser's failure to make above agreed payments or any part thereof, Hungerford & Terry, Inc. is to retain any and all partial payments which may have been made as liquidated damages, and shall be entitled to take immediate possession of said materials.

This proposal, of which the Conditions of Sale are an integral part, shall not become a contract or become binding until it has been approved and signed by a representative of Hungerford & Terry, Inc. at its home office, Clayton, NJ. Persons signing on behalf of purchaser hereby represent that they are legally authorized to enter into this contract.

TONKAWATER™
a Kurita brand

February 20, 2024

Josh Harner, PE
Project Engineer
Burgess & Niple, Inc.
(812) 777-4265 x7597
cell (419) 305-1949
318 Main Street, Suite 502

Evansville, IN 47708

RE: Loveland, OH
RidION™ Ion Exchange System for Softening
Preliminary Proposal and Budgetary Estimate

Dear Mr. Harner,

In accordance with our understanding of the above project, Tonka Water, a Kurita brand, is pleased to provide information concerning the following process equipment. For this project, Tonka Water is proposing:

Tonka Water RidION™ Ion Exchange System for Hardness Removal

Total Design Flow:	2,100 gpm
Total Treated Flow:	1,470 gpm
Total Bypass Flow:	630 gpm
Vessel Load Rate:	5.8 gpm/sf
Number of Vessels:	4
Dimensions:	9'-0'' diameter x 11'-7'' approx. overall height
Working Pressure:	100 psi
Test Pressure:	130 psi
Approx. Shipping Weight Per Vessel:	8,200 lbs
Resin - Depth:	36 inches
Resin - Approx. Total Bags Per Project:	764 bags
Gravel - Depth:	15 inches
Gravel - Approx. Total Bags Per Project:	316 bags
Approx. Operating Weight Per Vessel:	52,400 lbs

TONKAWATER™
a Kurita brand

Capacity and Regeneration Information:

Vessel Capacity:

Resin Depth (ft.):	3
Resin Volume in Cu. Ft.:	190.8
Bed Loading, GPM/ Cu. Ft.:	1.93
in Bed Volumes / hr (BV/hr):	15.44
Bed capacity in grains:	3,816,000
Gallons btwn Regen. cycle:	195,994
in Bed Volumes (BV):	137
Hours btwn Regen. cycle (each vessel):	8.9
Multiple Vessel Regen Interval: (hrs between regen of any vessel)	2.2

Regeneration:	Duration (minutes)	Rate (GPM)	Rate (BV/hr)	Volume (gal/vessel)	Bed Volumes
Backwash:	10	318.0	13.37	3180	2.23
Saturated Brine:		16.1	0.68	434	0.30
Brine Dilution:		31.6	1.33	949	0.66
Brine:	30	47.7	2.01	1383	0.97
Slow Rinse:	60	47.7	2.01	2862	2.01
Fast Rinse:	10	367.3	15.44	3673	2.57
Total Regen:	110	-	-	11098	7.78

Act. Service Loading Rate (GPM/ft2):	5.78
(GPM/ft3)	1.93
Loading w/1 vessel in regen (GPM/ft2):	7.70
(GPM/ft3)	2.57
Total Regen Volume/Vessel (gallons):	11146
Lbs. Dry Salt/Regenerated Vessel:	1145
Lbs. Salt per 30 day period (all vessels): based on 12 hrs/day of operation	185384
Lbs. Salt per million gallons treated:	5841
Lbs. Salt per million gal blended finished water:	4087

- Each vertical pressure vessel is to be constructed of carbon steel, ASME code stamped, and will include:
  - Schedule 80 PVC header-lateral inlet distributor with upturned elbows
  - Schedule 80 PVC header-lateral brine distribution grid
  - Cation exchange softening resin -- NSF approved
  - Graded support gravels
  - Schedule 80 PVC header-lateral underdrain with Tonka Water non-metallic gravel retaining nozzles (concrete subfill required by installing contractor)
  - Full interior finish painting; exterior blasted and primed at factory (finish painting by others on site)
- Additional components and services are included as follows:
  - System valves, including electrically actuated Bray wafer-style butterfly valves for system regeneration, including heaters but no limit switches
  - Ductile iron vessel facepiping (shipped loose for installation by others)
  - Vessel effluent flow meters, one per vessel
  - Loss of head pressure gauge panel
  - Fully automated Allen-Bradley PLC control system and panel

- Brine delivery and dilution components, including brine pump, brine meter, valves, check valves, and other components for a fully functional brine delivery and dilution system (shipped separately for installation by the installing contractor; interconnecting piping by others)
- Bypass/blend components including flow meter, throttling service valves, and modulating control valve.
- Brine maker/salt storage silo, FRP construction
- Freight
- Field services consisting of installation inspection, media installation supervision, start-up and operator training

The budgetary price for this system is: $ 1,150,000.00

TONKAWATER™
a Kurita brand

Tonka Water RidION™ Ion Exchange System for Hardness Removal

Total Design Flow:	1,869 gpm
Total Treated Flow:	1,308 gpm
Total Bypass Flow:	561 gpm
Vessel Load Rate:	5.6 gpm/sf
Number of Vessels:	3
Dimensions:	10'-0'' diameter x 11'-7'' approx. overall height
Working Pressure:	100 psi
Test Pressure:	130 psi
Approx. Shipping Weight Per Vessel:	9,700 lbs
Resin - Depth:	36 inches
Resin - Approx. Total Bags Per Project:	708 bags
Gravel - Depth:	15 inches
Gravel - Approx. Total Bags Per Project:	294 bags
Approx. Operating Weight Per Vessel:	64,700 lbs

Capacity and Regeneration Information:

Vessel Capacity:

Resin Depth (ft.):	3
Resin Volume in Cu. Ft.:	235.5
Bed Loading, GPM/ Cu. Ft.:	1.85
in Bed Volumes / hr (BV/hr):	14.85
Bed capacity in grains:	4,710,000
Gallons btwn Regen. cycle:	241,911
in Bed Volumes (BV):	137
Hours btwn Regen. cycle (each vessel):	9.2
Multiple Vessel Regen Interval: (hrs between regen of any vessel)	3.1

Regeneration:	Duration (minutes)	Rate (GPM)	Rate (BV/hr)	Volume (gal/vessel)	Bed Volumes
Backwash:	10	392.5	13.37	3925	2.23
Saturated Brine:		19.8	0.68	535	0.30
Brine Dilution:		39.1	1.33	1172	0.66
Brine:	30	58.9	2.01	1707	0.97
Slow Rinse:	60	58.9	2.01	3533	2.01
Fast Rinse:	10	435.9	14.85	4359	2.47
Total Regen:	110	-	-	13523	7.68

Act. Service Loading Rate (GPM/ft2):	5.55
(GPM/ft3)	1.85
Loading w/1 vessel in regen (GPM/ft2):	8.33
(GPM/ft3)	2.78
Total Regen Volume/Vessel (gallons):	13583
Lbs. Dry Salt/Regenerated Vessel:	1413
Lbs. Salt per 30 day period (all vessels): based on 12 hrs/day of operation	164992
Lbs. Salt per million gallons treated:	5841
Lbs. Salt per million gal blended finished water:	4087

Kurita America Inc.
6600 94th Avenue North · Minneapolis, MN 55445
www.kuritaamerica.com · 866-663-7633

KURITA

TONKAWATER™
a Kurita brand

- Each vertical pressure vessel is to be constructed of carbon steel, ASME code stamped, and will include:
  - Schedule 80 PVC header-lateral inlet distributor with upturned elbows
  - Schedule 80 PVC header-lateral brine distribution grid
  - Cation exchange softening resin -- NSF approved
  - Graded support gravels
  - Schedule 80 PVC header-lateral underdrain with Tonka Water non-metallic gravel retaining nozzles (concrete subfill required by installing contractor)
  - Full interior finish painting; exterior blasted and primed at factory (finish painting by others on site)
- Additional components and services are included as follows:
  - System valves, including electrically actuated Bray wafer-style butterfly valves for system regeneration, including heaters but no limit switches
  - Ductile iron vessel facepiping (shipped loose for installation by others)
  - Vessel effluent flow meters, one per vessel
  - Loss of head pressure gauge panel
  - Fully automated Allen-Bradley PLC control system and panel
  - Brine delivery and dilution components, including brine pump, brine meter, valves, check valves, and other components for a fully functional brine delivery and dilution system (shipped separately for installation by the installing contractor; interconnecting piping by others)
  - Bypass/blend components including flow meter, throttling service valves, and modulating control valve.
  - Brine maker/salt storage silo, FRP construction
  - Freight
  - Field services consisting of installation inspection, media installation supervision, start-up and operator training

The budgetary price for this system is: $ 1,010,000.00

We look forward to working with you on this water treatment project. If you have any questions, please feel free to call me at 612.867.3805.

Sincerely,

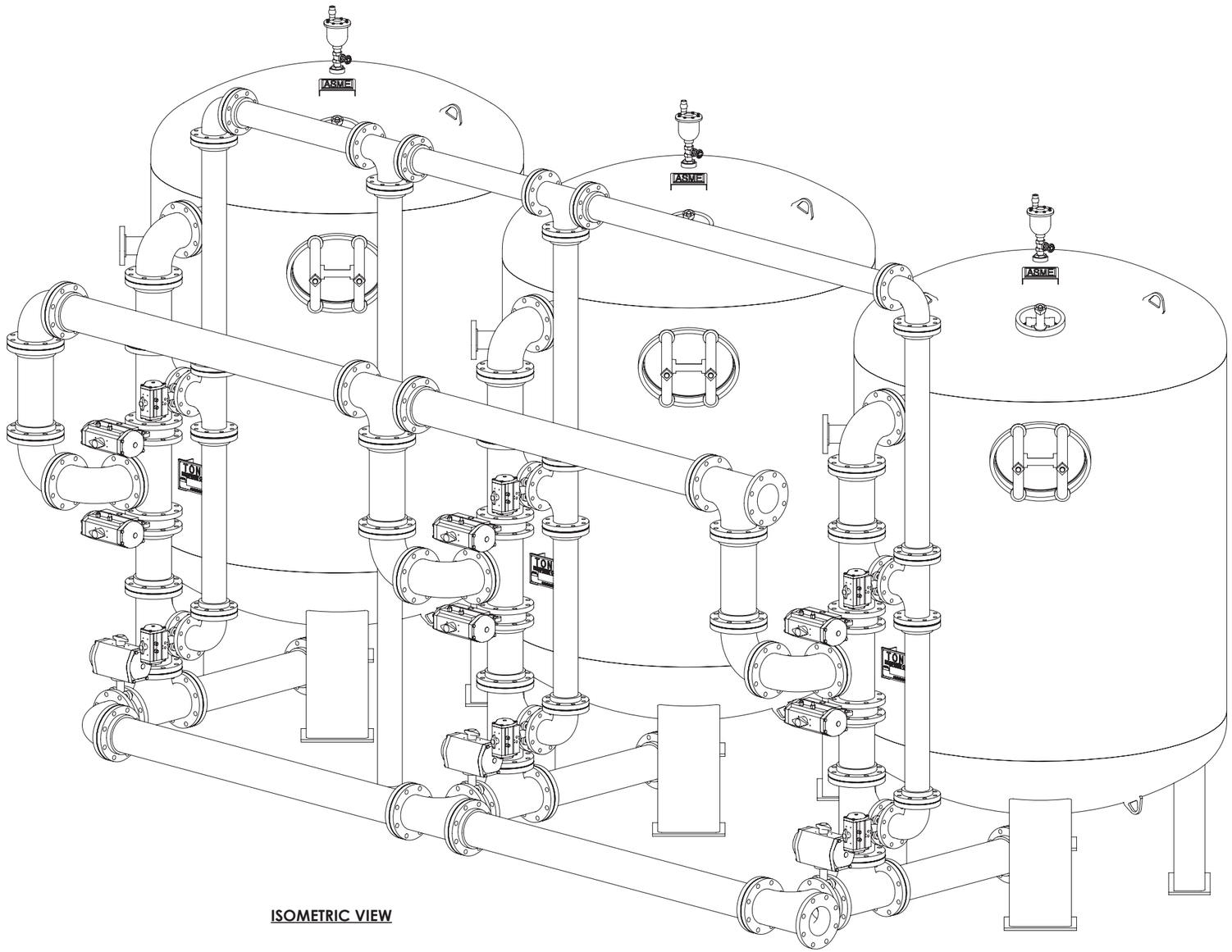
Nick Brogren
Territory Manager

cc: Tim Shaw, The Henry P. Thompson Company

Attachments: Catalog drawings and brochures

TONKAWATER™
a Kurita brand

RidION™ Ion Exchange System
3 Vessel System
Catalog Drawing



ISOMETRIC VIEW

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DO NOT SCALE DRAWING

DRAWN BY: DDI

START DATE: 04/15/2014

THICKNESS:

DWG. SCALE: 1:12

LENGTH:

MATERIAL:

APPR. BY:

APPR. DATE:

APPROX. WEIGHT: 31219.6573

TONKAWATER™
a Kurita brand

13305 WATERTOWER CIRCLE
PLYMOUTH, MN 55441
(763) 559-2837
www.tonkawater.com

RIDION™ ION EXCHANGE SYSTEM
3 VESSEL SYSTEM
CATALOG DRAWING

SHEET NUMBER: 1 OF 2

REV: 0

DRAWING NUMBER: 00066607

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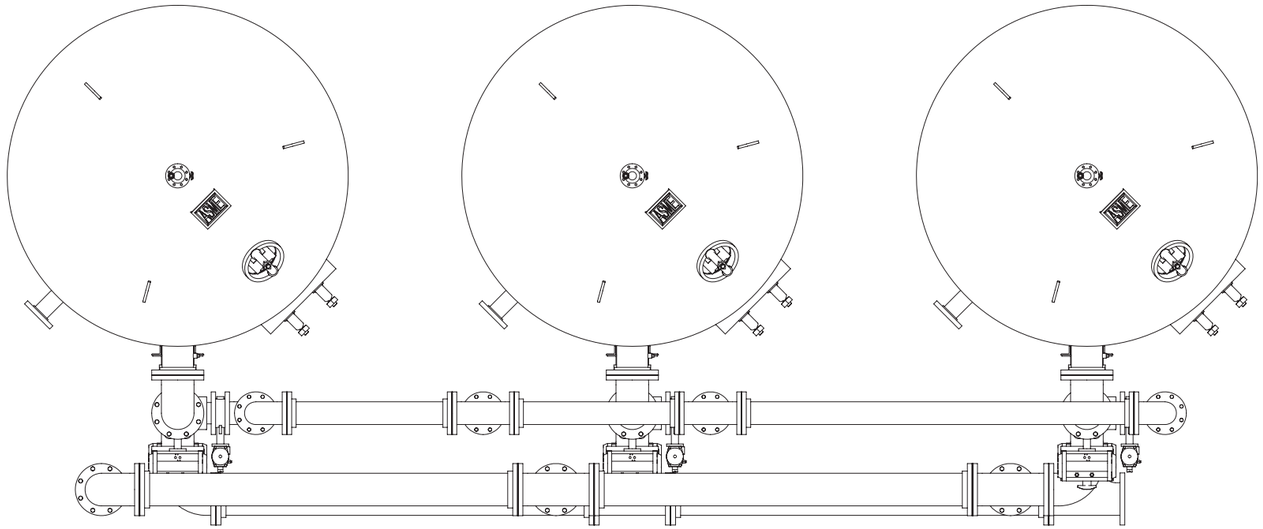
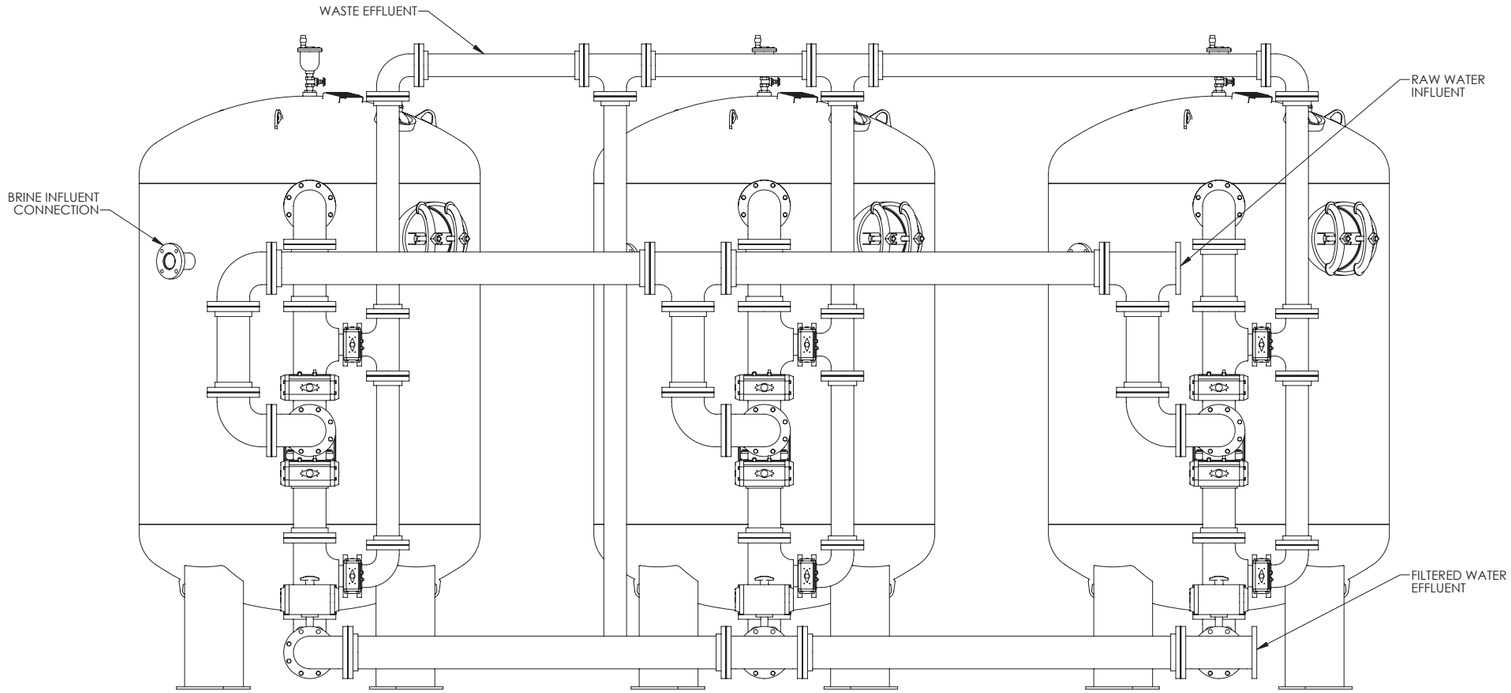
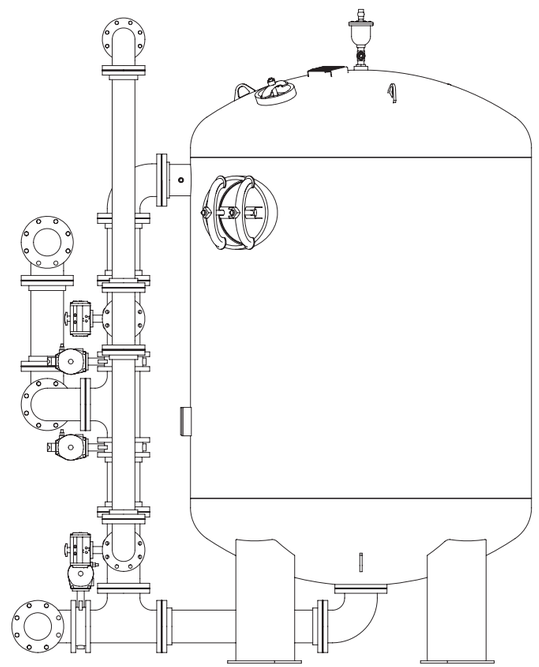


PLAN VIEW



FRONT ELEVATION



RIGHT SIDE ELEVATION

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DRAWN BY: DDI	START DATE: 04/15/2014	THICKNESS:	**RIDION™ ION EXCHANGE SYSTEM 3 VESSEL SYSTEM CATALOG DRAWING**	SHEET NUMBER: 2 OF 2	REV: **0**
	DWG. SCALE: 1:16	LENGTH:		DRAWING NUMBER: **00066607**	
MATERIAL:	APPR. BY:	APPR. DATE:	APPROX. WEIGHT: 31219.6573		

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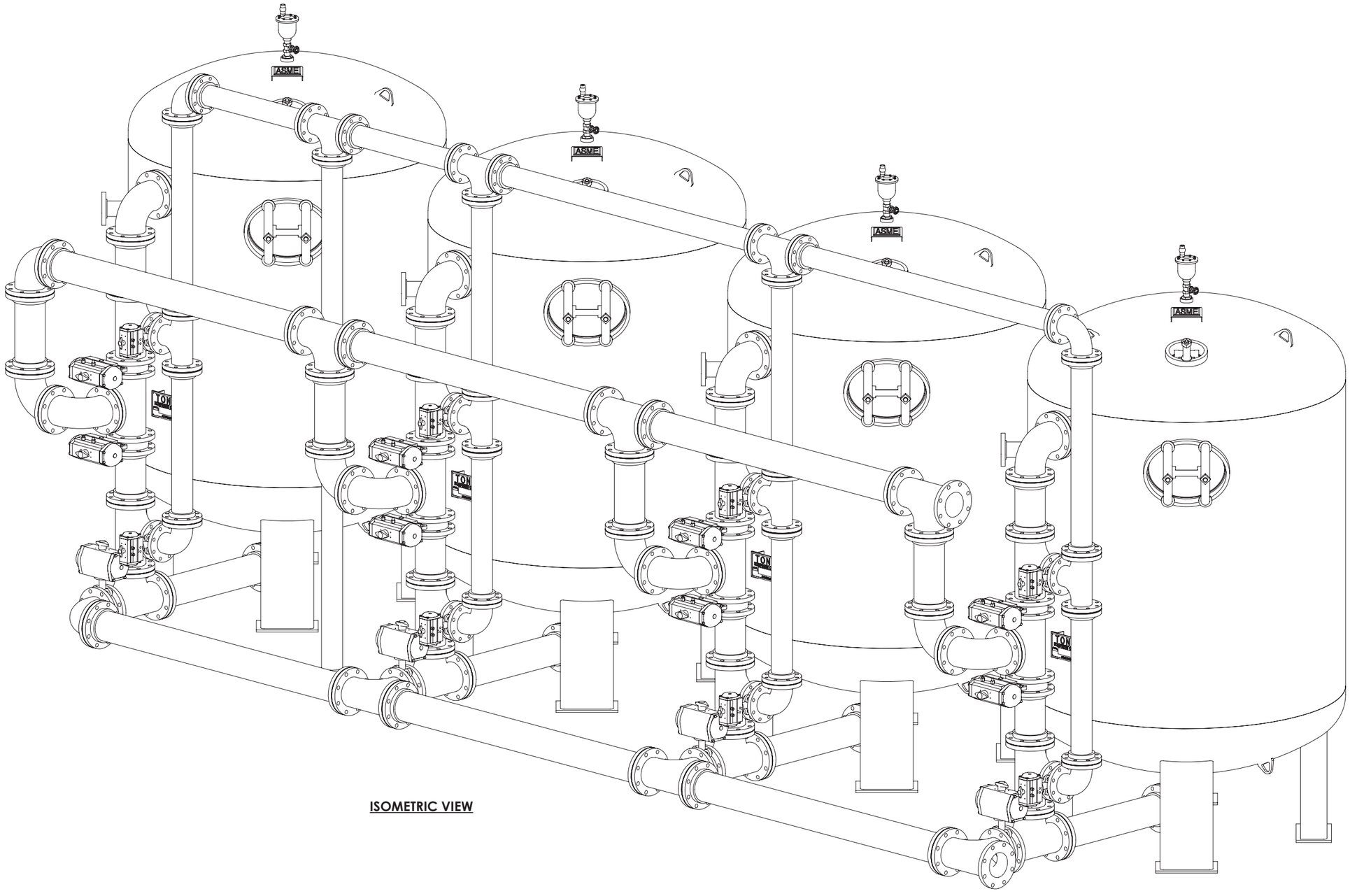
TONKAWATER™
a Kurita brand

RidION™ Ion Exchange System
4 Vessel System
Catalog Drawing



ISOMETRIC VIEW

DRAWING SIZE: **D**	DO NOT SCALE DRAWING	TONKAWATER™ a Kurita brand	13305 WATERTOWER CIRCLE PLYMOUTH, MN 55441 (763) 559-2837 www.tonkawater.com
DRAWN BY: DDI	START DATE: 04/15/2014	THICKNESS:	**RIDION™ ION EXCHANGE SYSTEM 4 VESSEL SYSTEM CATALOG DRAWING**
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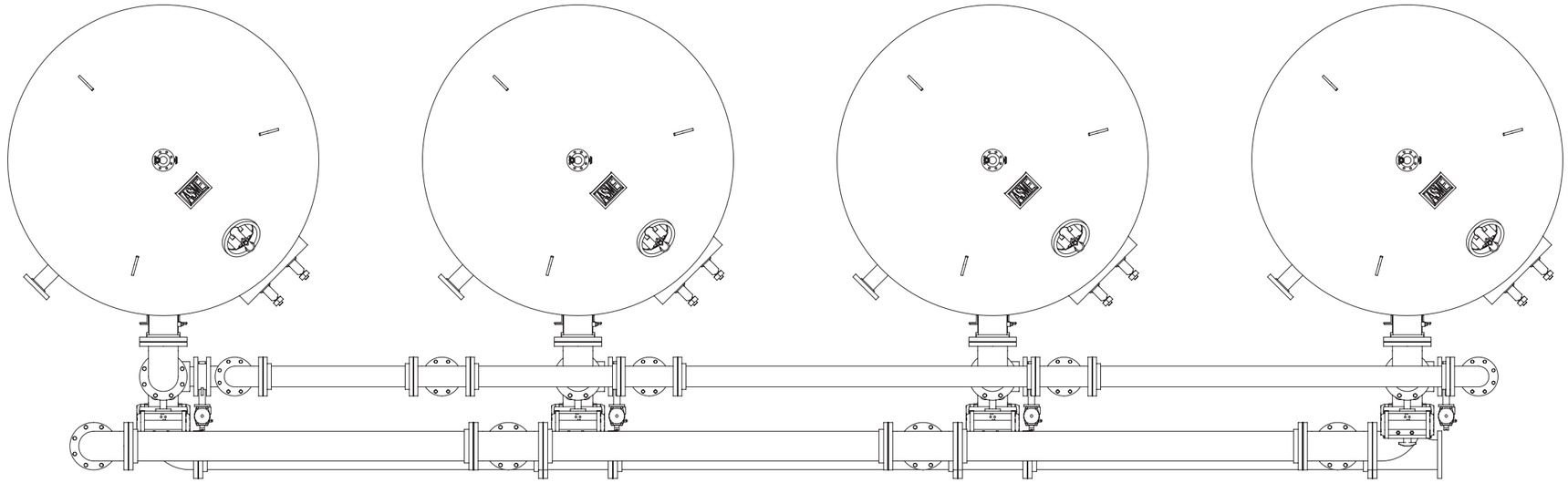
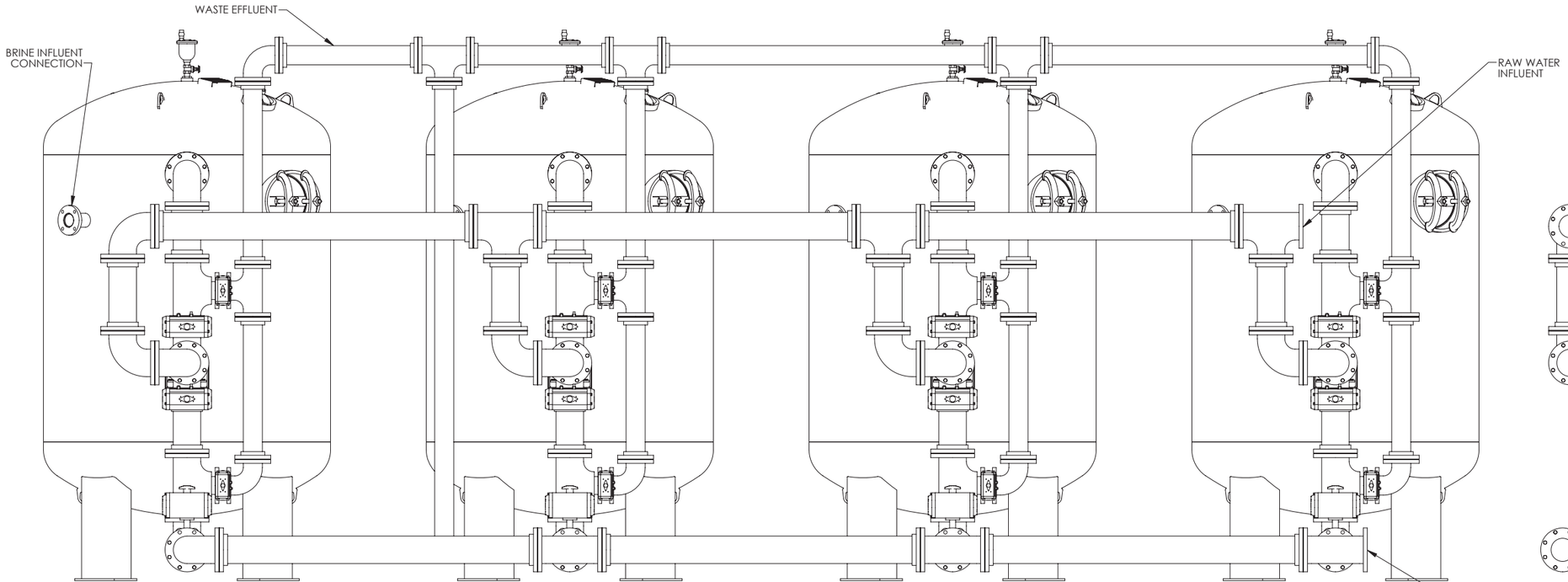
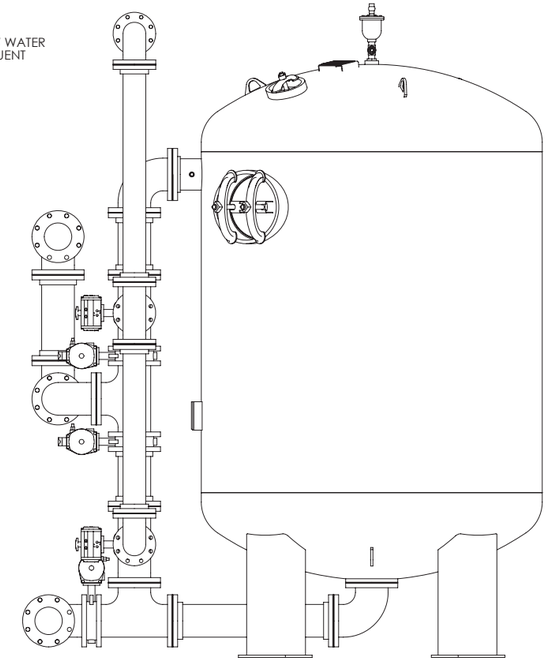


PLAN VIEW



FRONT ELEVATION



RIGHT SIDE ELEVATION

DRAWING SIZE: D	DO NOT SCALE DRAWING	TONKAWATER™ a Kurita brand	13305 WATERTOWER CIRCLE PLYMOUTH, MN 55441 (763) 559-2837 www.tonkawater.com
DRAWN BY: DDI	START DATE: 04/15/2014	RIDION™ ION EXCHANGE SYSTEM 4 VESSEL SYSTEM CATALOG DRAWING	SHEET NUMBER: 2 OF 2 REV: 0
	DWG. SCALE: 1:16		DRAWING NUMBER: 00066610
MATERIAL:	APPR. BY:	APPR. DATE:	APPROX. WEIGHT: 38854.015

Last Saved: Wednesday, July 19, 2017 3:43:00 PM



RIDION™

Conventional Ion Exchange Technology

ADVANTAGES

- **PLC-based regeneration controls**
- **Unique non-plugging, non-corroding regenerant distribution system**

Proven, reliable ion exchange processes

Tonka Water, a Kurita brand's RidION™ ion exchange systems solve a broad range of water treatment issues from uranium removal, to hardness and barium reduction. RidION™ systems incorporate the newest technologies in resin regeneration, guaranteeing an efficient and effective process with custom controls for your system. Tonka Water's RidION™ systems incorporate the latest resin technology utilizing the highest quality resins furnished by well-known manufacturers. Our unique regenerant distribution system accomplishes complete and uniform regeneration of the resin. With over 200 conventional ion exchange installations in the United States alone, Tonka Water's approach is proven consistently effective.

Treatment:

- Arsenic
- Barium
- Hardness
- Nitrates/sulfate
- Organics
- Perchlorate
- Radium
- Fluoride
- Uranium

763.559.2837
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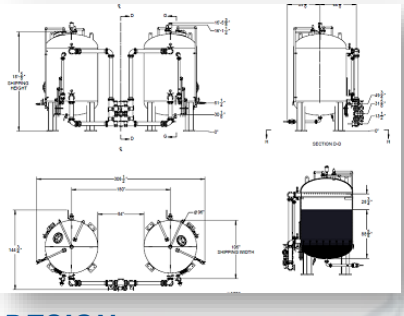
Tonka Water, a Kurita brand

KURITA



DESIGN

DEVELOP

DELIVER

Proposal for Softening System

Well 5

Loveland, Ohio

March 19, 2024

Loprest Representative Contact
Jim Pelton, Pelton Environmental
Email: jimpelton@peltonenv.com
Phone: 773-428-4499

Loprest Contact
Daryl Bond, National Sales Manager
Email: dbond@wrtnet.com
Phone: 610-568-6742

Quote Number 24-033

LOPREST
A DIVISION OF WRT ™

Water Treatment Solutions Since 1928
loprest.com

901 W. 116th Ave., Suite 400 • Westminster, CO 80234 • 303-424-5355

Softening System

PROCESS DESCRIPTION

The Loprest Ion Exchange Softening System includes three vessels in parallel to remove calcium and magnesium. One vessel is regenerated while the remaining vessels continue to operate in service.

MANUAL BLENDING

As raw water hardness varies over time, the blend ratio can be manually adjusted to achieve the desired blended effluent hardness concentration.

About Loprest

LOPREST'S CAPABILITIES

- Design and manufacturing of treatment systems: 10 to 10,000 GPM
- Process design for the removal of numerous contaminants
- Pressure filters, ion exchange systems, activated carbon systems
- Controls design, manufacturing, and programming
- Onsite filter inspection, evaluation, and maintenance

EFFICIENT Energy- and water-efficient designs to meet client needs

ECONOMICAL Design choices such as multi-cell horizontal filters and stainless steel underdrains reduce cost of ownership

PROVEN Thousands of treatment systems, over 90 years of experience

Complete System

This proposal includes a complete system for hardness removal:

- ASME Pressure Vessels
- Vessel Internals
- System Valving and Piping
- Ion Exchange Media
- PLC-based Controls for fully automated regeneration cycle
- System commissioning on-site

Design Parameters

The treatment system shall be specifically designed to remove the target contaminants from the groundwater supply. All components and media in contact with water are NSF-61 compliant for potable water consumption. The treatment system shall be designed based on the following parameters:

INFLUENT WATER QUALITY

Hardness as $CaCO_3$	330	PPM

EFFLUENT WATER QUALITY

Hardness as $CaCO_3$ (blended effluent)	120	PPM

DESIGN PARAMETERS

Design Pressure	100	PSI
System Design Flow Rate	2,780	GPM
Typical System Treated Flow Rate	1,772	GPM
Typical System Bypass Flow Rate	1,008	GPM
Number of Vessels	3	
Vessel Design Flow Rate	886	GPM
Maximum Waste Flow Rate	591	GPM
Ion Exchange Media Volume, Per Vessel	566	CU FT
Resin Bed Depth	72	IN

SOFTENING SYSTEM OPTIMIZATION

Regeneration Salt Dose per cubic foot of media →	5	7	10	LBS/CF
Softening Capacity (with 10% engineering factor)	18,450	20,250	24,300	GRAINS/CF
Service Cycle (per vessel)	540,000	590,000	710,000	GALLONS
Runtime (max system flow, all vessels online)	15	17	20	HOURS
Waste Volume per million gallons blended effluent	24,300	22,100	18,400	GALLONS
NaCl Salt required per million gallons blended effluent	1.7	2.1	2.5	TONS
Regeneration Cycle Duration (per vessel)	102	91	88	MINUTES

Scope of Supply

Engineering	Engineering including submittals, calculations, and installation instructions
Vessels	Three (3) ASME Code vertical vessels, 144" diam x 72" sideshell Internal: epoxy lined per NSF-61/NSF-600 External: epoxy primed, no topcoat
Internals	Inlet distributor and backwash collection: upturned elbows, Sch10 304L SS Brine distributor: header and laterals, 304L SS Underdrain: header, laterals, and drop pipes, 304L SS
IX Media	1,698 CU FT high-purity strong acid cation exchange resin
Valves	(16) Electrically actuated butterfly calves (3) Air/Vacuum release valves Manual ball valves and check valves as needed for isolation
Instruments	(4) Flow meters (1) Hardness analyzer (2) Conductivity analyzers (2) Pressure transmitters (8) Sample taps with pressure gauges
Brine Saturator	(1) Brine saturator, 12’ diameter HDPE tank with 12” gravel underdrain and appurtenances, 75 tons salt storage capacity.
Regeneration Pump Skid	Regenerant pump skid: includes 2 pumps, electric valves, flow meter, and pressure gauges to automate each step in regeneration process Fully wired and factory tested
Control Panel	Allen Bradley PLC with Automation Direct touchscreen OIT in NEMA 4 Enclosure Factory wired, programmed, and tested
Rinse Reclaim System	(1) Rinse reclaim tank, 13,000 gallons (3) Tank level transmitters (4) Electrically actuated valves (1) Reclaim pump with VFD (1) Flow meter (2) Pressure gauge/sample taps Manual valves as needed (1) Structural steel reclaim skid
Start-up and Commissioning	Start-up Operation Training Operation and Maintenance Manual
Freight	Freight to site included

Budgetary Pricing

Softening System — $ 1,545,000

as described above

PAYMENT TERMS

- 15% upon submitted drawings
- 35% to release for fabrication
- 40% when ready to ship
- 10% upon system commissioning

Payment of invoices is due in full within 30 days of the date of the invoice. Payments must be made by ACH or check.

DELIVERY

- Timeline to be determined

NOTES

- This proposal is based upon today's costs and is valid for a period of 30 days.
- System shipped as vessels, media, valves, piping, and appurtenances loose for field assembly by Contractor.
- Brine generator freeze protection system is not included.
- No interconnecting pipe between skids and brine generator.
- No offloading, setting, or installation.
- Taxes, bonding, and permitting not included.
- Pricing is based on Loprest standard terms and conditions.
- Compliance with Build America, Buy America (BABA) Act has not been taken into consideration for this proposal.

Standard Terms and Conditions

1. **Payment.** Unless otherwise agreed by the parties in writing, payment for all products purchased pursuant to this Agreement shall be made within 30 day of Seller's invoice. Any amount not paid as agreed shall be subject to an interest charge of 1% per month, compounded monthly. Buyer will be liable for all of Buyer's costs to collect amounts due under this agreement, including reasonable attorney's fees, whether or not any collection action is commenced.

2. **Limited Warranty.** Seller warrants the products sold to the Buyer to be free of defects in materials and workmanship for a period of one year after the products are delivered to Buyer. In the event of any such defect in the products during the warranty period, Seller will provide all parts and labor necessary to correct such defect.

3. **Disclaimer Of Implied Warranties; Limitation Of Remedies.** THE BUYER'S SOLE AND EXCLUSIVE REMEDY UNDER THE LIMITED WARRANTY PROVIDED HEREIN SHALL BE THE PARTS AND LABOR AS PROVIDED IN THIS AGREEEMENT. ALL IMPLIED WARRANTIES, INCLUDING THOSE OF **MERCHANTABILITY** AND OF **FITNESS FOR A PARTICULAR PURPOSE** ARE EXCLUDED. SELLER SHALL NOT BE RESPONSIBLE OR LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES ARISING FROM THE BREACH OF ANY WARRANTIES WITH RESPECT TO THE PRODUCTS PURCHASED PURSUANT TO THIS AGREEMENT.

4. **Waiver of and Indemnification for Claims.** BUYER HEREBY AGREES TO WAIVE, RELEASE, DISCHARGE, INDEMNIFY AND HOLD SELLER HARMLESS FOR ANY AND ALL CLAIMS FOR DAMAGES FOR DEATH, PERSONAL INJURY OR PROPERTY DAMAGE WHICH IT OR THIRD PARTIES MAY HAVE OR WHICH MAY HEREAFTER ACCRUE AS A RESULT OF THE BUYERS' USE OF THE PRODUCTS SOLD PURSUANT TO THIS AGREEMENT.

5. **Intellectual Property.** To the extent the products sold pursuant to this Agreement contain, reflect or consist of the Seller's intellectual property, the sale does not include a sale of such intellectual property or of a license to use such intellectual property beyond the use by the Buyer of the products sold.

6. **Assignment.** In the event that Buyer assigns its rights and obligations under this Agreement any assignment of its payment obligation will be ineffective and Seller will remain jointly and severally liable, with its assignee, to pay all amounts due pursuant to this Agreement.

7. **Non-Reliance on Written or Oral Statements**. Buyer has relied on its own investigation about the qualities and performance of the products purchased pursuant to this Agreement and has not relied upon the written or oral statements of Seller or its representatives in entering into this Agreement.

8. **Only Agreement.** This is the only Agreement between the Buyer and Seller relating to the products purchased pursuant to this Agreement, and no oral or other statements, not contained herein, shall be binding on either the Buyer or the Seller.

9. **Modification.** The terms of this Agreement may not be modified, except in a writing signed by the party to be bound.

10. **Non-Waiver; Severability.** Waiver by either party hereto of non-performance of any term, provision, covenant, obligation or condition of this Agreement shall not be considered a waiver of any subsequent nonperformance, nor as waiver of the term, provision, covenant, obligation or condition itself. If any provision of this Agreement is found to be prohibited, invalid or unenforceable, such finding will not invalidate or render unenforceable any remaining provisions of this Agreement.

11. **Arbitration.** Any disputes arising in any way in connection with this Agreement or the products sold by the Seller shall be resolved by binding arbitration under the Colorado Uniform Arbitration Act (C.R.S. § 13-22-201 *et seq.*) (the "Act"). The parties agree that the District Court of Jefferson County, Colorado shall have jurisdiction over them for the purposes of applying the provisions of the Act. All arbitration proceedings shall take place within the greater metropolitan area of Denver, Colorado. Buyer will reimburse Seller for all attorney's fees incurred by Seller in any arbitration (for collection or otherwise) in which Seller prevails.

12. **Governing Law.** This Agreement and any disputes or claims arising from it shall be governed by and construed according to the laws of the State of Colorado.

LOPREST
A DIVISION OF WRT™

Water Treatment Solutions Since 1928
loprest.com

WRT

Clean water. Clean earth. That's our promise.®

WRT is the parent company of Loprest. For more information about our services, call 303.424.5355 or visit wrtnet.com.

Corporate Offices: 901 W. 116th Ave., Suite 400 • Westminster, CO 80234

PUMPING AND CHEMICAL FEED PROPOSALS

BL ANDERSON

QUOTATION		
DATE	NUMBER	PAGE
3/26/2024	0002261	1 of 1

BILL TO
BUD001
BUDGET

SHIP TO
BUDGET

Accepted By:_____
Company:_____
Date:_____
PO#:_____
Ship To:_____

ATTENTION:
Josh Harner <josh.harner@burgessniple.com>

WE ARE PLEASED TO PROPOSE THE FOLLOWING FOR YOUR CONSIDERATION:

TERMS: NET 30

CUSTOMER REF/PO#	JOB TITLE	SLP	SHIPPING TYPE
QUOTE 2261	LOVELAND WTP	DMW/DMW	BEST WAY PP&ADD

QTY	PART	DESCRIPTION	UNIT PRICE	EXTENDED
4	FVT-11FLC	FRANKLIN ELECTRIC VERT TURBINE	$39,675.00	$158,700.00
2	NP 3102 SH3	FLYGT N IMPELLER SUBMERSIBLE	$18,004.00	$36,008.00
1	5050000N45	SNYDER 2000 GALLON FLUORIDE	$23,225.00	$23,225.00
1	5090000N45	SNYDER 2500 GALLON HYPO	$24,225.00	$24,225.00
1	CHEM FEED SKIDS	FLUORIDE AND HYPO SKIDS PUMPS SEPARATE	$85,833.33	$85,833.33
4	ERB 22 1 A44ACA7T1	MILTON ROY PROTEUS FEED PUMPS	$7,875.00	$31,500.00
1	D7282PE14N1	MILTON ROY MACROY FL TRANSFER	$26,442.00	$26,442.00
1	D8682PE14N1	MILTON ROY MAC ROY HYPO TRANS	$30,379.00	$30,379.00

SEE ATTACHED FOR DETAILS

FREIGHT AND START UP ESTIMATED AND INCLUDED

Dave Wilson
Sales Engineer
DWilson@blanderson.com
513-907-3793 cell (preferred)
513-889-4746 work
8887 Eagle Ridge Court
West Chester, OH 45069
www.blanderson.com

QUOTE VALID FOR 60 DAYS. CREDIT CARD PAYMENTS ARE SUBJECT TO AN ADDITIONAL 3% CHARGE NO TAXES OF ANY KIND ARE INCLUDED IN THIS PROPOSAL

TOTAL: $416,312.33

Pump Performance Datasheet

Company Name	
Company contact number	
Quote Number	1819252
Project name	Default

Model/Order No.	FVT-11FLC Enclosed Impeller (STD Model)
Stages	4
Quantity of pumps in parallel	1
Based on curve number	11FLC(4POLE)
Saved Date	22 Mar 2024 2:02 PM

Operating Conditions

Flow, rated	: 695.0 USgpm
Head, rated (requested)	: 230.0 ft
Head, rated (actual)	: 232.8 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available	: Ample
Site Supply Frequency	: 60 Hz

Performance

Speed criteria	: Synchronous
Speed	: 1750 rpm
Impeller dia.	: 8.69 in
Impeller diameter, maximum	: 8.81 in
Impeller diameter, minimum	: 8.19 in
Efficiency (bowl / pump)	: 85.85 / 85.01 %
NPSH required / margin required	: 8.34 / 0.00 ft
Ns (imp. eye flow) / Nss (imp. eye flow)	: 2,327 / 9,343 US Units
MCSF	: 455.1 USgpm
Head max.	: 321.8 ft
Head rise to shutoff (bowl / pump)	: 39.92 / 40.17 %
Flow, best eff. point (bowl / pump)	: 750.8 / 748.8 USgpm
Flow ratio, rated / BEP (bowl / pump)	: 92.57 / 92.81 %
Diameter ratio (rated / max)	: 98.58 %
Head ratio (rated dia / max dia)	: 94.95 %
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 in
Solids concentration, by volume	: 0.00 %
Temperature	: 68.00 deg F
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Vapor pressure, rated	: 0.34 psi.a

Material

Material selected	: Cast Iron

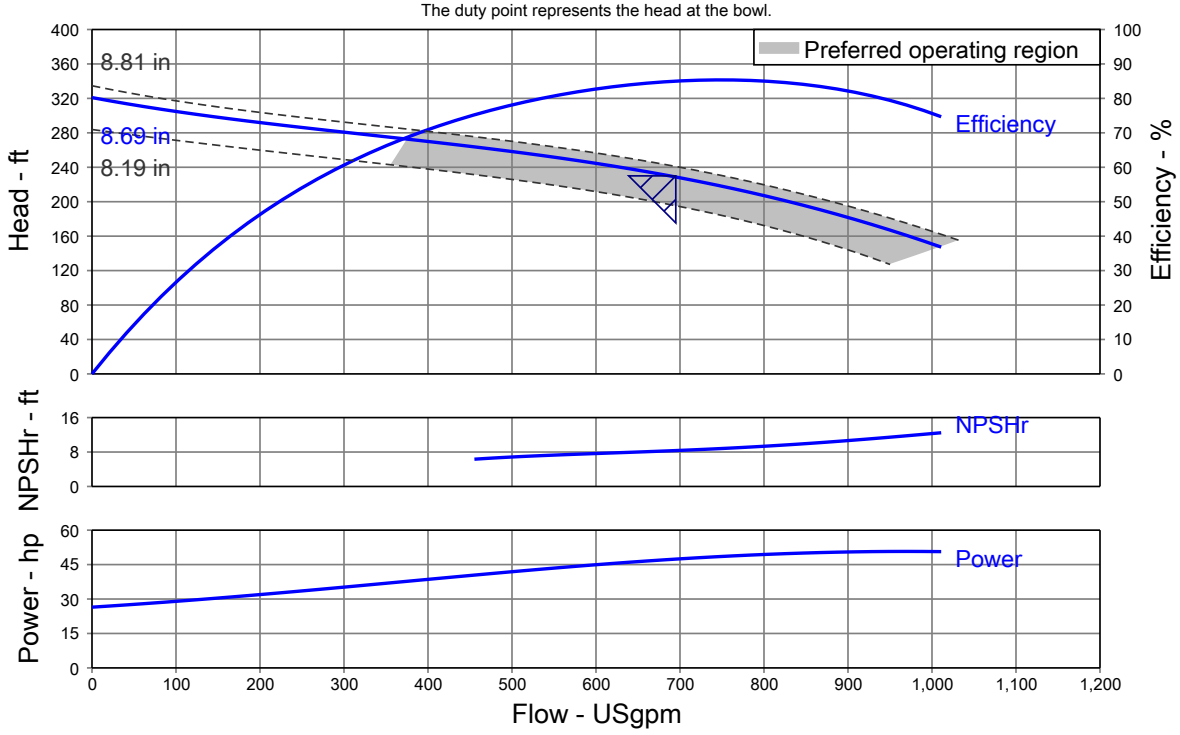
Pressure Data

Shut off pressure	: See the Additional Data page
Maximum allowable working pressure	: See the Additional Data page
Maximum allowable suction pressure	: N/A
Hydrostatic test pressure	: See the Additional Data page

Driver & Power Data (@Max density)

Driver sizing specification	: Rated power
Margin over specification	: 0.00 %
Service factor	: 1.15 (used)
Power, hydraulic	: 40.36 hp
Power (bowl / pump)	: 47.01 / 47.39 hp
Power, maximum	: 50.73 hp
Motor rating	: 50.00 hp / 37.29 kW

Pump performance. Adjusted for construction, viscosity, static lift to discharge nozzle centerline, friction and power losses of lineshaft and thrust bearings.
The duty point represents the head at the bowl.

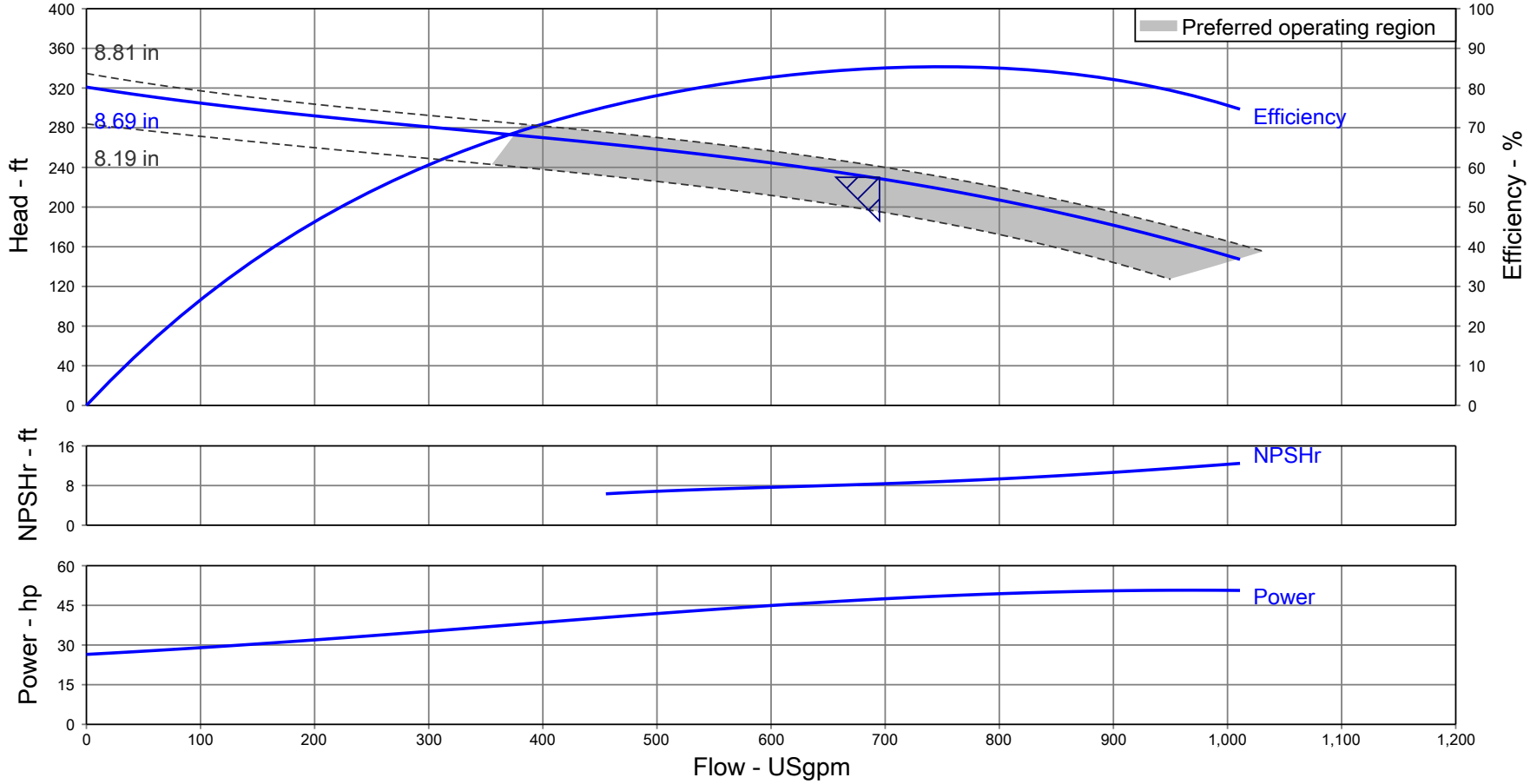


Pump Performance Curve

Company Name	
Company contact number	

Quote Number	1819252
Quote Date	22 Mar 2024
Project name	Default

Pump performance. Adjusted for construction, viscosity, static lift to discharge nozzle centerline, friction and power losses of lineshaft and thrust bearings.
The duty point represents the head at the bowl.



Description	: FVT-11FLC Enclosed Impeller (STD Model)
Stages	: 4
Flow, rated	: 695.0 USgpm
Head, rated	: 230.0 ft

Speed	: 1750 rpm
Based on curve number	: 11FLC(4POLE)
Efficiency (bowl / pump)	: 85.85 / 85.01 %
Power (bowl / pump)	: 47.01 / 47.39 hp

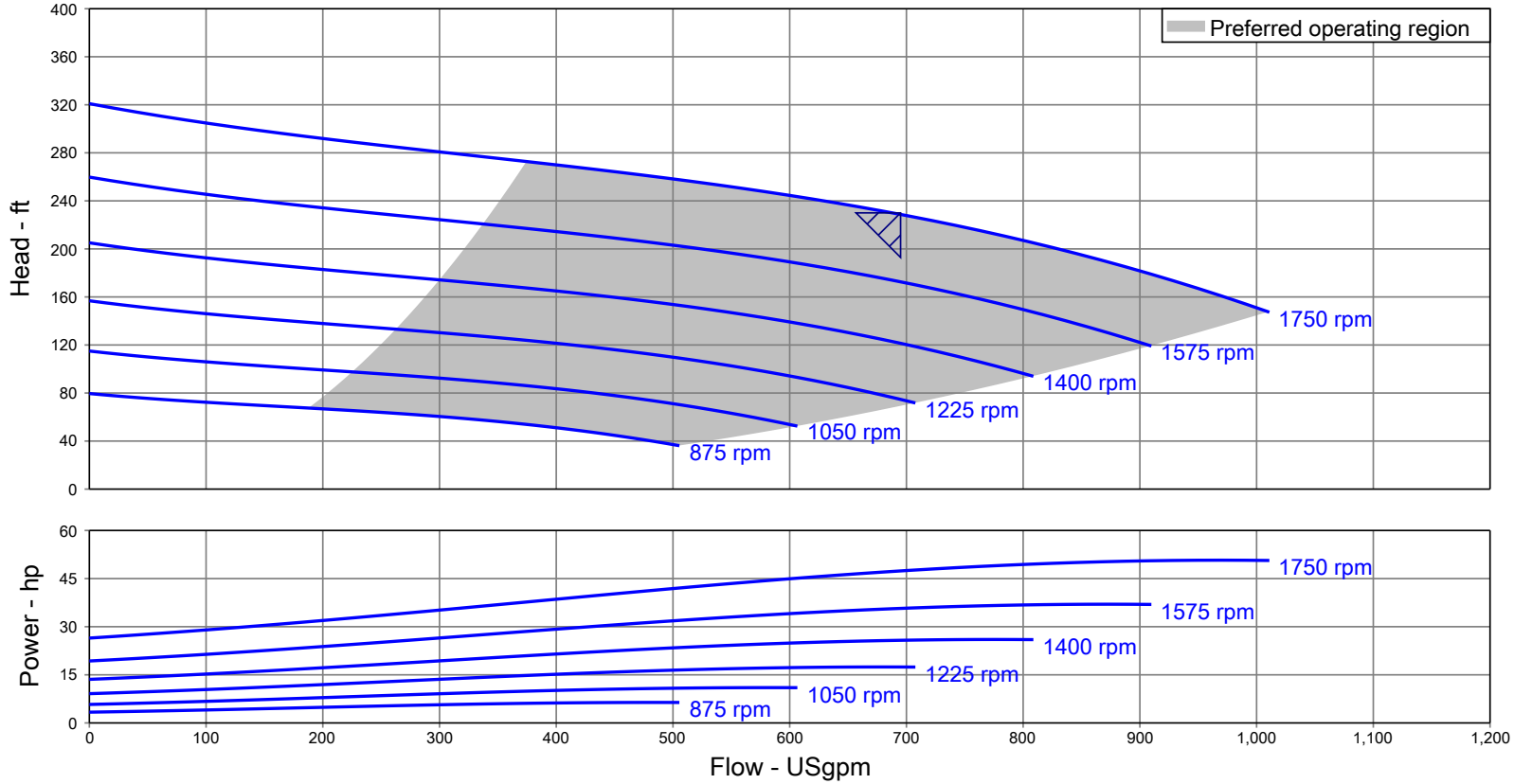
NPSH required	: 8.34 ft
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Saved Date	: 22 Mar 2024 2:02 PM

Multi-Speed Performance Curve

Company Name	
Company contact number	

Quote Number	1819252
Quote Date	22 Mar 2024
Project name	Default

Pump performance. Adjusted for construction, viscosity, static lift to discharge nozzle centerline, friction and power losses of lineshaft and thrust bearings.
The duty point represents the head at the bowl.



Description	: FVT-11FLC Enclosed Impeller (STD Model)
Stages	: 4
Flow, rated	: 695.0 USgpm
Head, rated	: 230.0 ft

Speed	: 1750 rpm
Based on curve number	: 11FLC(4POLE)
Efficiency (bowl / pump)	: 85.85 / 85.01 %
Power (bowl / pump)	: 47.01 / 47.39 hp
Impeller dia.	: 8.69 in

NPSH required	: 8.34 ft
Fluid density	: 1.000 / 1.000 SG
Viscosity	: 1.00 cP
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Saved Date	: 22 Mar 2024 2:02 PM

Pump Performance - Additional Data

Company Name	
Company contact number	
Quote Number	1819252
Project name	Default

Model/Order No.	FVT-11FLC Enclosed Impeller (STD Model)
Stages	4
Quantity of pumps in parallel	1
Based on curve number	11FLC(4POLE)
Saved Date	22 Mar 2024 2:02 PM

Performance Data	
Head, maximum diameter, rated flow	: 242.2 ft
Head, minimum diameter, rated flow	: 196.6 ft
Head max.	: 321.8 ft
Efficiency adjustment factor, total	: 1.00
Power adjustment, total	: 0.00 hp
Head adjustment factor, total	: 1.00
Flow adjustment factor, total	: 1.00
Flow adjustment factor, efficiency only (shift BEP)	: 1.00
Flow adjustment factor, end-of-curve only, total	: 1.00
MCSF adjustment factor	: 1.00
NPSHR adjustment factor, total	: 1.00
User applied performance adjustment comments	:
NPSH margin dictated by pump supplier	: 0.00 ft
NPSH margin dictated by user	: 0.00 ft
NPSH margin used (added to 'required' values)	: 0.00 ft

Stage, Speed and Solids Limits	
Stages, maximum	: 25
Stages, minimum	: 1
Pump speed limit, maximum	: 3600 rpm
Pump speed limit, minimum	: 1200 rpm
Curve speed limit, maximum	: 1800 rpm
Curve speed limit, minimum	: 1200 rpm
Variable speed limit, maximum	: -
Variable speed limit, minimum	: 5 rpm
Solids size limit	: 0.75 in
Typical Driver Data	
Driver speed, full load	: 1780 rpm
Driver speed, rated load	: 1781 rpm
Driver efficiency, 100% load	: N/A
Driver efficiency, 75% load	: N/A
Driver efficiency, 50% load	: N/A

Mechanical Limits	
Torque, rated power, rated speed	: 2.71 hp/100 rpm
Torque, maximum power, rated speed	: 2.90 hp/100 rpm
Torque, driver power, full load speed	: 2.81 hp/100 rpm
Torque, driver power, rated speed	: 2.81 hp/100 rpm
Torque, pump shaft limit	: 22.99 hp/100 rpm
Radial load, worst case	: -
Radial load limit	: -
Impeller peripheral speed, rated	: -
Impeller peripheral speed limit	: -

Various Performance Data	**Flow (USgpm)**	**Head (ft)**	**Efficiency (%)**	**NPSHr (ft)**	**Power (hp)**
Shutoff, rated	0.00	321.8	-	-	26.08
Shutoff, maximum	0.00	335.6	-	-	27.00
MCSF	455.1	264.8	75.98	6.33	40.04
Rated flow, minimum	695.0	196.6	85.44	-	40.38
Rated flow, maximum	695.0	242.2	85.93	-	49.46
BEP flow, rated	750.8	219.2	86.23	8.83	48.18
120% rated flow, rated	834.0	200.5	85.30	9.75	49.49
End of curve, rated	1,010.9	149.0	75.68	12.48	50.26
End of curve, minimum	950.1	128.8	75.85	11.45	40.72
End of curve, maximum	1,032.4	156.9	75.61	12.85	54.08
Maximum value, rated	-	321.8	86.23	-	50.73
Maximum value, maximum	-	-	86.49	-	54.08

System differential pressure	**@ Density, rated**	**@ Density, max**
Differential pressure, rated flow, rated (psi)	99.54	99.54
Differential pressure, shutoff, rated (psi)	139.3	139.3
Differential pressure, shutoff, maximum (psi)	145.2	145.2

Discharge pressure	**@ Suction pressure, rated**	**@ Suction pressure, max**	**@ Suction pressure, rated**	**@ Suction pressure, max**
Discharge pressure, rated flow, rated (psi.g)	99.54	99.54	99.54	99.54
Discharge pressure, shutoff, rated (psi.g)	139.3	139.3	139.3	139.3
Discharge pressure, shutoff, maximum (psi.g)	145.2	145.2	145.2	145.2

Ratios			
Maximum flow / rated flow, rated	: 145.46 %	Head rated diameter / head minimum diameter, rated flow	: 116.98 %

Pump Performance - Additional Data

Head and Power Losses	
Friction loss rate, column	: 1.49 %
Friction loss, column	: 0.14 ft
Friction loss, discharge head	: 0.26 ft
Friction loss, can/barrel	: -
Friction loss, suction bell and strainer	: 0.00 ft
Friction loss, bowl/column adaptor	: 0.01 ft
Friction loss, total	: 0.41 ft
Power loss, lineshaft bearings	: 0.08 hp
Power loss, thrust bearing	: 0.30 hp
Power loss, total	: 0.38 hp
Bowl vs. Pump Performance	
Head (bowl / pump)	: 230.0 ft / 228.7 ft
Efficiency (bowl / pump)	: 85.85 % / 85.01 %
Power (bowl / pump)	: 47.01 hp / 47.39 hp
NPSH required at first stage impeller eye	: 8.34 ft
Weights and Down Thrust	
Weight, lineshaft	: 36.97 lb
Weight, bowl assembly rotating element	: 388.0 lb
Thrust factor	: 7.90 lb/ft
Thrust, hydraulic (rated / max)	: 1,813.9 / 2,538.1 lbf
Thrust, bowl shaft end (rated / max)	: 0.00 / 0.00 lbf
Thrust, shaft step (rated / max)	: 107.7 / 107.7 lbf
Thrust, stuffing box sleeve (rated / max)	: -65.29 / -65.29 lbf
Thrust, total (rated / max)	: 2,281.3 / 3,005.5 lbf
Thrust Limit	: -

* Rated thrust @ rated head, density, and suction pressure where applicable
* Max thrust @ max head, density, and suction pressure where applicable

Pressure Data	Shut off pressure (psi.g)	Maximum allowable working pressure (psi.g)	Hydrostatic test pressure (psi.g)
Bowl	139.3	400.0	600.0
Column	139.3	1,030.0	-
Discharge head	139.3	200.0	-
Can/Barrel	-	-	-

Torque Limits	
Torque, lineshaft limit	: 7.50 hp/100 rpm

Dimensions	
Minimum clearance below suction bell lip/case	: 5.50 in
Minimum well diameter	: 12.00 in
Suction nozzle centerline height	: -
Suction to first stage impeller centerline	: 8.58 in
Bowl assembly length, first stage	: 24.38 in
Bowl assembly length, upper stage	: 9.88 in
Bowl assembly length, total	: 54.00 in
Suction bearing hub length	: 0.00 in
Strainer length	: 0.00 in
Bowl to column adaptor length	: 0.00 in
Discharge head stick-down	: 0.00 in
Submersible motor adaptor length	: -
Submersible motor length	: -
Column length	: 9.50 ft
Total pump length	: 14.00 ft
Can / barrel length	: -
Stuffing box sleeve diameter	: 1.50 in
Suction bell diameter	: 11.00 in
Minimum submergence to prevent vortexing	: 30.00 in
Minimum submergence for start-up	: 30.00 in
Actual submergence (based on LLL)	: 168 in
Discharge head height	: 20.44 in
Discharge nozzle centerline height	: 10.69 in
Min distance discharge nozzle centerline to suction bell	: 0.00
Lineshaft length	: 11.20 ft
Bowl shaft diameter	: 1.69 in
Bowl diameter, outside	: 11.00 in
Bowl diameter, exit	: 8.19 in
Column diameter, inside	: 8.07 in
Column internal obstruction diameter	: 2.38 in
Can/barrel diameter, inside	: -
Can/barrel obstruction diameter	
NPSH	
NPSH at bowl (available / required)	: Ample / 8.34 ft
NPSH at low liquid level (available / required)	: Ample / -
NPSH at suction flange (available / required)	: - / -
Liquid Velocities	
Column liquid velocity	: 4.77 ft/s
Discharge head liquid velocity	: 4.45 ft/s
Can liquid velocity	: -
Suction nozzle liquid velocity	: -

QUOTATION

Quote Information	
Quote No.	1819252
Quote Date	22 Mar 2024
Project name	Default
Est. Leadtime ARO	16 weeks

/ / /

Wilson, David (dwilson@blanderson.com-franklin)

Customer Information	
To	
Street Address	
City/State/Zip	/ /
Phone No.	

Pump		
Order No.	Qty	Description
	1	*11FLC-1C-2BS-08W-04-AC0-P*
		Bowl
		Configuration
		Bowl Options
		Model: 11FLC
		Bowl Lubrication : Water Lubricated
		Impeller Type: Enclosed
		Bowl shaft diameter: 1-11/16"
		NSF/ANSI 61 Certification: NSF – Compliant
		Material options
179-11FLMHC-030	4	Bowl Material: Cast Iron ASTM A48 Class 30 (default)
		Bowl Wear Ring Material: None
		Bowl Bearing Material: Bronze (Alloy C89835)
708-0004-188	1	Bolting material: 18-8ss Bowl Bolting
		Impeller options
444-11FLCA-304	4	Impeller Material: 304SS Standard (AISI Type 304)
		Impeller Wear Ring material: None
225-0007-416	4	Impeller Collets: AISI Type 416 SS
		Impeller Dynamic Balance: Standard (ISO Grade 6.3)
		Bowl shaft options
760-510076-416	1	Bowl Shaft Material: 416 SS (ASTM A582, Type 416)
		Coupling Type: Threaded Bowl Shaft Coupling
256-0021-416	1	Bowl Shaft Cplg Material: 416 SS (ASTM A582, Type 416)
		Discharge options
		Bowl Discharge Type: Threaded
136-0027-835	1	Bowl Discharge Bearings Material: Bronze (AlloyC89835)
		Bowl Shaft Projection: 7.5" FPS Standard
		Bowl Shaft Threaded Size: 1-3/16"
		Bowl Shaft Pitch Size: 12
		Column Reducing Bushing: Column Reducing Bushing
		Suction options (Selected above)
		Suction Type: Threaded

QUOTATION

Quote Information	
Quote No.	1819252
Quote Date	22 Mar 2024
Project name	Default
Est. Leadtime ARO	16 weeks

Pump		
Order No.	Qty	Description
816-0172-030	1	Suction Size: 8"
		Suction Bearings material: Bronze (Alloy C89835)
164-0007-1045	1	Sand Cap: Sand Cap
		Strainer Type: None
		Column **Configuration** Assemble Pumping Unit Complete: Yes - Less Motor and Barrel (if provided)
		Column Section Length: Max column length 5'
		Column Type: Threaded
		Column Diameter: 8"
		Column Material: Steel (ASTM A53, Grade B)
		Column Wall Thickness: 0.279"
		Column Assembly 8" Diameter Threaded Column / 9.5ft Total Length
		Column Top: Top Column Length: 4.5ft
		Column Bottom: Bottom Column Length: 5ft
		Column Coupling
		Lineshaft: Open (Product Lubricated)
		Lineshaft diameter: 1-3/16"
448-0005-RBR	1	Lineshaft Bearing Material: Neoprene Rubber
672-0043-304	1	Retainer: 304 SS Drop-In Retainer
		Lineshaft material: 416 SS (ASTM A582, Type 416)
256-0021-416	2	Lineshaft Coupling Material: 416 SS (ASTM A582, Type 416)
		Discharge Head & Motor **Configuration** **Discharge Head Design** Discharge Head: Franklin Supplied
		Motor Base Diameter: 10
		Discharge Head Type: Cast Iron
		Discharge Head Diameter: 8" Discharge
		Discharge Head Lubrication: Water Lubricated
		Discharge Head Options Cast Iron Packing Box
		Accessories Headshaft Material: 416 SS
		Stuffing Box Bearing Material: Bronze (C932)
		Discharge Head Seal: Braided Graphite Packing with Stainless Gland

QUOTATION

Quote Information	
Quote No.	1819252
Quote Date	22 Mar 2024
Project name	Default
Est. Leadtime ARO	16 weeks

Pump		
Order No.	Qty	Description
		Coating **Configuration** **Bowl Assembly Coating** Coating Name: Induron PE-70 Epoxy (NSF)
		Coating Thickness: 3-6 Mils DFT (per coat)
		Number of Coats: One Coat
		Coating Color: Gray
		Bowl Surfaces to be Coated: OD of Bowl (Special Coated)
		Column Assembly Coating Column Coating Name: Induron PE-70 Epoxy (NSF)
		Coating Thickness: 3-6 Mils DFT (per coat)
		Number of Coats: One Coat
		Coating Color: Gray
		Column Surfaces to be Coated: Interior and Exterior Column Surface
		Discharge Head Coating Exterior Discharge Head Coating Name: Induron PE-70 Epoxy (NSF)
		Exterior Discharge Head Coating Thickness: 3-6 Mils DFT (per coat)
		Exterior Discharge Head Number of Coats: One Coat
		Exterior Discharge Head Coating Color: Gray
		Interior Discharge Head Coating Name: Induron PE-70 Epoxy (NSF)
		Interior Discharge Head Coating Thickness : 3-6 Mils DFT (per coat)
		Interior Discharge Head Number of Coats : One Coat
		Interior Discharge Head Coating Color : Gray
		Testing Bowl Performance Test: Yes Non-Witness Test
		Hydrostatic Test - Bowl: Yes Non-Witness Test
		Hyd Institute - Acceptance Grade: 2U
		Other Optional Features or Requirements **Special Services / Warranty Options** Warranty: Standard (1 year)

Motor		
Order No.	Qty	Description
1		**Discharge Head & Motor** **Configuration** **Motor** Motor Type: VHS
		Enclosure: WP1

QUOTATION

Quote Information	
Quote No.	1819252
Quote Date	22 Mar 2024
Project name	Default
Est. Leadtime ARO	16 weeks

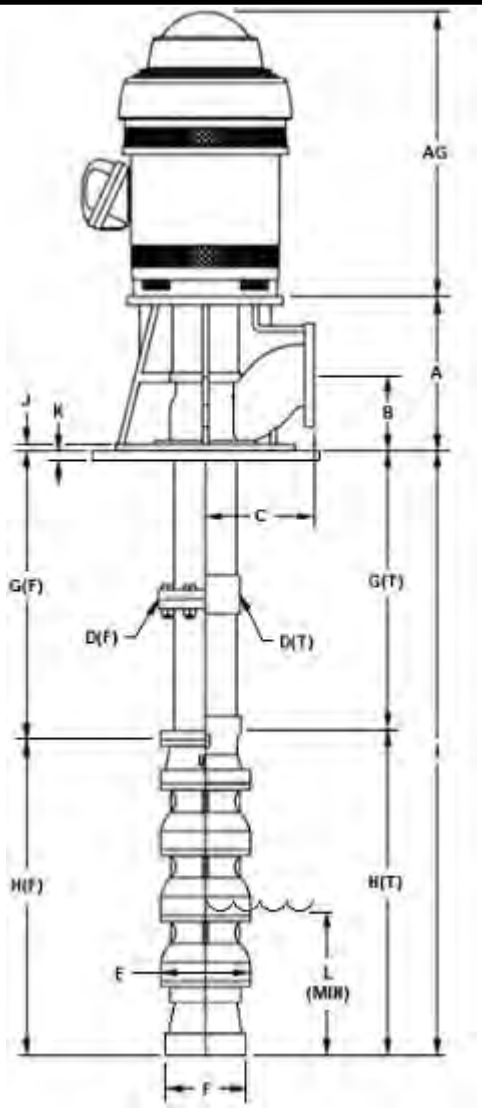
Motor		
Order No.	Qty	Description
		Voltage: 460 PWS
		Inverter Duty: No
		Motor Coupling: Non Reversible Ratchet
US-HO50P2SLG	1	Motor: Nidec 50 HP 1800 RPM 460 PWS V VHS WP1 326TP

FPS

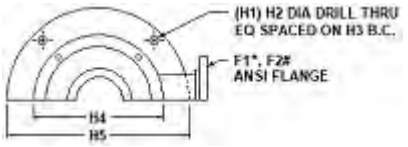
FE SELECT

Quote Number 1819252
Quote Date 17 Nov 2022
Revision

Dimensional Information (11FLC-1C-2BS-08W-04-AC0-P)



Disch Head



Found Plate - NA

Strainer Detail - N/A

Dim	Value
A	20.44 in
B	10.69 in
C	12.50 in
D	9.72 in
E	11.19 in
F	8.00 in
G	9.50 ft
H	54.00 in
I	14.00 ft
J	1.00 in
K	-
L	30.00 in
M	-
-	-
AG	33.31 in
H1	4
H2	1.13 in
H3	18.75 in
H4	16.50 in
H5	21.00 in
F1	8.00 in
F2	125#
-	-
-	-
-	-
-	-
-	-
-	-
-	-
-	-

NOTES:
1. ALL DIMENSIONS ARE IN INCHES +/- 0.375
2. NOT FOR CONSTRUCTION UNLESS CERTIFIED BY ENGINEERING

Project Name:	Default	Certified For:	
PO/REF ID:		Certified By:	
Date:	22 Mar 2024 2:02 PM	Customer:	
Quoted By:	David Wilson	Customer Contact:	
Quoted By Phone:		Customer Phone:	

Franklin Electric

FVT Vertical Turbine
Dimensional Information

Drawing Number: Rev:

FPS

FE SELECT

Quote Number 1819252
Quote Date 17 Nov 2022
Revision

Product Datasheet (11FLC-1C-2BS-08W-04-AC0-P)

Item Number: 004	Lube Type: Water Lubricated	Pump Speed: 1750 rpm
Pump Model: FVT11FLC	Number of Stages: 4	

General Data		
Flow: 695.0 USgpm	Head: 230.0 ft	NPSHR: 8.34 ft
Liquid: Water	SG: 0.9983	Efficiency: 85.01 %
Liquid Temp.: 68.00 deg F	Viscosity: 1.00 cP	MCSF: 455.1 USgpm

Pump Data		
Bowl Model: 11FLC	Column Conn. Size: 8.00 in	DH Model: TR8C 12/16.5 BD 3.75F
Stages: 04	Column Conn. Type: Threaded	Flange Size: 8" 125#
Bowl Shaft Diameter: 1-11/16"	LS Coupling Size: 1-3/16"-12	DH Construction: Cast Iron
Impeller Type: Enclosed	Lineshaft Diameter: 1.19 in	Column Size: 8" - Threaded
Impeller Dia.: 8.69 in	Total Rated Thrust: 2,281.3 lbf	Col Pipe Wall Thickness: 0.279"
Impeller Conn. Type: Collet	Power Rated: 50.00 hp	Strainer Type: None

Material Data		
Bowl: Cast Iron ASTM A48 Class 30 (default)	Impeller: 304SS Standard (AISI Type 304)	LS Coupling: 416 SS (ASTM A582, Type 416)
Bowl WR: None	Impeller WR: None	Col Pipe: Steel (ASTM A53, Grade B)
Bowl Shaft: 416 SS (ASTM A582, Type 416)	Lineshaft: 416 SS (ASTM A582, Type 416)	Discharge Head: Cast Iron
Collet: AISI Type 416 SS	Bowl Bearing: Bronze (Alloy C89835)	Strainer: -

Motor Data		
MFG: Nidec	HP: 50.00 hp	Enclosure: WP1
Type: VHS	RPM: 1750 rpm	Phase: 3
Frame: 326TP	Volts: 460 PWS	Frequency: 60 Hz
Catalog: HO50P2SLG		

Weights	Mechanical Seal Data	
Est. Pump Wt.: 550.0 lb	Mfg:	Type:
Est. Motor Wt.: 537.0 lb	Size:	API Code:

Coatings	
Bowl ID: Vitreous Enamel	Bowl OD: Induron PE-70 Epoxy (NSF)
Column ID: Induron PE-70 Epoxy (NSF)	Column OD: Induron PE-70 Epoxy (NSF)
Head ID: Induron PE-70 Epoxy (NSF)	Head OD: Induron PE-70 Epoxy (NSF)
Tube OD:	

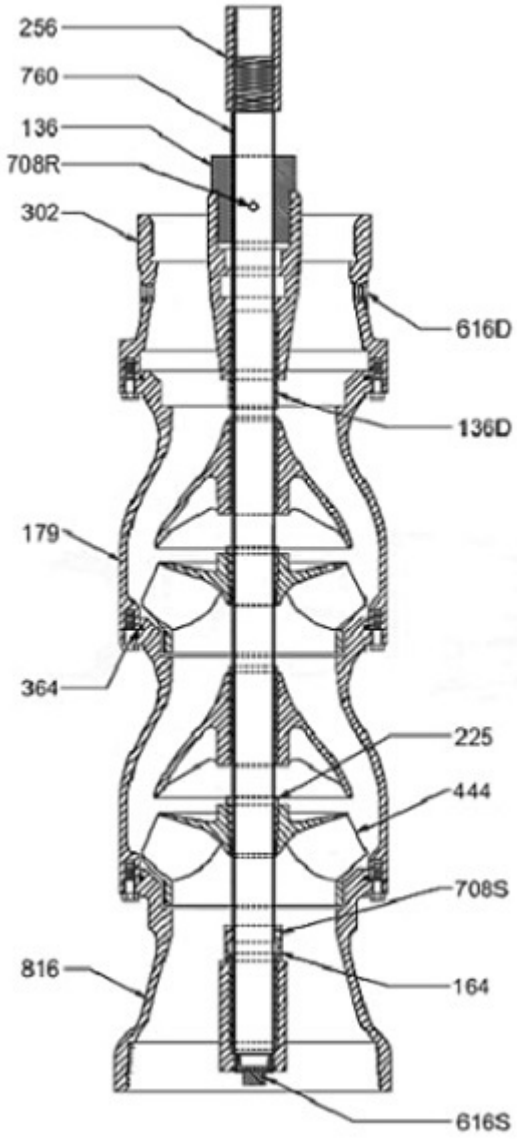
Project Name:	Default	Certified For:	
PO/REF ID:		Certified By:	
Date:	22 Mar 2024 2:02 PM	Customer:	
Quoted By:	David Wilson	Customer Contact:	
Quoted By Phone:		Customer Phone:	
Franklin Electric		**FVT Vertical Turbine Product Datasheet**	
		Drawing Number:	Rev:

FPS

FE SELECT

Quote Number 1819252
Quote Date 17 Nov 2022
Revision

Bill of Materials (11FLC-1C-2BS-08W-04-AC0-P)



ITEM	DESCRIPTION	QTY	PART NUMBER
136	SUCTION CASE BEARING	1	136-0091-835
136D	DISCHARGE CASE BEARING	1	136-0027-835
164	SAND COLLAR	1	164-0007-1045
179	BOWL ASSEMBLY	4	179-11FLMHC-030
225	IMPELLER COLLET	4	225-0007-416
256	BOWLSHAFT COUPLING	1	256-0021-416
302	DISCHARGE CASE	1	302-0088-065
364	BOWL O-RING	5	364-0147-BN
444	IMPELLER	4	444-11FLCA-304
616D	DISCHARGE CASE PLUG	2	616-0003-STL
616S	SUCTION CASE PLUG	1	616-0006-STL
708R	DISCHARGE CASE SET SCREW	1	708-0004-188
708S	SAND COLLAR SET SCREW	2	708-0002-188
708	ASSEMBLY HEX SCREWS	40	708-0077-188
760	BOWL SHAFT	60.25	760-510076-416
816	SUCTION CASE	1	816-0172-030
-			-
-			-
-			-

IMPELLER TRIM: 8.69 in

NOTES:
1. ALL DIMENSIONS ARE IN INCHES +/- 0.375
2. NOT FOR CONSTRUCTION UNLESS CERTIFIED BY ENGINEERING

Project Name:	Default	Certified For:	
PO/REF ID:		Certified By:	
Date:	22 Mar 2024 2:02 PM	Customer:	
Quoted By:	David Wilson	Customer Contact:	
Quoted By Phone:		Customer Phone:	

Franklin Electric

FVT Vertical Turbine
Bill of Materials

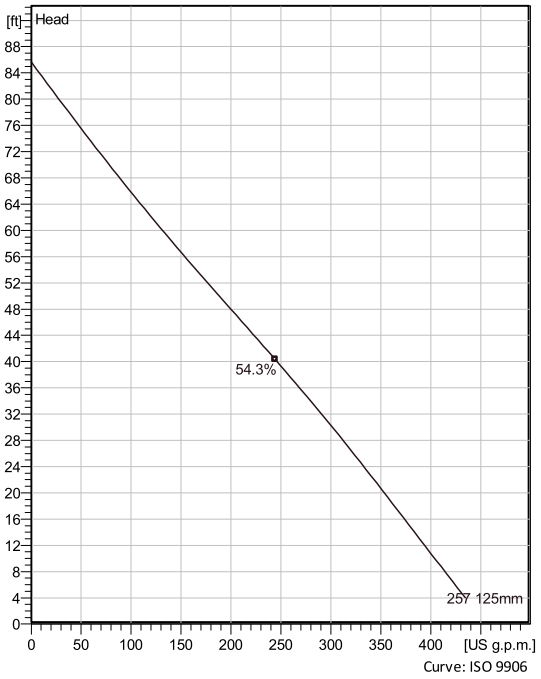
Drawing Number: Rev:

NP 3102 SH 3~ Adaptive 257

Patented self cleaning semi-open channel impeller, ideal for pumping in most waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
N3102.770 18-10-2AL-W 6.5hp

Installation type
P - Semi permanent, Wet

Impeller diameter
125 mm

Discharge diameter
3 inch

Pump information

Impeller diameter
125 mm

Discharge diameter
3 inch

Inlet diameter
100 mm

Maximum operating speed
3440 rpm

Number of blades
2

Max. fluid temperature
40 °C

Material

Impeller
Stainless steel

Stator housing material
Grey cast iron

Project	Xylect-22029516	**Created by**	Dave Wilson		
Block		**Created on**	3/20/2024	**Last update**	3/20/2024

NP 3102 SH 3~ Adaptive 257

Technical specification

Motor - General

Motor number N3102.770 18-10-2AL-W 6.5hp	**Phases** 3~	**Rated speed** 3440 rpm	**Rated power** 6.5 hp
Approval FM	**Number of poles** 2	**Rated current** 8.2 A	**Stator variant** 12
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty** S1
Version code 770			

Motor - Technical

Power factor - 1/1 Load 0.94	**Motor efficiency - 1/1 Load** 78.9 %	**Total moment of inertia** 0.37 lb ft²	**Starts per hour max.** 30
Power factor - 3/4 Load 0.94	**Motor efficiency - 3/4 Load** 80.5 %	**Starting current, direct starting** 56 A	
Power factor - 1/2 Load 0.91	**Motor efficiency - 1/2 Load** 79.6 %	**Starting current, star-delta** 18.7 A	

Project	Xylect-22029516	**Created by**	Dave Wilson		
Block		**Created on**	3/20/2024	**Last update**	3/20/2024

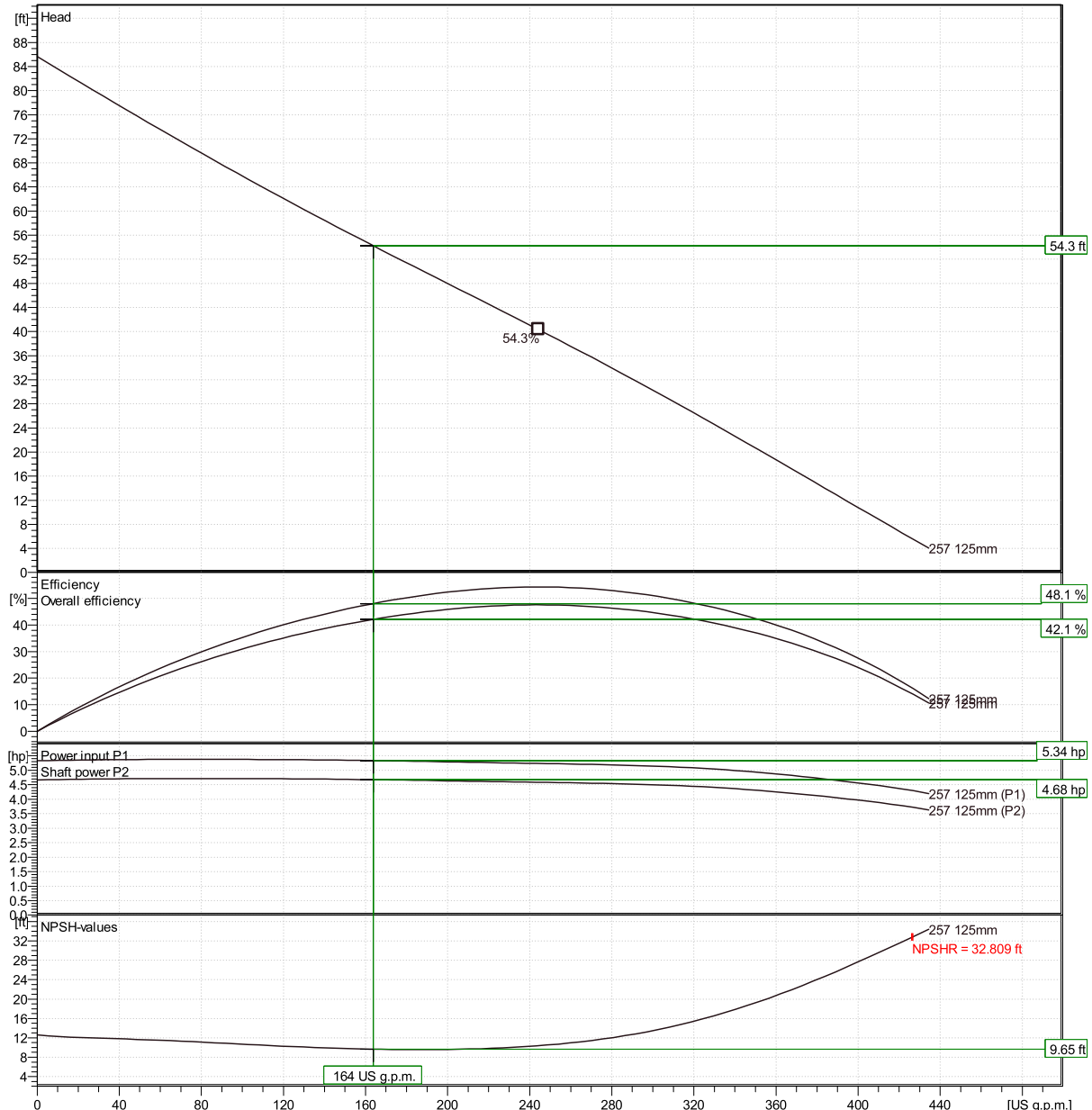
NP 3102 SH 3~ Adaptive 257

Performance curve

Duty point

Flow	Head
164 US g.p.m.	54.3 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

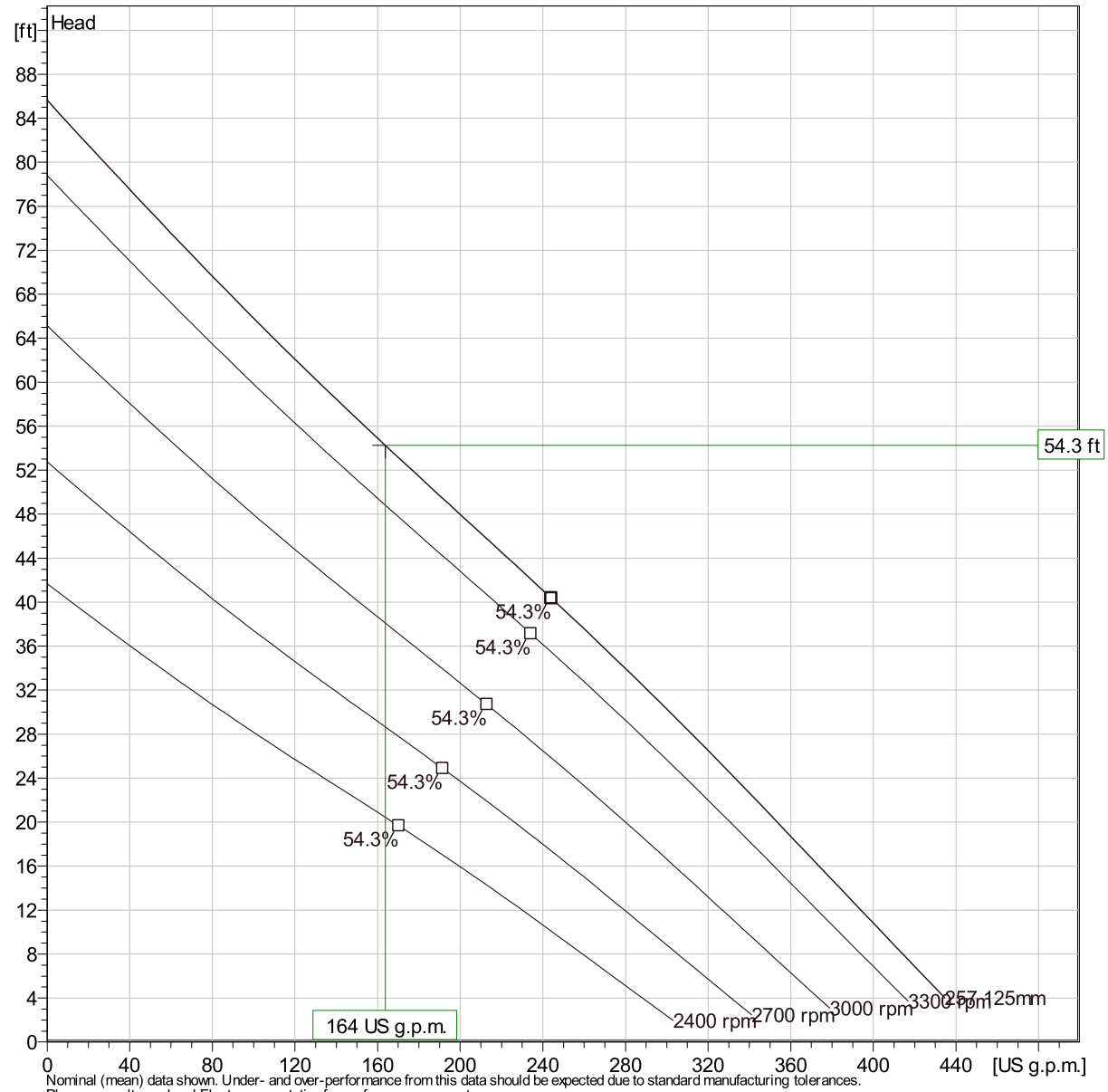
Curve: ISO 9906

Xylect-22029516	Dave Wilson		
Created on	3/20/2024	**Last update**	3/20/2024

NP 3102 SH 3~ Adaptive 257

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

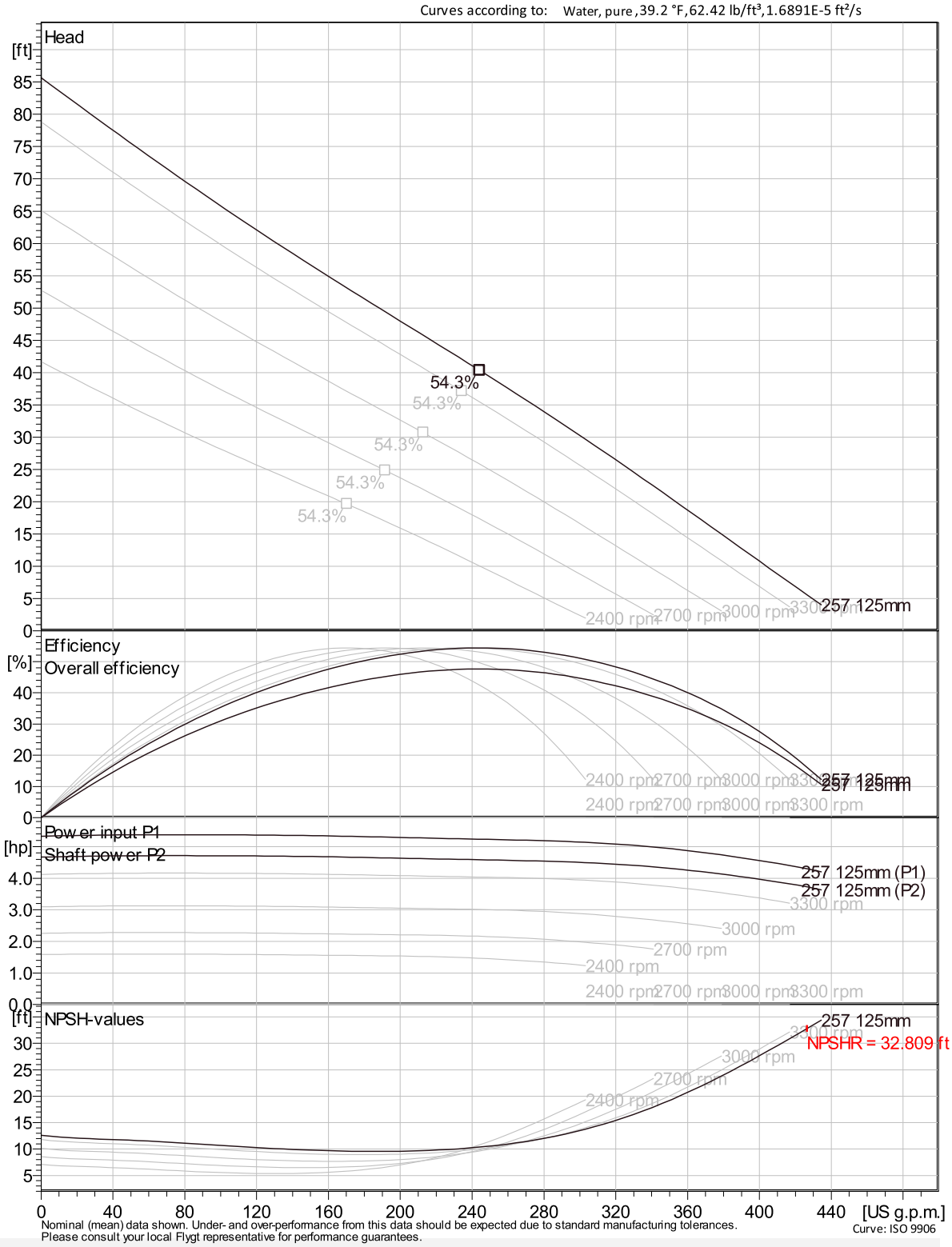
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	164	54.3	4.68	164	54.3	4.68	48.1 %	405	9.65

Project		**Created by**	Dave Wilson		
Block	Xylect-22029516	**Created on**	3/20/2024	**Last update**	3/20/2024

NP 3102 SH 3~ Adaptive 257

VFD Curve

Curves according to: Water, pure ,39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



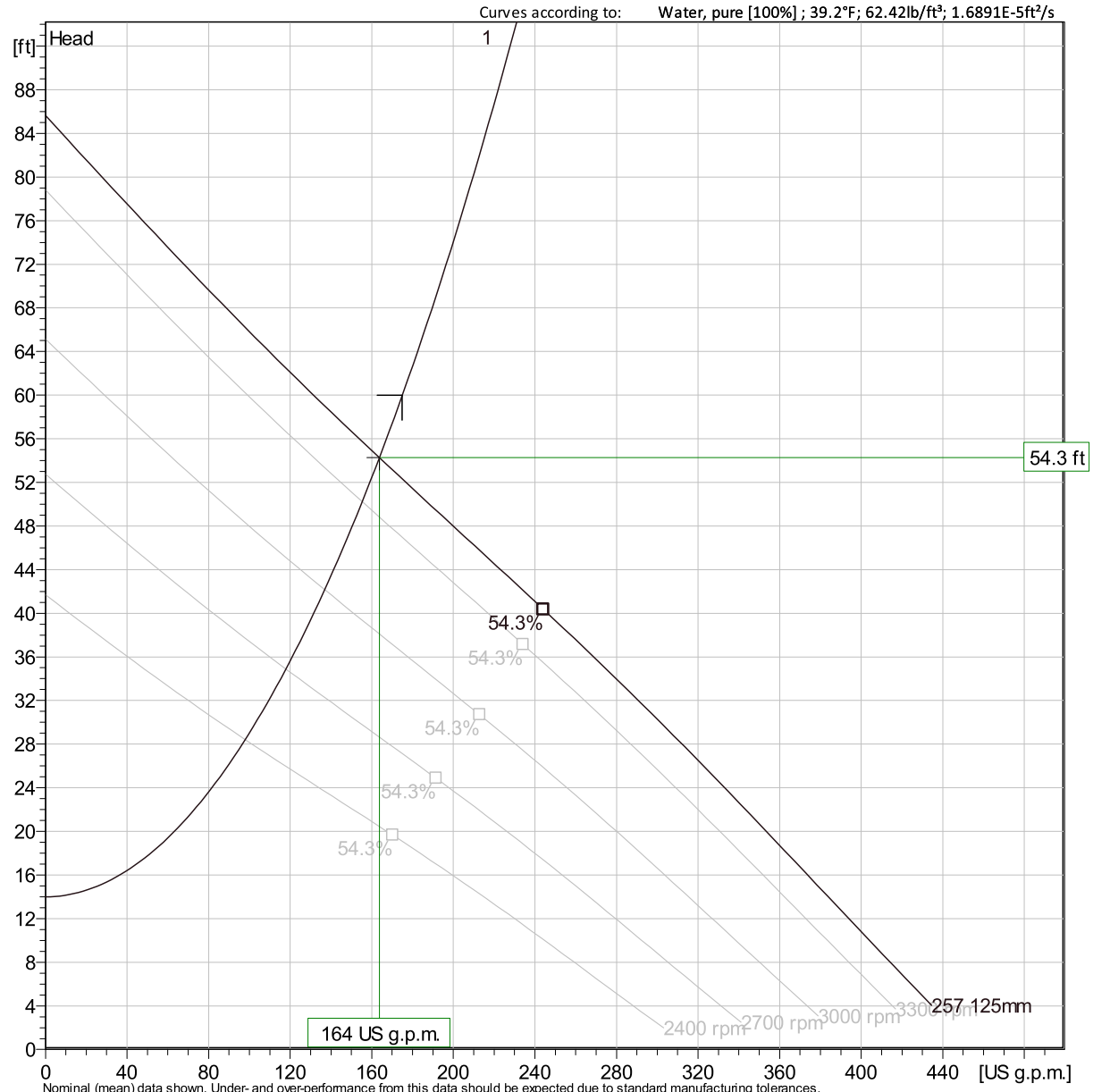
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

Project	Xylect-22029516	**Created by**	Dave Wilson		
Block		**Created on**	3/20/2024	**Last update**	3/20/2024

NP 3102 SH 3~ Adaptive 257

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

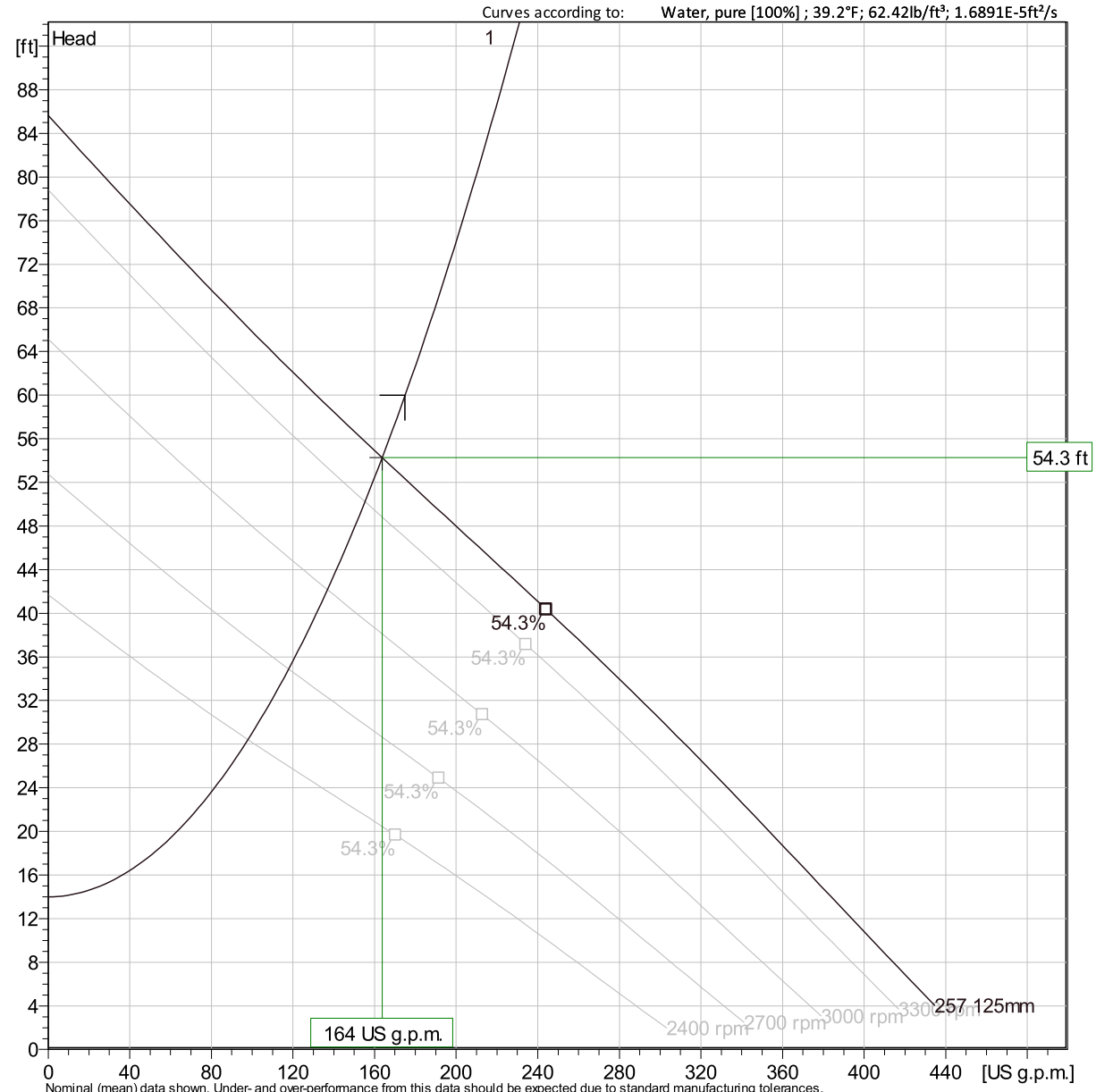
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	57.3 Hz	164	54.3	4.68	164	54.3	4.68	48.1 %	405	9.65
1	55 Hz	155	50.2	4.13	155	50.2	4.13	47.8 %		9.05
1	50 Hz	137	42.2	3.11	137	42.2	3.11	47 %		7.8
1	45 Hz	118	34.9	2.27	118	34.9	2.27	45.9 %		6.64

Project	Xylect-22029516	**Created by**	Dave Wilson		
Block		**Created on**	3/20/2024	**Last update**	3/20/2024

NP 3102 SH 3~ Adaptive 257

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

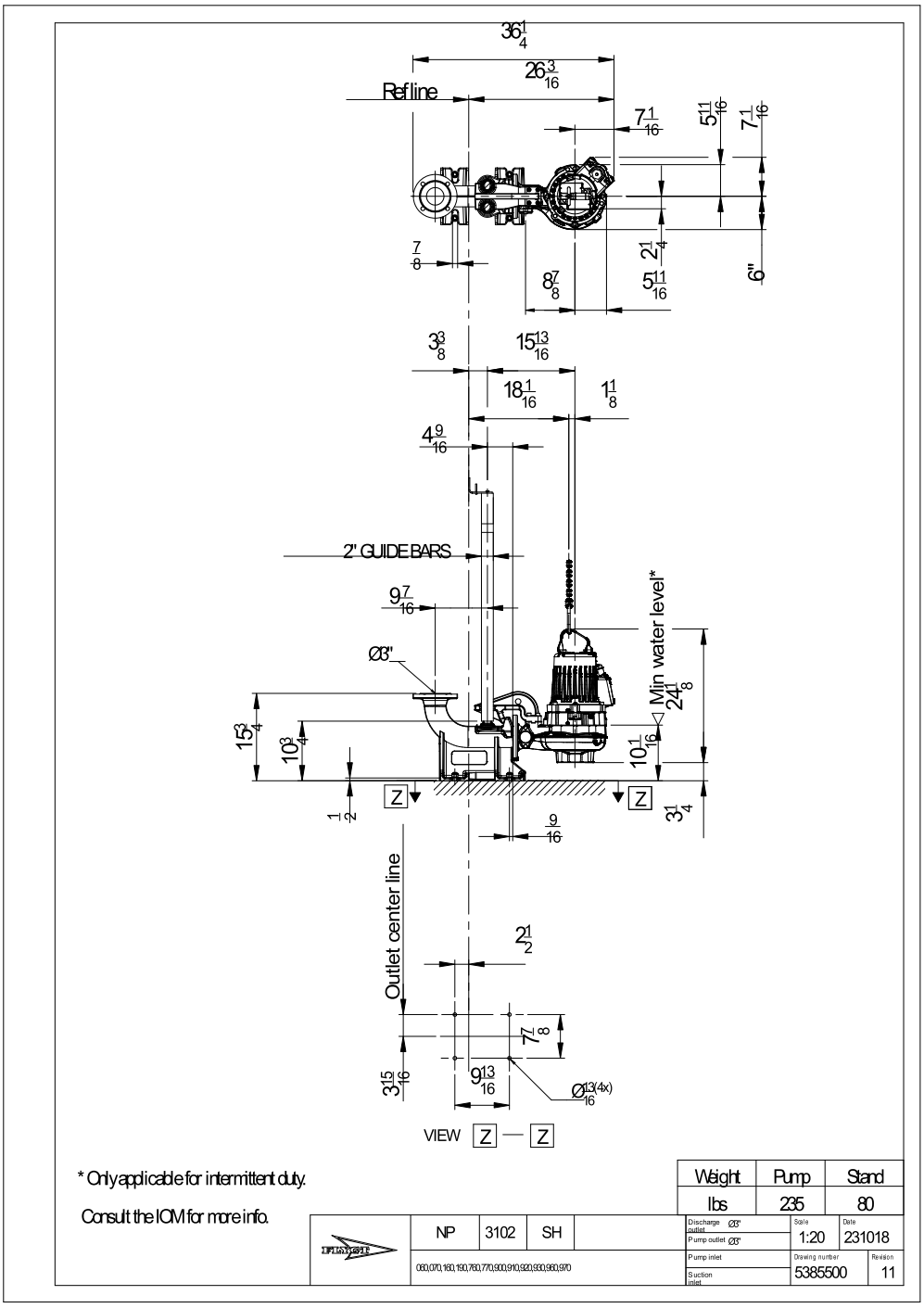
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	40 Hz	98	28.4	1.59	98	28.4	1.59	44.2 %		5.58

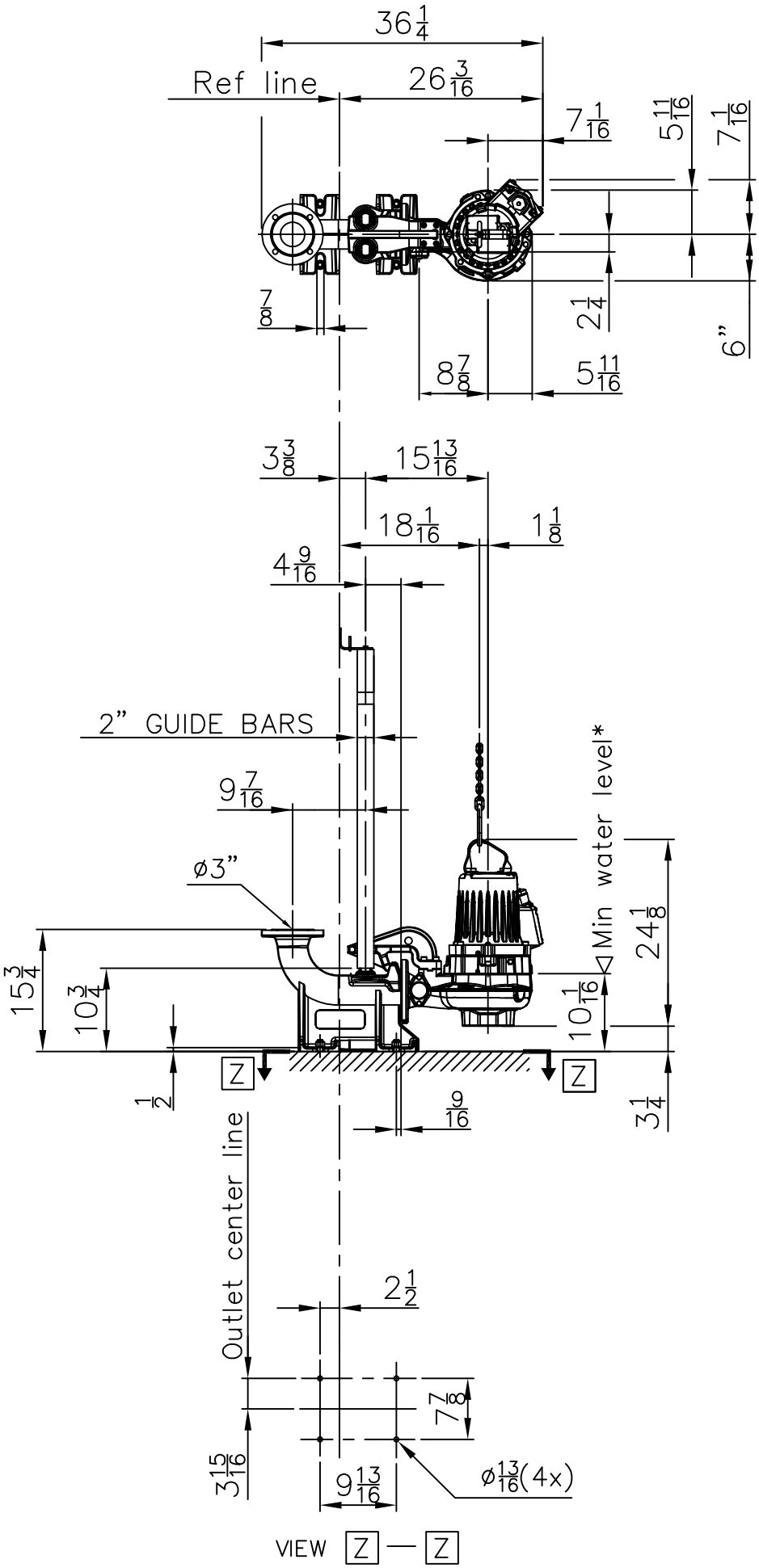
Project	Xylect-22029516	**Created by**	Dave Wilson		
Block		**Created on**	3/20/2024	**Last update**	3/20/2024

NP 3102 SH 3~ Adaptive 257

Dimensional drawing



Project	Xylect-22029516	**Created by**	Dave Wilson
Block		**Created on**	3/20/2024 **Last update** 3/20/2024



* Only applicable for intermittent duty.
Consult the IOM for more info.

Weight	Pump	Stand
lbs	235	80

IFLYGT	NP	3102	SH		Discharge outlet ø3”	Scale 1: 20
					Pump outlet ø3”	Date 231018
	060,070,160,190,760,770,900,910,920,930,960,970				Pump inlet	Drawing number 5385500
					Suction inlet	Revision 11

BL ANDERSON

SNYDER TANK CONFIGURATION

TANK

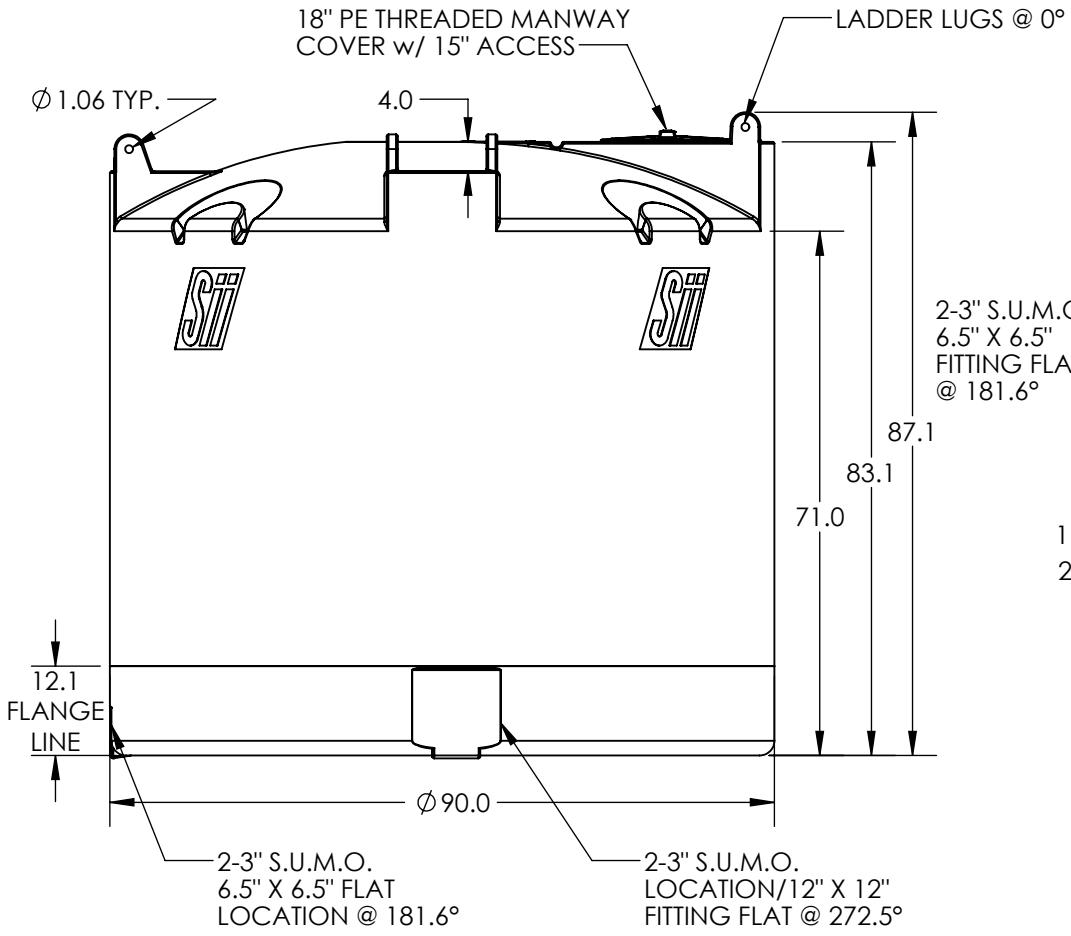
PART NUMBER	TANK TYPE	RESIN	CAPACITY	COLOR	BRIMFUL CAPACITY	D x H	CYLINDER H.	SG	MANWAY (IN)
5050000N45	VERTICAL STORAGE TANK	HDLPE	2000	NATURAL	2100	90 x 88	72	1.9	18

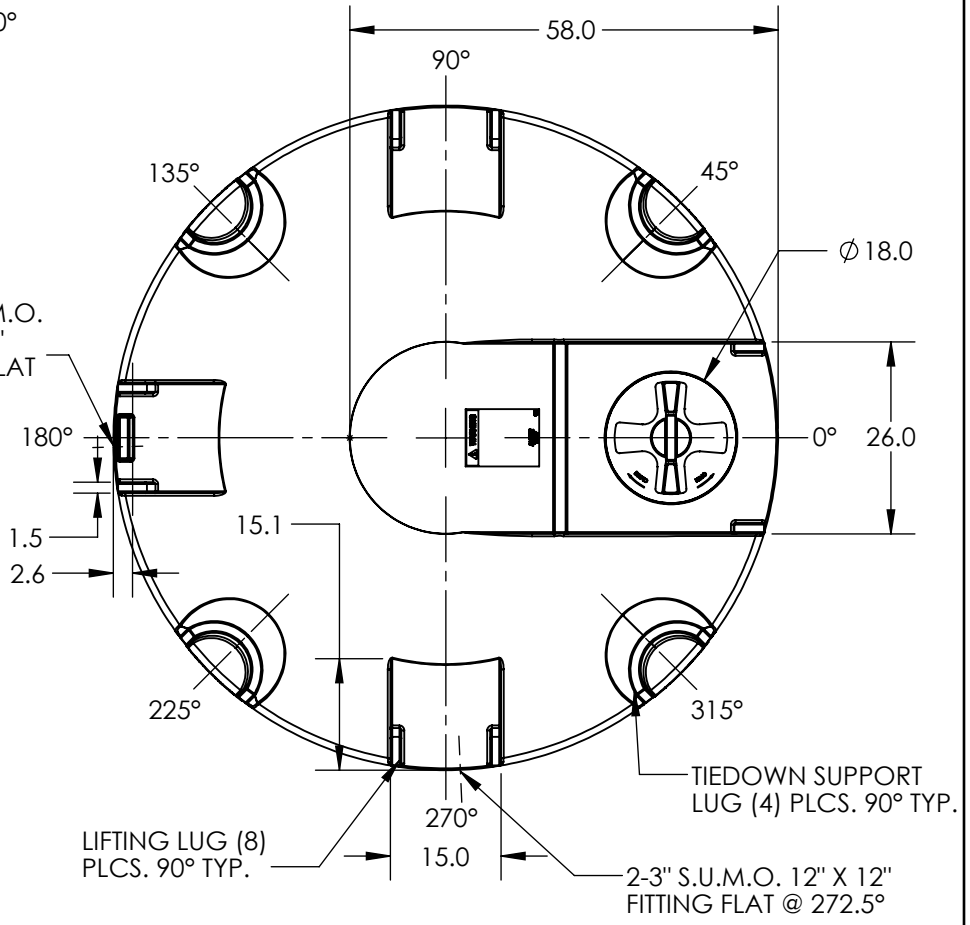
FITTINGS

PART NUMBER	DESCRIPTION	FITTING	GASKET	BOLT ENCAPS.	BOLT	FITTING SIZE (IN)	# BOLTS	BOLT DIAMETER	
34700661	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	HASTELLOY	3	4	0.625	
34700862	FLANGE ADAPTER	PVC				3			FILL
34700661	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	HASTELLOY	3	4	0.625	
34701258	SIPHON TUBE	PVC				3			
34700862	FLANGE ADAPTER	PVC				3			DRAIN
34700663	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	HASTELLOY	4	8	0.625	
34700863	FLANGE ADAPTER	PVC				4			OVERFLOW
34700667	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	HASTELLOY	8	8	0.75	
34700865	FLANGE ADAPTER	PVC				8			VENT

ACCESSORIES

PART NUMBER	DESCRIPTION
00000173	PROTECTIVE PACKAGING - 1700 - 3900 GALLONS
339---	FRP LADDER FOR VST,CCS (2000+ GALLONS)
34700397	FRP LADDER ATTACHMENT KIT
347-FRPCAGE	FRP LADDER SAFETY CAGE
00000286	STENCILING - 22 CHARACTERS PER LINE MAX. ADD 54 PER ADDITIONAL LINE
34701515	ULTRASONIC LEVEL INDICATOR – INCLUDES FITTING. FOR TANKS 79IN OR TALLER ONLY.
00000285	ASTM DOCUMENTATION
34701134	18" MANWAY (PE) - FUME TIGHT*** BOLTED SEALED 13-1/2" 48IN - 143IN DIA.
99700194	GALLONAGE INDICATOR ADHESIVE DECALS - 90IN DIA. VST's





***ALL EXTERNAL PIPING MUST BE INDEPENDENTLY SUPPORTED.**
***ONLY BASE FITTINGS TO BE LEFT INSTALLED AT TIME OF SHIPMENT PER SII PROCEDURE.**
***Consult Snyder's Guidelines for Use and Installation prior to delivery.**
Available on-line at http://www.snyderindustriestanks.com/Technical

ALL DIMENSIONS ARE IN INCHES, NOMINAL, & SUBJECT TO CHANGE WITHOUT NOTICE.
ALL DIMENSIONS ON ROTATIONAL MOLDED PARTS ARE SUBJECT TO A ± 3% TOLERANCE.

DO NOT SCALE	DRAWN BY	DATE
STATUS: **Released**	ET3	02/11/2014

SNYDER INDUSTRIES, INC.
(402) 467-5221
www.snydernet.com

TITLE: **ASM TK 2000VDT X 90**

REVISION: **A**

SHEET: 1 OF 1

PART NO.: **5050000N**

ENG. ID.: **D001146**

BL ANDERSON

SNYDER TANK CONFIGURATION

TANK

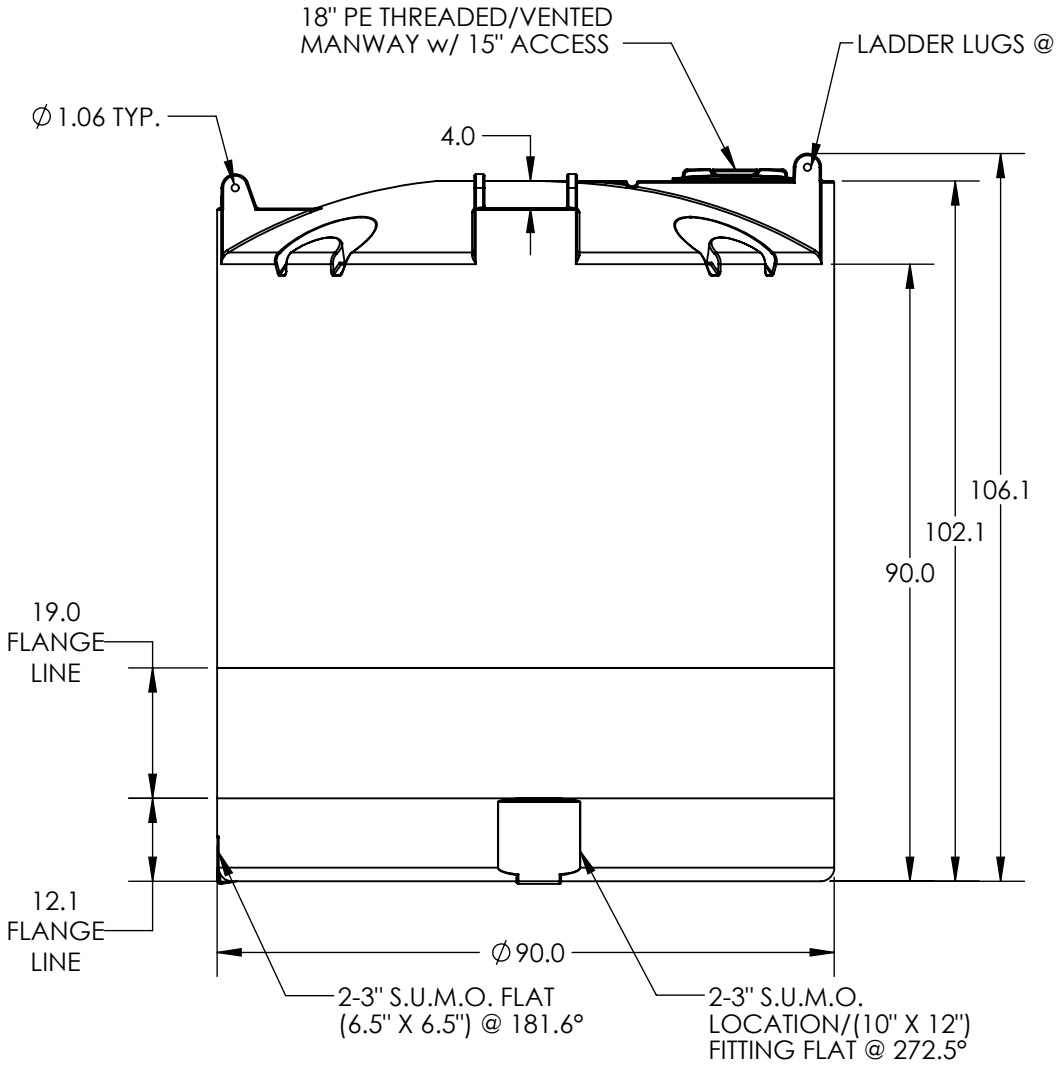
PART NUMBER	TANK TYPE	RESIN	CAPACITY	COLOR	BRIMFUL CAPACITY	D x H	CYLINDER H.	SG	MANWAY (IN)
5090000N45	VERTICAL STORAGE TANK	HDLPE	2500	NATURAL	2600	90 x 107	92	1.9	18

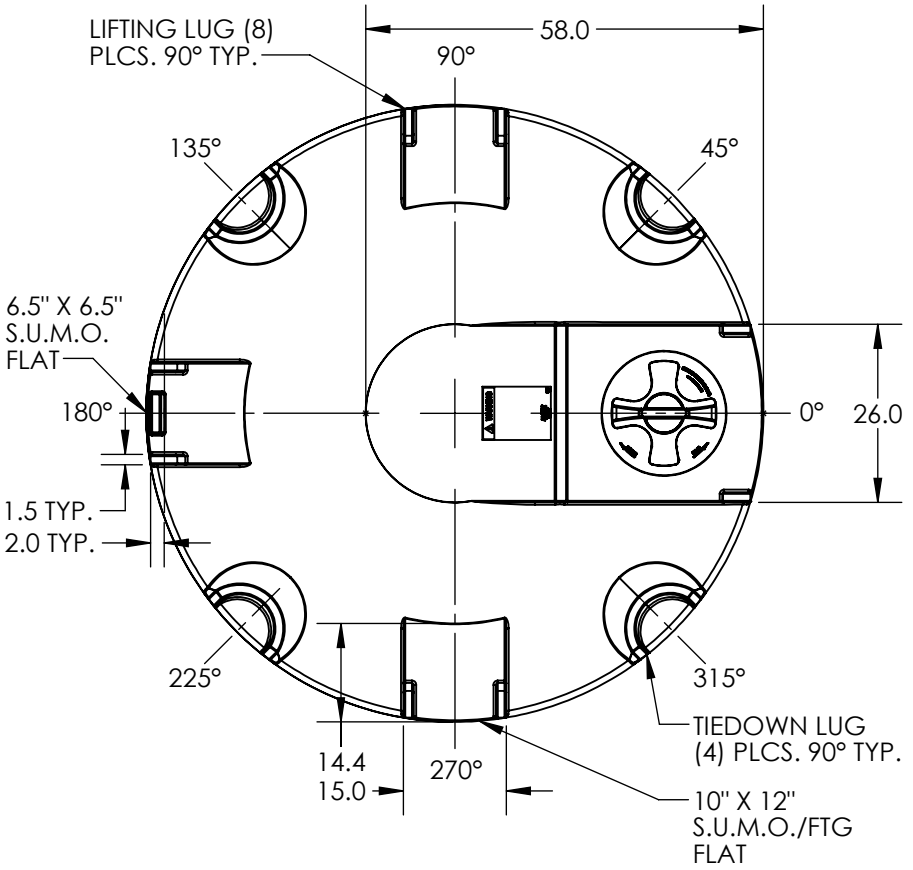
FITTINGS

PART NUMBER	DESCRIPTION	FITTING	GASKET	BOLT ENCAPS.	BOLT	FITTING SIZE (IN)	# BOLTS	BOLT DIAMETER	
34700689	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	TITANIUM	3	4	0.625	
34700862	FLANGE ADAPTER	PVC				3			FILL
34700689	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	TITANIUM	3	4	0.625	
34701258	SIPHON TUBE	PVC				3			
34700862	FLANGE ADAPTER	PVC				3			DRAIN
34700691	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	TITANIUM	4	8	0.625	
34700863	FLANGE ADAPTER	PVC				4			OVERFLOW
34700695	BOLTED DOUBLE FLANGE FITTING	PVC	VITON	PE	TITANIUM	8	8	0.75	
34700865	FLANGE ADAPTER	PVC				8			VENT

ACCESSORIES

PART NUMBER	DESCRIPTION
00000173	PROTECTIVE PACKAGING - 1700 - 3900 GALLONS
339---	FRP LADDER FOR VST,CCS (2000+ GALLONS)
34700397	FRP LADDER ATTACHMENT KIT
347-FRPCAGE	FRP LADDER SAFETY CAGE
00000286	STENCILING - 22 CHARACTERS PER LINE MAX. ADD 54 PER ADDITIONAL LINE
34701515	ULTRASONIC LEVEL INDICATOR – INCLUDES FITTING. FOR TANKS 79IN OR TALLER ONLY.
00000285	ASTM DOCUMENTATION
34701134	18" MANWAY (PE) - FUME TIGHT*** BOLTED SEALED 13-1/2" 48IN - 143IN DIA.
99700194	GALLONAGE INDICATOR ADHESIVE DECALS - 90IN DIA. VST's





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ALL DIMENSIONS ON ROTATIONAL MOLDED PARTS ARE SUBJECT TO A ± 3% TOLERANCE.

DO NOT SCALE	DRAWN BY	DATE
STATUS: **Released**	ET3	02/07/2014

4700 Fremont Street
Lincoln, NE 68504
(402) 467-5221
www.snydernet.com

TITLE:	REVISION
ASM TK 2500VDT X 90	**A**
	SHEET 1 OF 1
PART NO. **5090000N**	ENG. ID. **D001150**

environmental improvements, inc.

Preliminary Budget

DATE: March 26, 2024
BID DATE: N/A
TO: Dave Wilson
BL Anderson
PROJECT: Loveland, Ohio
Water Treatement Plant
SECTION: N/A

REV: 0
THRU ADDENDUM: 0
SUBMITTALS: 4-6 Weeks
DELIVERY: 10-12 Weeks
QUOTE VALID FOR: 90 Days

SCOPE OF SUPPLY

SECTION:	QTY:	DESCRIPTION:	MANUFACTURER
		Fluorosilicic Acid, 23-25%	
	1	Duplex Chemical Feed Skid	Environmental Improvements
		Free Standing System, Welded HDPE Skid Assembly to include:	
		• (2) - Milton Roy ERB 22 1 A44ACA7T1 Pumps w/ flex connections (BL Anderson Supplied)	
		• (2) - Calibration Column sized 500 ml (PVC), with 1/2" Isolation Valves (PVC/Viton)	
		• (2) - Y-Strainer (PVC/Viton)	
		• (2) - Discharge Plumbing Assembly with 1/2" Isolation Valves (PVC/Viton)	
		• (2) - Discharge pulsation dampener 10 cu in. (PVC/Viton)	
		• (2) - Pressure Gauge with diaphragm isolator	
		• (2) - Pressure Switch with diaphragm isolator	
		• (2) - Pressure Relief Valve (PVC)	
		• (2) - Back Pressure Valve (PVC)	
		• (4) - Flushing Connection with quick connect fittings	
		• (2) - Nema 4x Junction Box	
		• (1) - 40 Gal Gemini Dual Containment® Tank - XLPE HD 1.9 - Natural	
		• (1) - Chem-Scale™ Electronic Chemical Tank Scale	
		• (1) - Solo G2™ Digital Weight Indicator, single channel	
		• (2) - Solo G2™ Alarm/Control Relay	
		• Interconnect PVC, pipe, valves and supports system within the skid	
		• Electrical Wiring and conduit within the skid	
	1	Transfer Pump (BL Anderson Supplied)	
		• Milton Roy MacRoy D7282PE14N1 (storage to day tank)	
		Sodium Hypochlorite, 10-12%	
	1	Duplex Chemical Feed Skid	Environmental Improvements
		Free Standing System, Welded HDPE Skid Assembly to include:	
		• (2) - Milton Roy ERB 23 1 A74TCA7T1 Pumps w/ flex connections (BL Anderson Supplied)	
		• (2) - Calibration Column sized 500 ml (PVC), with 1/2" Isolation Valves (CPVC/Viton)	
		• (2) - Y-Strainer (CPVC/Viton)	
		• (2) - Discharge Plumbing Assembly with 1/2" Isolation Valves (CPVC/Viton)	
		• (2) - Discharge pulsation dampener 10 cu in. (CPVC/Viton)	
		• (2) - Pressure Gauge with diaphragm isolator	
		• (2) - Pressure Switch with diaphragm isolator	
		• (2) - Pressure Relief Valve (CPVC)	
		• (2) - Back Pressure Valve (CPVC)	
		• (4) - Flushing Connection with quick connect fittings	
		• (2) - Nema 4x Junction Box	
		• Interconnect CPVC, pipe, vented ball valves and supports system within the skid	
		• Electrical Wiring and conduit within the skid	

SECTION:	QTY:	DESCRIPTION:	MANUFACTURER

Sodium Hypochlorite, 10-12% (CONTINUED)

1 Day Chemical Storage Equipment to Include:

- (1) - 90 Gal Gemini Dual Containment® Tank - XLPE HD 1.9 - Natural
- (1) - Chem-Scale™ Electronic Chemical Tank Scale
- (1) - Solo G2™ Digital Weight Indicator, single channel

1
- (2) - Solo G2™ Alarm/Control Relay

Transfer Pump (BL Anderson Supplied)

- Milton Roy MacRoy D8682PE14N1 (storage to day tank)

COMMENTS & CLARIFICATIONS

- Ball valves, check valves, fittings & piping outside of skid shall be provided by others. Chemical Supply & Installation by others.
- Environmental Improvements proposes to furnish materials, and or equipment for the above project. Any items not shown above as detailed under 'SCOPE OF SUPPLY', or other attachments to this proposal, are EXCLUDED. In Addition, installation labor, misc. plumbing, piping, valves, fittings, chemical supply, gauges, supports, anchor bolts, electrical conduit and any other items not specifically listed above, shall be supplied by others.
- Freight to job site, one year warranty and O&M's are all included in the scope of supply.

PROTEUS® Series
Metering Pumps

DATA SHEET

Manual, Enhanced, and Communications Models

The PROTEUS® metering pump is a mechanically actuated diaphragm pump driven by advanced variable speed technology to provide the most accurate and reliable performance in the industry. This proven technology is easy to maintain and will provide years of maximum up-time service. Available in three control configurations, Manual, Enhanced, and Communications Models, the PROTEUS® pump fits seamlessly into the process control requirements of every application. The Manual model is the entry level model with two digital inputs, the Enhanced model provides a full range of capabilities, and the Communications model offers Profibus DP or Modbus RTU communication protocols for 2-way communication. All models come standard with a color backlit display, multilanguage options and remote operation options. The PROTEUS® metering pump provides everything you need for complete control of your process.

Applications

Whatever your application, the PROTEUS metering pump can provide the performance you need. Designed for the specific requirements of municipal and industrial water and waste treatment, the PROTEUS pump is suitable for a wide range of applications.

- Water treatment
- Waste water treatment
- General industry
- Agricultural
- Chemical
- Oil & gas
- Power generation
- Pulp & paper
- Textiles
- Other (contact your local authorized representative)

NSF Certified to NSF/ANSI 61 & 372

Performance Specifications

Turndown Ratio:	**Up to 1000:1**
Steady State Accuracy:	**+/- 1.0%**
Repetitive Accuracy:	**+/- 3.0%**
Linearity:	**+/- 3.0%**
Duty Rating:	**Continuous**

Features and Benefits

- Intuitive user interface with backlit color display makes setup and customization simple.
- Wide range of control and input/output options to meet the demanding needs of most applications.
- Universal power supply providing maximum flexibility to power your pump: 100-240V, 50/60 Hz
- Multi-language navigation (English, French, Spanish, Portuguese and Chinese) for convenient operation anywhere in the field.
- Innovative drive system creates superior +/- 1% steady state accuracy over 1000:1 turndown ratio for greater flexibility of handling difficult chemicals.
- Optional liquid-end materials to maximize the life of the pump in challenging environments: polypropylene, PVDF, and 316L Stainless Steel.
- Mechanically actuated diaphragms for simple maintenance and reliable operation.
- Rugged construction with NEMA 4X/IP 65 housing and protective cover for the harshest environments.

MILTON ROY

Literature #IR-54815.04 Rev 2/2020

OUTPUT CODE 2 — 5.6 GPH (21.2 LPH); 175 psi (12 bar)

Drive End Note: Cordsets from the accessories table may be required for the customer to connect to desired input/output.

Control	Description	Cordset Included	Part Number	
ERB12	Manual Control	-	-	See Note
ERB22	Enhanced Control	4 Pin Cordset	54711	
ERB32	Enhanced Control with ProfiBus	5 Pin Cordset	55199	
ERB42	Enhanced Control with ModBus	5 Pin Cordset	55199	

Power Code	Voltage	Plug
1	110/240V	110 - 120 VAC 1 Phase US Plug
2	220/240V	220 - 240 VAC 1 Phase US Plug
3	220/240V	220 - 240 VAC 1 Phase DIN Plug
5	220/240V	220 - 240 VAC 1 Phase UK Plug
6	220/240V	220 - 240 VAC 1 Phase Australia / New Zealand Plug

Liquid End	Head	Seat	Balls	Check Valve Body	Max Turndown Ratio	RPM Kit Standard	RPM Kit DN15 Conn.
Standard Plastic							
A44AC	PP	TFE/P	Ceramic	PVDF	1000:1	RPM54771	RPM54772
A44A1	PP	TFE/P	316L	PVDF	1000:1	RPM54778	RPM54779
A44AT	PP	TFE/P	PTFE	PVDF	1000:1	RPM56409	RPM56410
A74TC	PVDF	PTFE	Ceramic	PVDF	200:1	RPM54773	RPM54774
A74AT	PVDF	TFE/P	PTFE	PVDF	1000:1	RPM56409	RPM56410
Standard Metallic							
A1411	316L	316L	316L	316L	1000:1	see below	
Slurry							
S1414	316L	316L	440C	316L	1000:1	RPM54776	
High Viscosity	**PE Tubing limited to 150 psi (10.3) Bar**						
V44T1	PP	PTFE	316L	PP	1000:1	RPM54777	

Standard Plastic	Diaphragm	O-Rings	Fittings	Connections	Tubing Kit	RPM Kit
A7T1	PTFE/PVDF	TFE/P	PVDF	Imperial Tube	1	-
A7PN	PTFE/PVDF	TFE/P	PVDF	1/2" NPT/BSP	-	-
A7M2	PTFE/PVDF	TFE/P	PVDF	Metric Tube	2	-
A2FN	PTFE/PVDF	TFE/P	PVDF/PVC	DN 15 Female	-	see above
A7DN (PVDF heads only)	PTFE/PVDF	TFE/P	PVDF	DN 15 Male	-	see above
Standard Metallic						
A1PN	PTFE/316L	TFE/P	316L	1/2" NPT/BSP	-	RPM56407
V1PN	PTFE/316L	FKM	316L	1/2" NPT/BSP	-	RPM54775
Slurry						
V1PN	PTFE/316L	FKM	316L	1/2" NPT/BSP	-	-
High Viscosity						
N4T3	PTFE/PVDF	-	PP	Imperial Tube	3	-

ERB12	1	A44AC	A7T1

OUTPUT CODE 3 — 14.0 GPH (53.0 LPH); 75 psi (5 bar)

Drive End Note: Cordsets from the accessories table may be required for the customer to connect to desired input/output.

Control	Description	Cordset Included	Part Number	
ERB13	Manual Control	-	-	See Note
ERB23	Enhanced Control	4 Pin Cordset	54711	
ERB33	Enhanced Control with ProfiBus	5 Pin Cordset	55199	
ERB43	Enhanced Control with ModBus	5 Pin Cordset	55199	

Power Code	Voltage	Plug
1	110/240V	110 - 120 VAC 1 Phase US Plug
2	220/240V	220 - 240 VAC 1 Phase US Plug
3	220/240V	220 - 240 VAC 1 Phase DIN Plug
5	220/240V	220 - 240 VAC 1 Phase UK Plug
6	220/240V	220 - 240 VAC 1 Phase Australia / New Zealand Plug

Liquid End	Head	Seat	Balls	Check Valve Body	Max Turndown Ratio	RPM Kit Standard	RPM Kit DN15 Conn.
Standard Plastic							
A44AC	PP	TFE/P	Ceramic	PVDF	1000:1	RPM54771	RPM54772
A44A1	PP	TFE/P	316L	PVDF	1000:1	RPM54778	RPM54779
A44AT	PP	TFE/P	PTFE	PVDF	1000:1	RPM56409	RPM56410
A74TC	PVDF	PTFE	Ceramic	PVDF	200:1	RPM54773	RPM54774
A74AT	PVDF	TFE/P	PTFE	PVDF	1000:1	RPM56409	RPM56410
Standard Metallic							
A1411	316L	316L	316L	316L	1000:1	see below	
Slurry							
S1414	316L	316L	440C	316L	1000:1	RPM54776	
High Viscosity							
V44T1	PP	PTFE	316L	PP	1000:1	RPM54777	

Standard Plastic	Diaphragm	O-Rings	Fittings	Connections	Tubing Kit	RPM Kit
A7T1	PTFE/PVDF	TFE/P	PVDF	Imperial Tube	1	-
A7PN	PTFE/PVDF	TFE/P	PVDF	1/2" NPT/BSP	-	-
A7M2	PTFE/PVDF	TFE/P	PVDF	Metric Tube	2	-
A2FN	PTFE/PVDF	TFE/P	PVDF/PVC	DN15 Female	-	see above
A7DN PVDF heads only	PTFE/PVDF	TFE/P	PVDF	DN15 Male	-	see above
Standard Metallic						
A1PN	PTFE/316L	TFE/P	316L	1/2" NPT/BSP	-	RPM56407
V1PN	PTFE/316L	FKM	316L	1/2" NPT/BSP	-	RPM54775
Slurry						
V1PN	PTFE/316L	FKM	316L	1/2" NPT/BSP	-	-
High Viscosity						
N4T3	PTFE/PVDF	-	PP	Imperial Tube	3	-

ERB13	1	A44AC	A7T1

OUTPUT CODE 4 — 18.0 GPH (68.1 LPH); 50 psi (3.5 bar)

Drive End Note: Cordsets from the accessories table may be required for the customer to connect to desired input/output.

Control	Description	Cordset Included	Part Number	
ERB14	Manual Control	-	-	See Note
ERB24	Enhanced Control	4 Pin Cordset	54711	
ERB34	Enhanced Control with ProfiBus	5 Pin Cordset	55199	
ERB44	Enhanced Control with ModBus	5 Pin Cordset	55199	

Power Code	Voltage	Plug
1	110/240V	110 - 120 VAC 1 Phase US Plug
2	220/240V	220 - 240 VAC 1 Phase US Plug
3	220/240V	220 - 240 VAC 1 Phase DIN Plug
5	220/240V	220 - 240 VAC 1 Phase UK Plug
6	220/240V	220 - 240 VAC 1 Phase Australia / New Zealand Plug

Liquid End	Head	Seat	Balls	Check Valve Body	Diaphragm	Max Turndown Ratio	RPM Kit
Standard PP							
A46VC	PP	FKM	Ceramic	PP	PTFE	500:1	RPM54780
A46V1	PP	FKM	PTFE	PP	PTFE	500:1	RPM54784
A46AC	PP	TFE/P	Ceramic	PP	PTFE	500:1	RPM56405
A46A1	PP	TFE/P	316L	PP	PTFE	500:1	RPM56406
Standard PVDF							
A76VC	PVDF	FKM	Ceramic	PVDF	PTFE	500:1	RPM54780
A76AT	PVDF	TFE/P	PTFE	PVDF	PTFE	500:1	RPM56411
A76AC	PVDF	TFE/P	Ceramic	PVDF	PTFE	500:1	RPM56405
Standard Metallic							
A1611	316L	316L	316L	316L	PTFE	1000:1	see below
Slurry							
S1614	316L	316L	440C	316L	PTFE	1000:1	RPM54783
High Viscosity							
V46T1	PVC	PTFE	PTFE	PP	PTFE	1000:1	RPM54782

Standard PP	O-Rings	Fittings	Connections	Tubing Kit	RPM Kit
N4PN	-	PP	1/2" NPT/BSP	-	-
N4TN	-	PP	Imperial Tube	-	-
N2FN	-	PP/PVC	DN15 Female	-	-
Standard PVDF	-				
N2FN	-	PVDF/PVC	DN15 Female	-	-
N7PN	-	PVDF	1/2" NPT/BSP	-	-
N7TN	-	PVDF	Imperial Tube	-	-
Standard Metallic					
A1PN	TFE/P	316L	1/2" NPT/BSP	-	RPM56408
V1PN	FKM	316L	1/2" NPT/BSP	-	RPM54781
Slurry					
V1PN	FKM	316L	1/2" NPT/BSP	-	-
High Viscosity					
N4P4	-	PP	1/2" NPT/BSP	4	-
N4T4	-	PP	Imperial Tube	4	-

ERB14	1	A46AC	N4PN

OUTPUT CODE 2 — 16 GPH (60.6 LPH); 150 psi (10.3 bar)

Drive End Note: Cordsets from the accessories table may be required for the customer to connect to desired input/output.

Control	Description	Cordset Included	Part Number	
ERC12	Manual Control	-	-	See Note
ERC22	Enhanced Control	4 Pin Cordset	54711	
ERC32	Enhanced Control with ProfiBus	5 Pin Cordset	55199	
ERC42	Enhanced Control with ModBus	5 Pin Cordset	55199	

Power Code	Voltage	Plug
1	110/240V	110 - 120 VAC 1 Phase US Plug
2	220/240V	220 - 240 VAC 1 Phase US Plug
3	220/240V	220 - 240 VAC 1 Phase DIN Plug
5	220/240V	220 - 240 VAC 1 Phase UK Plug
6	220/240V	220 - 240 VAC 1 Phase Australia / New Zealand Plug

Liquid End	Head	Seat	Balls	Check Valve Body	Max Turndown Ratio	RPM Kit Standard	RPM Kit DN15 Conn.
Standard Plastic							
A44A1	PP	TFE/P	316L	PVDF	1000:1	RPM54778	RPM54779
A44AC	PP	TFE/P	Ceramic	PVDF	1000:1	RPM54771	RPM54772
A44AT	PP	TFE/P	PTFE	PVDF	1000:1	RPM56409	RPM56410
A74AT	PVDF	TFE/P	PTFE	PVDF	1000:1	RPM56419	RPM56410
A74TC	PVDF	PTFE	Ceramic	PVDF	200:1	RPM54773	RPM54774
Standard Metallic							
A1411	316L	316L	316L	316L	1000:1	see below	
Slurry							
S1414	316L	316L	440C	316L	1000:1	see below	
High Viscosity							
V44T1	PP	PTFE	316L	PP	1000:1	see below	

Standard Plastic	Diaphragm	O-Rings	Fittings	Connections	Tubing Kit	RPM Kit
A2FN	PTFE/PVDF	TFE/P	PVDF/PVC	DN 15 Female	1	-
A7M2	PTFE/PVDF	TFE/P	PVDF	Metric Tube	2	-
A7PN	PTFE/PVDF	TFE/P	PVDF	1/2" NPT/BSP	-	-
A7T1	PTFE/PVDF	TFE/P	PVDF	Imperial Tube	1	-
A7DN (PVDF heads only)	PTFE/PVDF	TFE/P	PVDF	DN 15 Male	-	-
Standard Metallic						
A1PN	PTFE/316L	TFE/P	316L	1/2" FNPT	-	RPM56407
V1PN	PTFE/316L	FKM	316L	1/2" FNPT	-	RPM54775
Slurry						
V1PN	PTFE/316L	FKM	316L	1/2" FNPT	-	RPM54776
High Viscosity						
N4T3	PTFE/PVDF	-	PP	Imperial Tube	3	RPM54777

ERC12	1	A44AC	A7T1

OUTPUT CODE 3 — 32 GPH (121.1 LPH); 100 psi (6.9 bar)

Drive End Note: Cordsets from the accessories table may be required for the customer to connect to desired input/output.

Control	Description	Cordset Included	Part Number	
ERC13	Manual Control	-	-	See Note
ERC23	Enhanced Control	4 Pin Cordset	54711	
ERC33	Enhanced Control with ProfiBus	5 Pin Cordset	55199	
ERC43	Enhanced Control with ModBus	5 Pin Cordset	55199	

Power Code	Voltage	Plug
1	110/120V	110 - 120 VAC 1 Phase US Plug
2	220/240V	220 - 240 VAC 1 Phase US Plug
3	220/240V	220 - 240 VAC 1 Phase DIN Plug
5	220/240V	220 - 240 VAC 1 Phase UK Plug
6	220/240V	220 - 240 VAC 1 Phase Australia / New Zealand Plug

Liquid End	Head	Seat	Balls	Check Valve Body	Max Turndown Ratio	RPM Kit
Standard PP						
A46A1	PP	TFE/P	316L	PP	500:1	RPM56406
A46AC	PP	TFE/P	Ceramic	PP	500:1	RPM56405
A46V1	PP	FKM	316L	PP	500:1	RPM54784
A46VC	PP	FKM	Ceramic	PP	500:1	RPM54780
Standard PVDF						
A76AC	PVDF	TFE/P	Ceramic	PVDF	500:1	RPM56405
A76AT	PVDF	TFE/P	PTFE	PVDF	500:1	RPM56411
A76VC	PVDF	FKM	Ceramic	PVDF	500:1	RPM54780
Standard Metallic						
A1611	316L	316L	316L	316L	1000:1	see below
Slurry						
S1614	316L	316L	440C	316L	1000:1	RPM54783
High Viscosity						
V46T1	PP	PTFE	316L	PP	1000:1	RPM54782

Standard PP	Diaphragm	O-Rings	Fittings	Connections	Tubing Kit	RPM Kit
N4PN	PTFE	-	PP	1/2" MNPT	-	-
N2FN	PTFE	-	PP/PVC	DN15 Female	-	-
Standard PVDF						
N2FN	PTFE	-	PP/PVC	DN15 Female	-	-
N7PN	PTFE	-	PVDF	1/2" MNPT	-	-
Standard Metallic						
A1PN	PTFE	TFE/P	316L	1/2" FNPT	-	RPM56408
V1PN	PTFE	FKM	316L	1/2" FNPT	-	RPM54781
Slurry						
V1PN	PTFE	FKM	316L	1/2" FNPT	-	-
High Viscosity						
N4P4	PTFE	-	PP	1/2" MNPT	4	-

ERC13	1	A46VC	N4PN

OUTPUT CODE 4 — 53 GPH (200.6 LPH); 60 psi (4.1 bar)

Drive End Note: Cordsets from the accessories table may be required for the customer to connect to desired input/output.

Control	Description	Cordset Included	Part Number	
ERC14	Manual Control	-	-	See Note
ERC24	Enhanced Control	4 Pin Cordset	54711	
ERC34	Enhanced Control with ProfiBus	5 Pin Cordset	55199	
ERC44	Enhanced Control with ModBus	5 Pin Cordset	55199	

Power Code	Voltage	Plug
1	110/120V	110 - 120 VAC 1 Phase US Plug
2	220/240V	220 - 240 VAC 1 Phase US Plug
3	220/240V	220 - 240 VAC 1 Phase DIN Plug
5	220/240V	220 - 240 VAC 1 Phase UK Plug
6	220/240V	220 - 240 VAC 1 Phase Australia / New Zealand Plug

Liquid End	Head	Seat	Balls	Check Valve Body	Max Turndown Ratio	RPM Kit
Standard PP						
A46A1	PP	TFE/P	316L	PVDF	500:1	RPM56406
A46AC	PP	TFE/P	Ceramic	PVDF	500:1	RPM56405
A46V1	PP	FKM	316L	PVDF	500:1	RPM54784
A46VC	PP	FKM	Ceramic	PVDF	500:1	RPM54780
Standard PVDF						
A76AC	PVDF	TFE/P	Ceramic	PVDF	500:1	RPM56405
A76AT	PVDF	TFE/P	PTFE	PVDF	500:1	RPM56411
A76VC	PVDF	FKM	Ceramic	PVDF	500:1	RPM54780
Standard Metallic						
A1611	316L	316L	316L	316L	1000:1	see below
Slurry						
S1614	316L	316L	440C	316L	1000:1	RPM54783
High Viscosity						
V46T1	PP	PTFE	PTFE	PP	1000:1	RPM54782

Standard PP	Diaphragm	O-Rings	Fittings	Connections	Tubing Kit	RPM Kit
N7NN	PTFE	-	PVDF	3/4" MNPT	-	-
N2GN	PTFE	-	PVDF/PVC	DN20 Female	-	-
Standard PVDF						
N7NN	PTFE	-	PVDF	3/4" MNPT	-	-
N2GN	PTFE	-	PVDF/PVC	DN20 Female	-	-
Standard Metallic						
A1NN	PTFE	TFE/P	316L	3/4" MNPT	-	RPM56408
V1NN	PTFE	FKM	316L	3/4" MNPT	-	RPM54781
Slurry						
V1NN	PTFE	FKM	316L	3/4" MNPT	-	-
High Viscosity						
N4N5	PTFE	-	PP	3/4" MNPT	5	-

ERC14	1	A46VC	N7NN

Tubing Kits (included in select pump configurations)

Tubing Kit 1
- Injection Valve
- Foot Valve
- 1 Weight (Suction Tubing)
- 16' PE Tube 3/8"
- 20" Reinforced PVC Hose 1/4" x 1/2"

Tubing Kit 2
- Injection Valve
- Foot Valve
- 1 Weight (Suction Tubing)
- Metric Ferrules 6x12mm
- 6m Reinforced PVC Hose 6x12mm

Tubing Kit 3
- Injection Valve
- 2m Reinforced PVC hose 15x23mm (Suction)
- 3m PE Tube 1/2" (Discharge)
- 1 Suction hose fitting (1/2" FNPT x 15x23 hose) & 2 hose clamps

Tubing Kit 4
- 2m Reinforced PVC hose 15x23mm (Suction)
- 1 Suction hose fitting (1/2" FNPT x 15x23 hose) & 2 hose clamps

Tubing Kit 5
- 6.5ft Reinforced PVC hose 0.75" x 1.031" (Suction)
- 1 Suction hose fitting (3/4" MNPT x 0.75" x 1.031" hose) & 2 hose clamps

Output Code ERBx2, ERBx3, ERCx2

Imperial Connections Part Number	Imperial Connections Description	Metric Connections Part Number	Metric Connections Description
PP Head, 316 SS Balls			
58982	Injection Valve, PTFE	58982	Injection Valve, PTFE
58987	Foot Valve, Mixed	58987	Foot Valve, Mixed
59008	Connection Kit, 0.375 and 0.25 x 0.5	59009	Connection Kit, 6x12
	Tubing Kit, includes:		Tubing Kit, includes:
10342-10	3/8" TUBE x 10 FT	36181-6M	8mm TUBE X 6m
54342-20	1/4" x 1/2" HOSE x 20 FT	70121-6M	6x12mm HOSE X 6m
PP Head, Ceramic Balls			
58983	Injection Valve, Mixed	58983	Injection Valve, Mixed
58985	Foot Valve, Aflas	58985	Foot Valve, Aflas
59008	Connection Kit, 0.375 and 0.25 x 0.5	59009	Connection Kit, 6x12
	Tubing Kit, includes:		Tubing Kit, includes:
10342-10	3/8" TUBE X 10 FT	36181-6M	8mm TUBE X 6m
54342-20	1/4" x 1/2" HOSE x 20 FT	70121-6M	6x12mm HOSE X 6m
PVDF Head, Ceramic Balls			
58983	Injection Valve, Mixed	58983	Injection Valve, Mixed
58986	Foot Valve, PTFE	58986	Foot Valve, PTFE
59008	Connection Kit, 0.375 and 0.25 x 0.5	59009	Connection Kit, 6x12
	Tubing Kit, includes:		Tubing Kit, includes:
10342-10	3/8" TUBE X 10 FT	36181-6M	8mm TUBE X 6m
54342-20	1/4" x 1/2" HOSE x 20 FT	70121-6M	6x12mm HOSE X 6m
		High Viscosity	
		58984	Injection Valve, HV
		59010	Connection Kit, Hose Clamp
		59013	Tubing Kit, HV

Output Code ERBx4 (all kits), ERCx3 (NPT Connections only)

Imperial Connections Part No	Imperial Connections Description	Metric Connections Part No	Metric Connections Description
PP Head			
26758	Injection Valve, 0.5" Tube, PP, PTFE, Cer	26710	Injection Valve, NPT, PP, PTFE, Cer
25154	Foot Valve, 0.5" Tube, PP, PTFE, Cer	26015	Foot Valve, NPT, PP, PTFE, Cer
77384	Connection Kit, 0.5" Tubing		
PVDF Head			
33481	Injec. Valve, 0.5" Tube, PVDF, PTFE, Cer	38270	Injec. Valve, NPT, PVDF, PTFE, Cer
33480	Foot Valve, 0.5" Tube, PVDF, PTFE, Cer	38271	Foot Valve, NPT, PVDF, PTFE, Cer
77384	Connection Kit, 0.5" Tubing		
High Viscocity			
56912	Inject. Valve 0.5" MNPT, PVDF, PTFE, Cer		

Input/Output Cordsets

Part No.	Description	Application Notes
48414	CORDSET, 5 PIN, 2 M / 6.6 FT	(J2) Digital output
49035	CORDSET, 6 PIN, 2 M / 6.6 FT	(J1 & J4) Digital input & Analog output
54711	CORDSET, 4 PIN, 2 M / 6.6 FT	(J3) Analog input
55199	CORDSET, 5 PIN, 2 M / 6.6 FT	(C) ProfiBus/ModBus Communicaton

Extension Cable Assembles - 5 Pin

Part No.	Description
50503-3	Extension Cable, 3 M / 9.8 Ft
50503-6	Extension Cable, 6 M / 19.7 Ft
50503-15	Extension Cable, 15 M / 49.2 Ft
50503-30	Extension Cable, 30 M / 98.4 Ft

Extension Cable Assembles - 6 Pin

Part No.	Description
50684-3	Extension Cable, 3 M / 9.8 Ft
50684-6	Extension Cable, 6 M / 19.7 Ft
50684-15	Extension Cable, 15 M / 49.2 Ft
50684-30	Extension Cable, 30 M / 98.4 Ft

Literature #IR-54815.04 Rev 2/2020

Electronic control by model

	Control Version		
	Manual model	Enhanced model	Communications model
User Interface			
Four Color Backlit graphical display	●	●	●
Flow rate or volume display (GPH, L/hr)	●	●	●
Capacity setting display	●	●	●
Start/Stop button	●	●	●
Mode/Select button	●	●	●
Full capacity (100%) button	●	●	●
Prime button	●	●	●
Active operation mode indication on display	●	●	●
Active alarm indication on display	●	●	●
Calibration status indication on display	●	●	●
Operation Modes			
Manual (Internal)	●	●	●
Analog [0/4-20 mA] (External)		●	●
Pulse [volume/pulse] (External)		●	●
Batch (External)		●	●
Cycle Timer (Internal)		●	●
Timed event (Internal)		●	●
Control Input			
Programmable digital contacts	1	4	4
User 1		●	●
User 2		●	●
User 3		●	●
Single level float switch	●	●	●
Dual low level float switch		●	●
Pulse control		●	●
Remote start/stop	●	●	●
Remote internal/external mode selection		●	●
Programmable analog inputs	0	2	2
Pacing		●	●
Tank level		●	●
Control Protocol			
Modbus RTU*			●
Profibus DP*			●

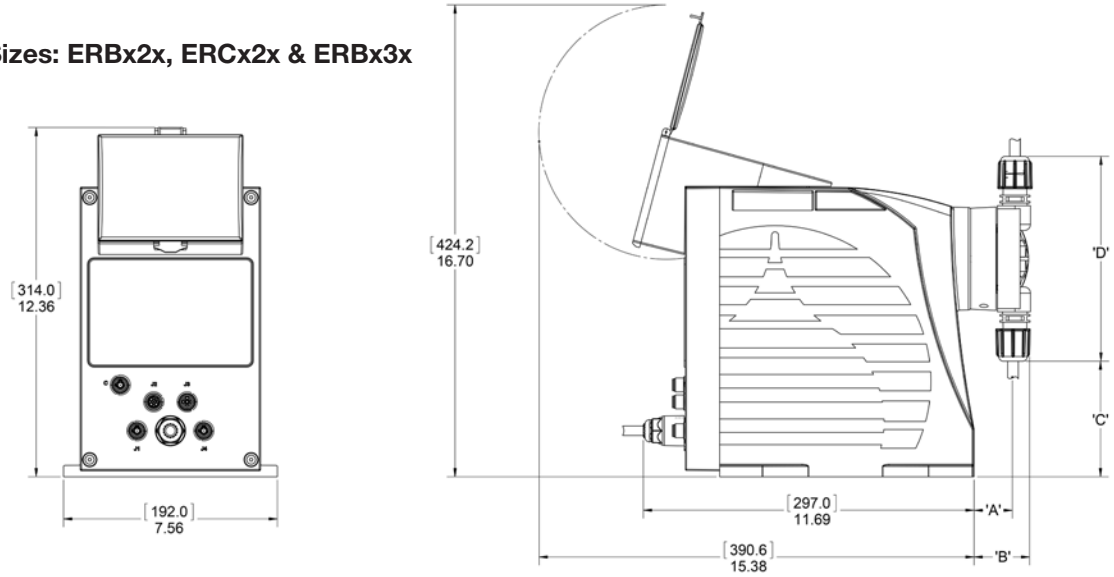
* Must order pump configured for your control protocol (See section table).

	Control Version		
	Manual model	Enhanced model	Communications model
Control Output			
Programmable digital contacts	0	2	2
Pump running		●	●
Pump standby/stopped [not pumping but ready]		●	●
Alarm status		●	●
User alarm status		●	●
Internal/External mode indication		●	●
Pump stopped		●	●
Stroke pulse		●	●
Timed event running		●	●
Programmable analog output	0	1	1
Flow rate [4-20 mA correlates to 0 - max capacity]		●	●
Mirror analog input 1		●	●
Mirror analog input 2		●	●
Power supply for remote device [24V] (eg. Flow sensor)	0	1	1
Operation functions			
Capacity control by motor speed variation	●	●	●
Variable stroke profile (variable discharge speed/constant suction speed)	●	●	●
Slow suction mode for viscous or degassing media	●	●	●
Calibration function (single point)	●	●	●
Prime feature (max capacity) button, timer	●	●	●
Totalizer (strokes, volume, hours motor operation, number of power cycles)	●	●	●
Keypad lock (software driven with password)	●	●	●
Clock feature (date and 12 hour time)	●	●	●
Diaphragm replacement mode (sets stroke to extended position)	●	●	●
Display firmware revision	●	●	●
Load factory defaults	●	●	●
Battery to maintain date and time settings when main power is removed	●	●	●
EEPROM nonvolatile memory (configurations saved/powers up in last used mode)	●	●	●
Internal/External input control mode configuration	●	●	●
Alarm output mask configuration (configure which events trigger alarm output relay)	●	●	●
Analog input response curve customization		●	●
Input pulse width setting		●	●
Start/Stop via remote signal	●	●	●
Pump switch off on tank empty	●	●	●
Modus RTU / Profibus DP protocol			●
StayPrime Degassing Technology	●	●	●
Alarm Log	●	●	●

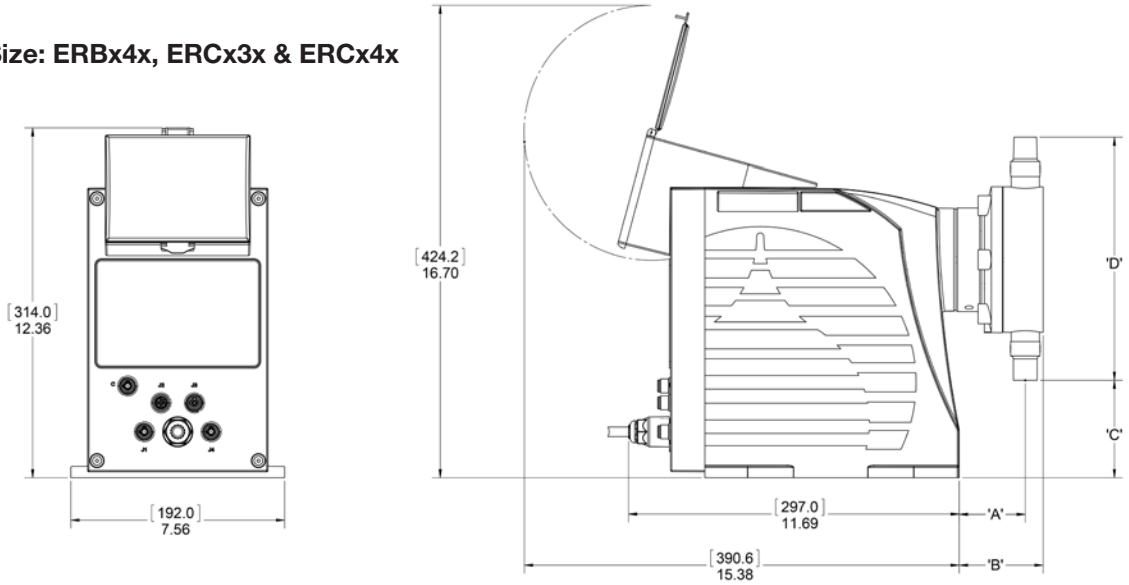
Literature #IR-54815.04 Rev 2/2020

MILTON ROY

Drive Sizes: ERBx2x, ERCx2x & ERBx3x

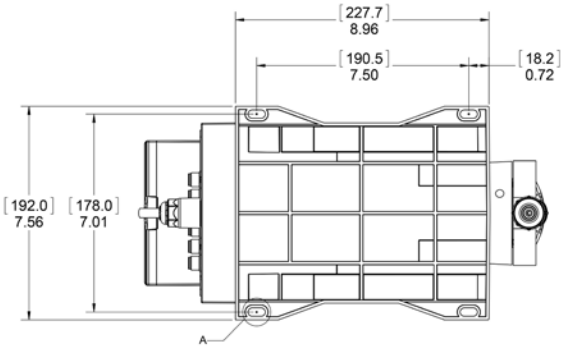


Drive Size: ERBx4x, ERCx3x & ERCx4x



Mounting Information

(All drive sizes)



DRIVE	LIQUID END	A		B		C		D	
		INCH	[mm]	INCH	[mm]	INCH	[mm]	INCH	[mm]
ERBx4x, ERCx3x ERCx4x	"TUBE CONNECTIONS: CODE A44, A74"	1.44	36.7	2.03	51.7	4.09	103.9	7.25	184.2
	"DN PIPE CONNECTIONS: CODE A44, A74"	1.44	36.7	2.00	50.7	2.45	62.2	10.54	267.7
	"STAINLESS HEAD AND SLURRY HEAD: CODE A14, S14"	1.38	35.0	2.01	51.0	3.70	94.0	8.03	204.0
	"HIGH VISCOSITY HEAD: CODE V44"	1.61	40.8	2.30	58.3	4.32	109.8	7.63	193.7
ERBx4x ERCx3x ERCx4x	"NPT CONNECTIONS: CODE A46, A76"	2.33	59.3	2.96	75.3	3.45	87.6	8.58	218.0
	"TUBE CONNECTIONS: CODE A46, A76"	2.33	59.3	2.96	75.3	2.82	71.6	9.84	250.0
	"DN PIPE CONNECTIONS: CODE A46, A76"	2.33	59.3	3.13	79.5	2.05	52.1	11.38	289.0
	"STAINLESS HEAD AND SLURRY HEAD: CODE A16, S16"	2.42	61.4	3.28	83.4	2.98	75.6	9.49	241.0
	"HIGH VISCOSITY HEAD (NPT DISCHARGE): CODE V46"	2.33	59.3	2.95	74.9	3.73	94.8	8.30	210.8
	"HIGH VISCOSITY HEAD (TUBE DISCHARGE): CODE V46"	2.33	59.3	2.95	74.9	3.73	94.8	8.93	226.8

Note: Tube connections A46 and A76 aren't available on ERC, neither is the V46 high viscosity tube option.

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Milton Roy® is a brand of Ingersoll Rand.

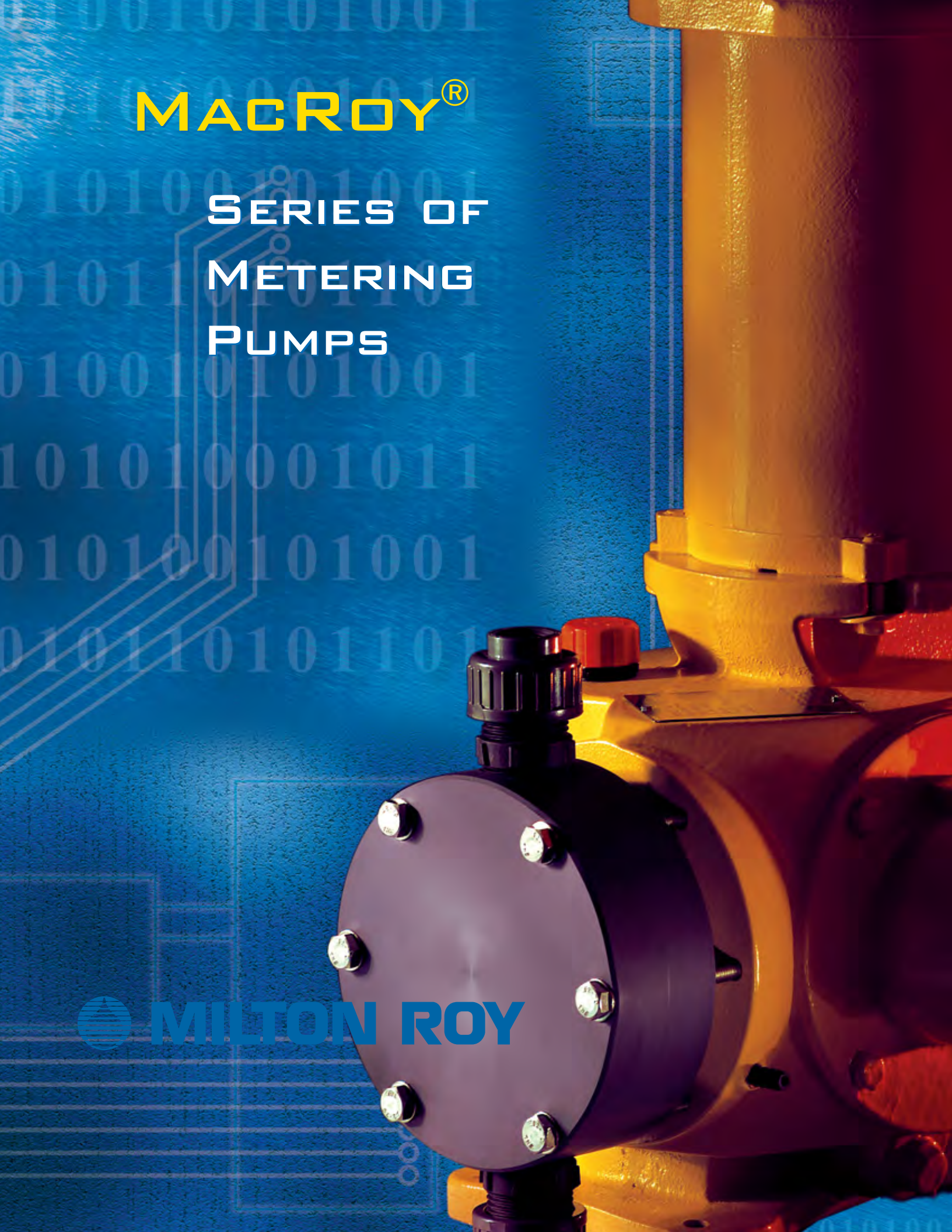
Contact your local representative to find out more about PROTEUS® the intelligent pump that's making a name for itself.

info@miltonroy.com
www.miltonroy.com
www.proteuspumps.com

Literature #IR-54815.04 Rev 2/2020

MacRoy®

Series of Metering Pumps

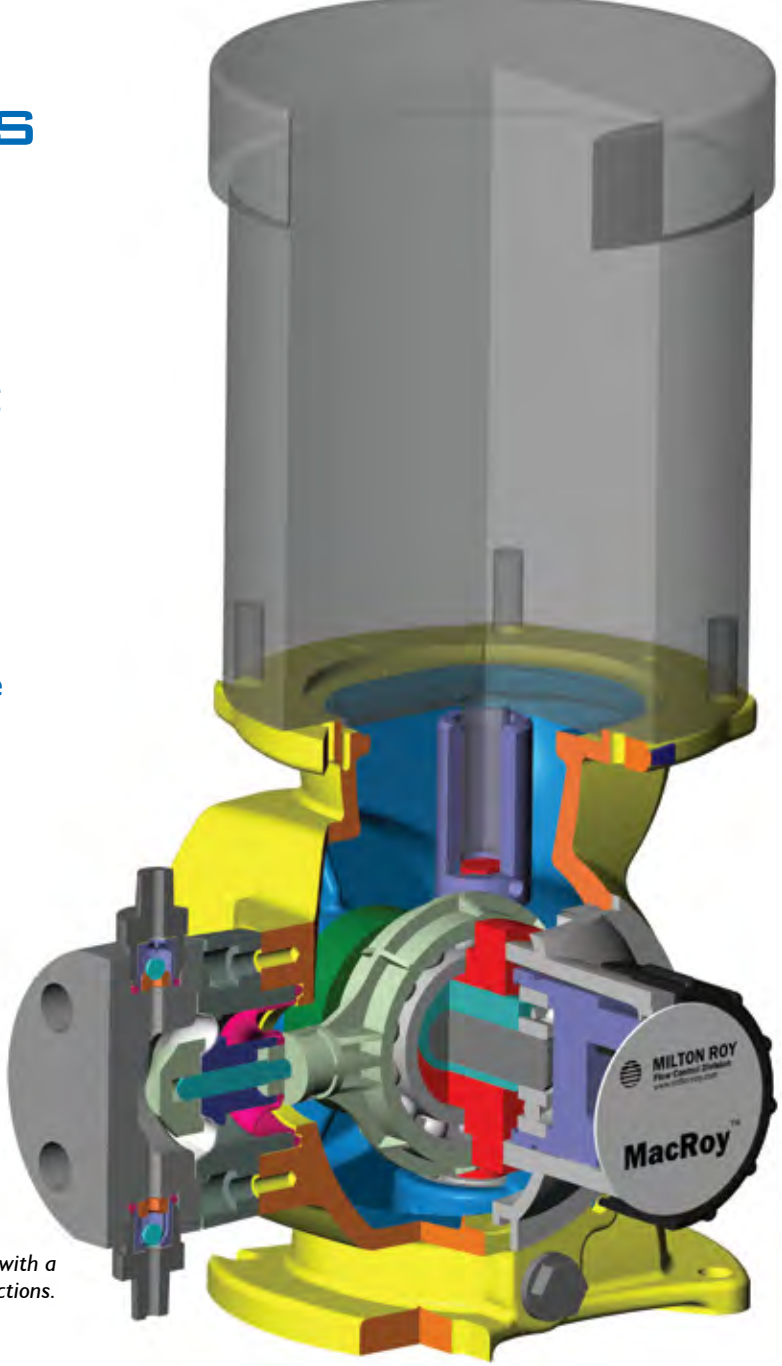


MILTON ROY

MacRoy® Series

The MacRoy® Series of metering pumps offer traditional Milton Roy reliability with outstanding value for applications up to 175 psi (12 Bar).

Milton Roy has combined its heavy-duty industrial drive technology with state of the art design and manufacturing processes in creating the MacRoy® Series metering pump. This family of Mechanically Actuated Diaphragm metering pumps is designed for durability and cost effectiveness.



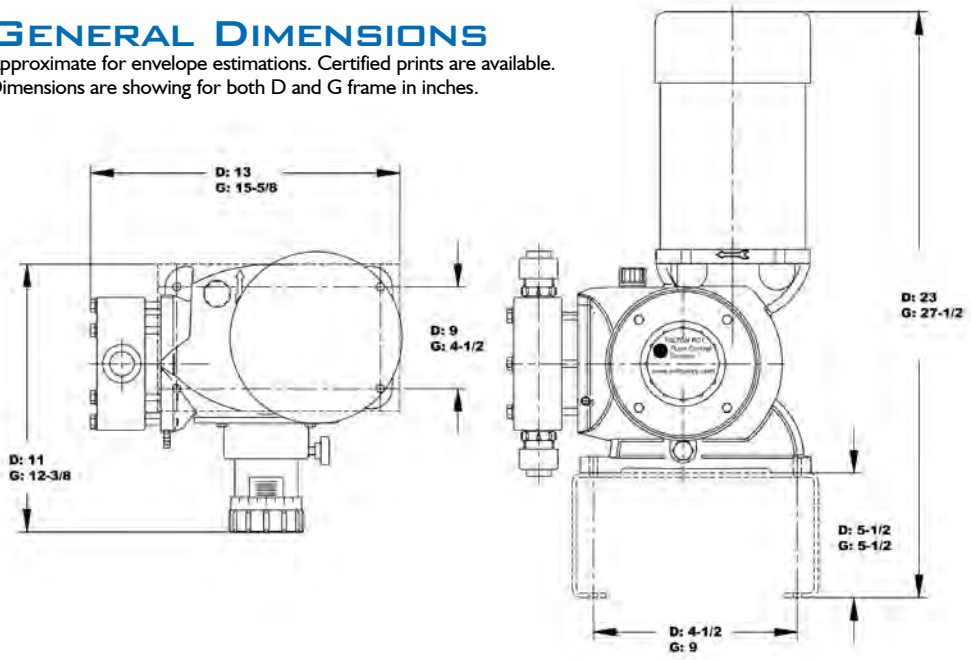
Illustrated to the right is a D4 with a PVC liquid end, featuring NPT connections.

MacRoy Features and Specifications

- Flow Rates up to 312 GPH (1180 Liters/hr)
- Mechanically Actuated Diaphragm liquid end eliminates flow restrictions
- Durable, metallic housing designed to withstand tough environments
- High efficiency motors minimize heat buildup
- A robust, metallic, worm gear drive coupled with the industrial duty variable eccentric stroke adjustment mechanism yields a 10 to 1 turn down ratio with smooth velocity profiles as compared to the pulsating flows of solenoid pumps or lost motion designs
- Smooth running, low friction bronze gears
- The PTFE, high performance, diaphragm design increases diaphragm life by eliminating the stresses inherent in most designs
- Reliable low flow performance is a result of high performance check valves with machined seats
- All gear components operate in an oil bath for long life
- Precision stroke adjustment can be operated while the pump is running or stopped
- Steady State Accuracy – ± 1% of full capacity over the 10 to 1 turndown ratio
- Liquid Temperature Range – 14° to 122° F (-14° to 50° C)
- Coating – 2 part epoxy
- Average Weight with motor – Frame D: 45 lbs (20 kgs)
  Frame G: 105 lbs (48 kgs)

General Dimensions

Approximate for envelope estimations. Certified prints are available.
Dimensions are showing for both D and G frame in inches.



NPT Connection Sizes

Frame	Liquid End Size	Connection Port Size for the Following Materials			
		Black PP, PVC, PVDF & Acrylic	Applications		316 SS
				HSO4	
D	2	1/4" Male	1/4" Male	1/4" Male	1/4" Male
	4		1/2" Male		1/2" Male
	7 & 8	1/2" Female			
G	5				
	6 & 7	1" Female	1" Male	1" Female	1" Male

Materials of Construction

Material	Frame	Liquid End Size	Head	Check Valve	Seals	Seats	Balls	Diaphragm
Black Polyproylene	D	2	Black PP	PVDF	Aflas	Alloy C22	Ceramic	PTFE
		4				PTFE		
		7 & 8			Viton	PVC		
	G	5						
		6 & 7		PP				
PVC	D	2	PVC	PVDF	Aflas	Alloy C22		
		4				PTFE		
		7 & 8			Viton	PVC		
	G	5						
		6 & 7		PVC				
PVDF	D	2	PVDF	PVDF	Aflas	Alloy C22		
		4				PTFE		
		7 & 8			PTFE	PVDF		
	G	All						
Acrylic	D	2	Acrylic	PVDF	Aflas	Alloy C22		
		4				PTFE		
		7 & 8			Viton	PVC		
	G	5						
		6 & 7		PVC				
Polymer Applications	D & G	All	PVC	PVC	Viton	316 SS	316 SS	
Slurry Applications	D & G	All		316 SS				
H2SO4 Applications	D & G	All		PVDF	Aflas	CA 20	CA 20	
316 SS	D	2	316 SS	316 SS	PTFE	316 SS	316 SS	
		4				PTFE		
		7 & 8			Viton	316 SS		
	G	5						
		6 & 7			PTFE			

Pump Selection by Capacity and Pressure

Pump Selection MacRoy			Maximum Ratings						
			Capacity @ 60 Hz (1725 RPM)		Capacity @ 50 Hz (1425 RPM)		Pressure		
Frame	Liquid End	Gear Code	GPH	Liter/Hr	GPH	Liter/Hr	PSI	Bar	
D	2	1	0.18	0.7	0.15	0.6	175	12	Ratings based on 1/4 HP (.25 kW)
		2	0.35	1.3	0.29	1.1			
		6	0.48	1.8	0.40	1.5			
		3	0.7	2.6	0.58	2.2			
	4	1	3.0	11.4	2.5	9.5	150	10	
		2	6.6	25	5.5	21			
		6	10	38	6.9	26			
		3	14.4	45	12	45			
	7	1	13	99	10	39	100	7	
		2	25	95	21	79			
		6	34	129	28	106			
		3	50	189	42	159			
	8	1	31	117	26	98	75	5	
		2	57	216	47	178			
		6	87	329	72	273			
		3	127	481	106	401			
G	5	1	26	98.4	22	82	150	10	Ratings based on 1 HP (.75 kW)
		2	53	200.6	44	167			
		6	75	283.9	62	237			
		3	106	401.2	88	334			
		8	–	–	110	416			
	6	1	37	140.0	31	117	100	7	
		2	74	280.1	62	233			
		6	104	393.6	87	328			
		3	147	556.4	122	464			
		8	–	–	154	583			
	7	1	75	283.9	62	237	50	3.5	
		2	150	567.8	125	473			
		6	213	806.2	177	672			
		3	300	1135.5	250	946			
		8	–	–	312	1181			

MacRoy G with PVC liquid end and manual micrometer stroke adjustment.

MacRoy D & G Product Code

Frame and Liquid End	Gear Ratio	Motor &/ or Mount	Liquid End Material	Connections	Capacity Control	Double Diaphragm	Base	Stroke Counting
☐☐	☐	☐	☐	☐	☐☐	☐	☐	☐

Frame and Liquid End

D Frame

- D2
- D4
- D7
- D8

G Frame

- G5
- G6
- G7

Gear Ratio Code

- 1 = 43 SPM
- 2 = 86 SPM
- 6 = 120 SPM
- 3 = 173 SPM
- 8 = 180 SPM @ 1450 RPM

Motor &/or Mount

- 8 = 1 ph 60 Hz 115/230 VAC 1725 RPM TE
- J = 3 ph 60 Hz 230/460 VAC 1725 RPM TE
- 9 = 1 ph 50 Hz 115/230 VAC 1450 RPM TE
- L = 3 ph 50 Hz 220/380 VAC 1450 RPM TE
- M = IEC 71, F130 V1 Flange Mount Less Motor
- N = IEC 80, F165 V1 Flange Mount Less Motor (G Frame only)
- X = Nema 56C Mount Less Motor

Liquid End Material

- 2 = PVDF
- 4 = Black Polypropylene (UV Stable)
- 7 = 316 ss
- 8 = PVC
- A = Acrylic
- P = Polymer Service
- L = Slurry Applications
- N = H_2SO_4 Applications

Connections

- P = NPT
- T = Tubing
- B = Bleed Valve NPT
- C = Bleed Valve Tubing

Capacity Control

- M4 = Manual
- E1 = 4-20, Nema 4, 115V
- E2 = 4-20, Nema 4, 230V
- EA = 4-20, Ex Prf, 115V
- EB = 4-20, Ex Prf, 230V

Double Diaphragm

- N = None
- D = Double Diaphragm
- 3 = Double Diaphragm w/ Gauge
- 4 = Double Diaphragm w/Nema 4 Rupture Detection
- 7 = Double Diaphragm w/Nema 7 Rupture Detection

Base Code

- N = None
- 1 = Simplex Optional Base

Stroke Counting

- N = None
- 1 = Stroke Counting (20 to 250 VAC/DC)

The photograph to the right is a D4 with a PVC liquid end, featuring NPT style check valves.

MacRoy, Dependable and Versatile

The MacRoy™ series of pumps has proven its exceptional value over years of solid performance in a wide range of applications and industries. Water treatment chemicals, process additives, acids, out-gassing fluids, slurries, and many more applications are all handled with ease by this robust metering pump design. Your local representative can assist you in applying the MacRoy™ metering pump to your process.

Accessories

Safety Valves

Protect pump and piping from overpressure.

Back Pressure Valves

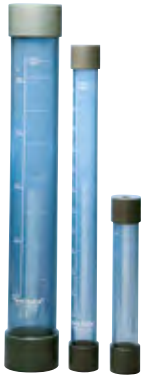
Provide smooth, artificial pressure in pump discharge line for atmospheric or low pressure systems to ensure pumping accuracy.

Pulsation Dampeners

Minimize pressure and flow surges in the pump discharge. When applied to pump inlet, more favorable NPSH conditions result.

Calibration Columns

Allow periodic verification of pump performance during routine checks or after system maintenance.



MILTON ROY
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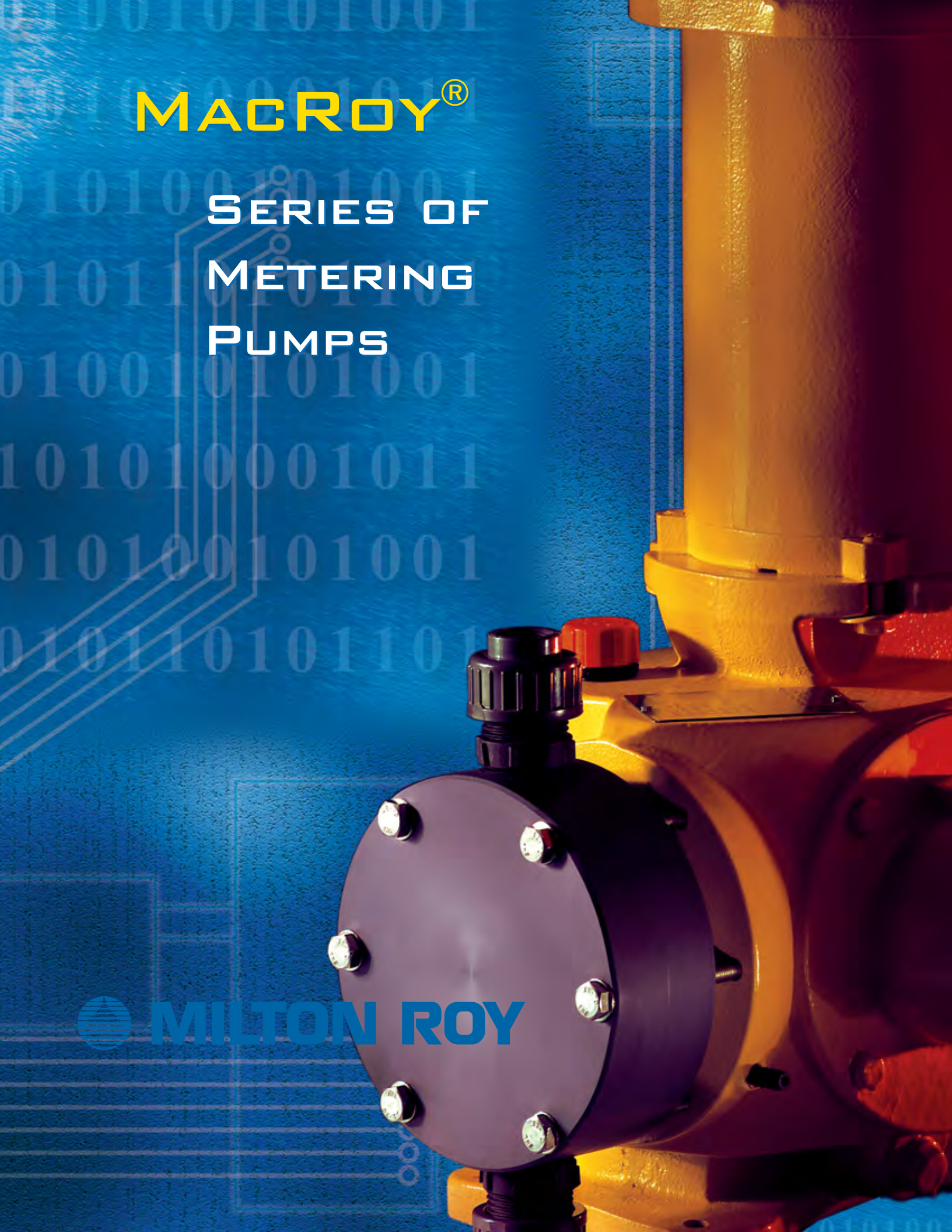
PD 3212 4/11

MacRoy®

Series of Metering Pumps



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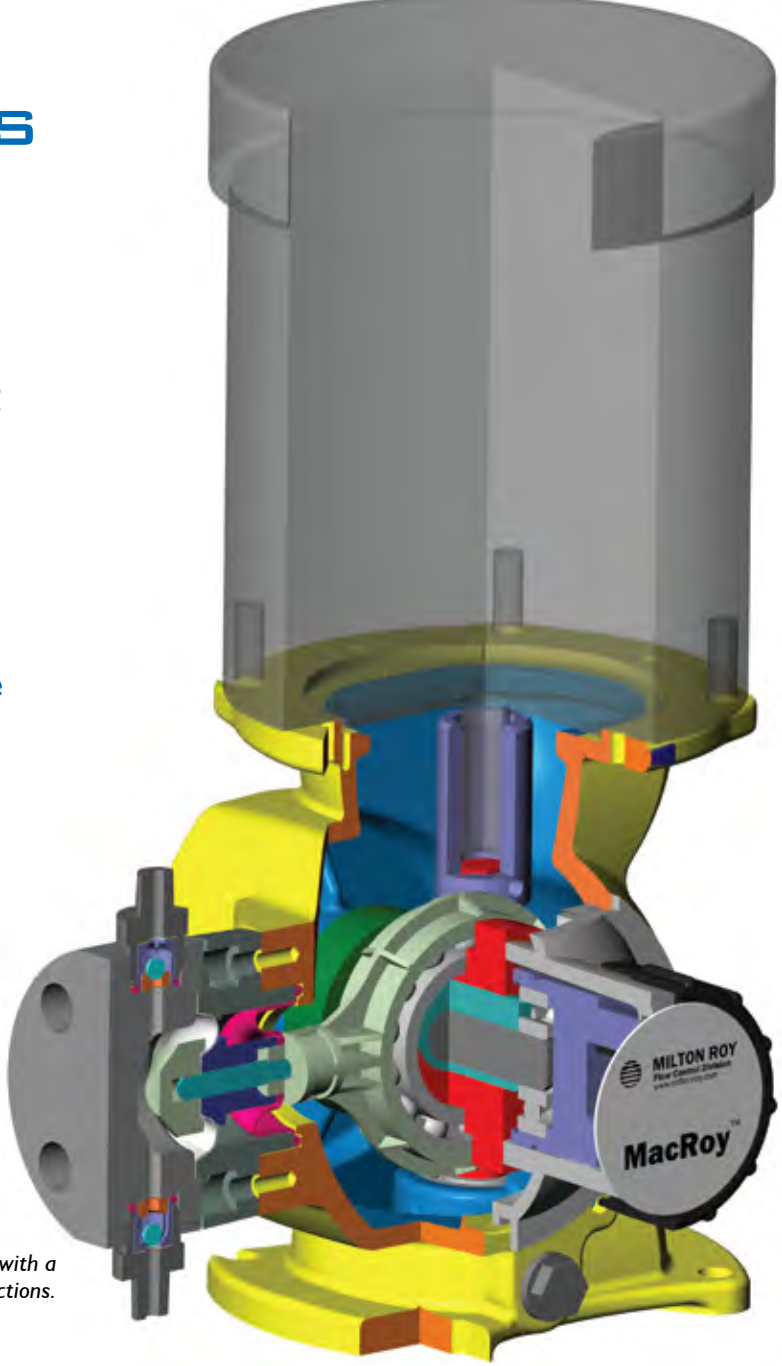

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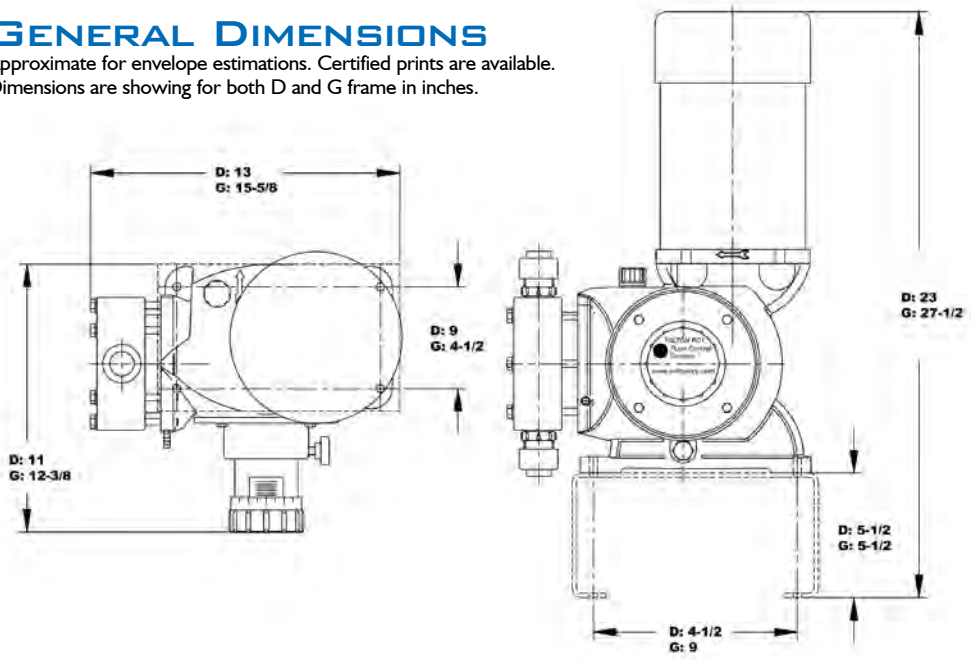
- Reliable low flow performance is a result of high performance check valves with machined seats
- All gear components operate in an oil bath for long life
- Precision stroke adjustment can be operated while the pump is running or stopped
- Steady State Accuracy – ± 1% of full capacity over the 10 to 1 turndown ratio
- Liquid Temperature Range – 14° to 122° F (-14° to 50° C)
- Coating – 2 part epoxy
- Average Weight with motor – Frame D: 45 lbs (20 kgs)
  Frame G: 105 lbs (48 kgs)

General Dimensions

Approximate for envelope estimations. Certified prints are available.
Dimensions are showing for both D and G frame in inches.



NPT Connection Sizes

Frame	Liquid End Size	Connection Port Size for the Following Materials			
		Black PP, PVC, PVDF & Acrylic	Applications		316 SS
				HSO4	
D	2	1/4" Male	1/4" Male	1/4" Male	1/4" Male
	4		1/2" Male		1/2" Male
	7 & 8	1/2" Female			
G	5				
	6 & 7	1" Female	1" Male	1" Female	1" Male

Materials of Construction

Material	Frame	Liquid End Size	Head	Check Valve	Seals	Seats	Balls	Diaphragm
Black Polyproylene	D	2	Black PP	PVDF	Aflas	Alloy C22	Ceramic	PTFE
		4				PTFE		
		7 & 8			Viton	PVC		
	G	5						
		6 & 7		PP				
PVC	D	2	PVC	PVDF	Aflas	Alloy C22		
		4				PTFE		
		7 & 8			Viton	PVC		
	G	5						
		6 & 7		PVC				
PVDF	D	2	PVDF	PVDF	Aflas	Alloy C22		
		4				PTFE		
		7 & 8			PTFE	PVDF		
	G	All						
Acrylic	D	2	Acrylic	PVDF	Aflas	Alloy C22		
		4				PTFE		
		7 & 8			Viton	PVC		
	G	5						
		6 & 7		PVC				
Polymer Applications	D & G	All	PVC	PVC	Viton	316 SS	316 SS	
Slurry Applications	D & G	All		316 SS				
H2SO4 Applications	D & G	All		PVDF	Aflas	CA 20	CA 20	
316 SS	D	2	316 SS	316 SS	PTFE	316 SS	316 SS	
		4				PTFE		
		7 & 8			Viton	316 SS		
	G	5						
		6 & 7			PTFE			

Pump Selection by Capacity and Pressure

Pump Selection MacRoy			Maximum Ratings						
			Capacity @ 60 Hz (1725 RPM)		Capacity @ 50 Hz (1425 RPM)		Pressure		
Frame	Liquid End	Gear Code	GPH	Liter/Hr	GPH	Liter/Hr	PSI	Bar	
D	2	1	0.18	0.7	0.15	0.6	175	12	Ratings based on 1/4 HP (.25 kW)
		2	0.35	1.3	0.29	1.1			
		6	0.48	1.8	0.40	1.5			
		3	0.7	2.6	0.58	2.2			
	4	1	3.0	11.4	2.5	9.5	150	10	
		2	6.6	25	5.5	21			
		6	10	38	6.9	26			
		3	14.4	45	12	45			
	7	1	13	99	10	39	100	7	
		2	25	95	21	79			
		6	34	129	28	106			
		3	50	189	42	159			
	8	1	31	117	26	98	75	5	
		2	57	216	47	178			
		6	87	329	72	273			
		3	127	481	106	401			
G	5	1	26	98.4	22	82	150	10	Ratings based on 1 HP (.75 kW)
		2	53	200.6	44	167			
		6	75	283.9	62	237			
		3	106	401.2	88	334			
		8	–	–	110	416			
	6	1	37	140.0	31	117	100	7	
		2	74	280.1	62	233			
		6	104	393.6	87	328			
		3	147	556.4	122	464			
		8	–	–	154	583			
	7	1	75	283.9	62	237	50	3.5	
		2	150	567.8	125	473			
		6	213	806.2	177	672			
		3	300	1135.5	250	946			
		8	–	–	312	1181			

MacRoy G with PVC liquid end and manual micrometer stroke adjustment.

MacRoy D & G Product Code

☐☐	☐	☐	☐	☐	☐☐	☐	☐	☐
Frame and Liquid End	Gear Ratio	Motor &/ or Mount	Liquid End Material	Connections	Capacity Control	Double Diaphragm	Base	Stroke Counting

Frame and Liquid End

D Frame

D2
D4
D7
D8

G Frame

G5
G6
G7

Gear Ratio Code

1 = 43 SPM
2 = 86 SPM
6 = 120 SPM
3 = 173 SPM
8 = 180 SPM @ 1450 RPM

Motor &/or Mount

8 = 1 ph 60 Hz 115/230 VAC 1725 RPM TE
J = 3 ph 60 Hz 230/460 VAC 1725 RPM TE
9 = 1 ph 50 Hz 115/230 VAC 1450 RPM TE
L = 3 ph 50 Hz 220/380 VAC 1450 RPM TE
M = IEC 71, F130 V1 Flange Mount Less Motor
N = IEC 80, F165 V1 Flange Mount Less Motor (G Frame only)
X = Nema 56C Mount Less Motor

Liquid End Material

2 = PVDF
4 = Black Polypropylene (UV Stable)
7 = 316 ss
8 = PVC
A = Acrylic
P = Polymer Service
L = Slurry Applications
N = H_2SO_4 Applications

Connections

P = NPT
T = Tubing
B = Bleed Valve NPT
C = Bleed Valve Tubing

Capacity Control

M4 = Manual
E1 = 4-20, Nema 4, 115V
E2 = 4-20, Nema 4, 230V
EA = 4-20, Ex Prf, 115V
EB = 4-20, Ex Prf, 230V

Double Diaphragm

N = None
D = Double Diaphragm
3 = Double Diaphragm w/ Gauge
4 = Double Diaphragm w/Nema 4 Rupture Detection
7 = Double Diaphragm w/Nema 7 Rupture Detection

Base Code

N = None
1 = Simplex Optional Base

Stroke Counting

N = None
1 = Stroke Counting (20 to 250 VAC/DC)

The photograph to the right is a D4 with a PVC liquid end, featuring NPT style check valves.

MacRoy, Dependable and Versatile

The MacRoy™ series of pumps has proven its exceptional value over years of solid performance in a wide range of applications and industries. Water treatment chemicals, process additives, acids, out-gassing fluids, slurries, and many more applications are all handled with ease by this robust metering pump design. Your local representative can assist you in applying the MacRoy™ metering pump to your process.

Accessories

Safety Valves

Protect pump and piping from overpressure.

Back Pressure Valves

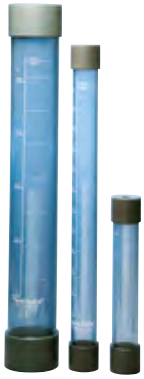
Provide smooth, artificial pressure in pump discharge line for atmospheric or low pressure systems to ensure pumping accuracy.

Pulsation Dampeners

Minimize pressure and flow surges in the pump discharge. When applied to pump inlet, more favorable NPSH conditions result.

Calibration Columns

Allow periodic verification of pump performance during routine checks or after system maintenance.



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