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SUNRAY SHORES WATER DISTRICT
SUNRAY SHORES C#1 PUMP STATION, STORAGE AND TRANSMISSION MAIN
PUMP STATION BASIS OF DESIGN
March, 2024

Introduction

The Sunray Shores Water District services a single-family community located in Belmont, NH near the eastern boundary of Winnisquam Lake. Approximately 100 lots are serviced by two existing wells that are routed to an existing pump house that distributes to existing water mains. Over the years, this system has deteriorated and seen a growing number of maintenance and distribution problems. A redesigned, modernized system will help this community get the water production it needs to properly and consistently serve its users.

Existing Conditions

The community serviced by Sunray Shores Water District is currently serviced by approximately 8700 linear feet of 3-inch and 2-inch water main. Water is distributed by two existing wells that is pumped approximately 1670 linear feet through a 3-inch transmission main to an existing pump house that has approximately 500 gallons of storage on site. Approximately 100 single family homes are serviced by this system.

Proposed Water System Improvements

The proposed improvements to the existing system consists of replacing the existing 3-inch transmission main from the wells to a new glass fused to steel storage tank that will be able to hold 22,000 gallons. A suction line from this tank will be ran to the new booster pump station which will distribute water to the community via 4-inch distribution mains servicing the entire community. It is assumed the 100 single-family connections will consist of an average of 3-bedrooms per home and a per Ev-Dw 405.19 a peaking factor of 8 will be used to calculate the peak flows. The existing wells will continue to be utilized to supply the water to this proposed system.

Water System Demand Scenario

The present day conditions were utilized to determine the demand scenario for the hydraulic model. A demand flow of 150 gpd per bedroom was utilized to determine the Average Daily Demand flows. Peak flow demands are shown in Table-1 below.

Table 1

Source	ADD, gpm	Peak Flow, gpm
100 3-bedroom units = 45000 gpd	31.25 gpm	250 gpm

Headloss Calculations

A peak flow of 250 gpm was distributed throughout the hydraulic model by the location of services throughout the 100 single-family connections. Two similar high elevation points were created based on existing finished floor elevations (FFE's) and assuming an additional elevation of 20 ft for the highest water use elevation. These locations were at Map 107, Lot 145 on Sunset Drive and Map 107 Lot 88 on existing Tucker Shore Drive. Calculations below show the Total Dynamic Head (TDH) calculations for each scenario.

Scenario 1: TDH calculation for Map 107, Lot 145 on Sunset Drive:

Peak flow – 90 gpm (approximately 36% of peak demand for entire development) with 45 psi residual pressure at elevation 525.00
Pump Station slab elevation = 488.90
Pump Volute elevation = 489.90
Pump suction pressure = -0.4 psi

TDH calculation at 90 gpm peak flow:

Elevation Head = Highest User + Desired Pressure at Highest User – Pump Elevation – Suction Pressure at Pump
= 525.00 + (45psi x 2.31) - 489.90 – (-0.4psi x 2.31) = 140 ft

Friction Head
Pump station losses at 90 gpm
4 inch PVC pipe 1683 LF = 11 ft

TDH = Elevation Head + Friction Head = 140 ft + 11 ft = 151 ft @ 90 gpm

Scenario 2: TDH calculation for Map 107, Lot 88 on Tucker Shore Drive:

Peak flow – 103 gpm (approximately 41% of peak demand for entire development) with 45 psi residual pressure at elevation 525.00
Pump Station slab elevation = 488.90
Pump Volute elevation = 489.90
Pump suction pressure = -0.4 psi

Sunray Shores Water District
C#1 – Pump Station Basis of Design
March 20, 2024

TDH calculation at 103 gpm peak flow:

Elevation Head = Highest User + Desired Pressure at Highest User – Pump Elevation – Suction Pressure at Pump
= 525.00 + (45psi x 2.31) - 489.90 – (-0.4psi x 2.31) = 140 ft

Friction Head
Pump station losses at 103 gpm
4 inch PVC pipe 2119 LF = 18 ft

TDH = Elevation Head + Friction Head = 140 ft + 18 ft = 158 ft @ 103 gpm

Using the information from these two scenarios, the Design Point was 158 ft TDH at 250 gpm. Please note that while the peak demand flow for the entire community is 250 gpm, the flows are dispersed amongst various different areas in the development to determine the TDH. The peak demand of 250 gpm can still be seen in the hydraulic model at the flows from the tank to the pump station and then the pump station to the development.

Pump Selection

Variable speed units are desired to adjust for varying flow rates over time, with pressure remaining constant with varying demands. Using a peak flow of 250 gpm for the revised system, the following selection was made:

Recommended pump by Grundfos is Hydro MPC-E or approved equal.
Grundfos: Hydro MPC-E 2 CRE 32-4-2, 15 HP, 250 gpm @ 158 ft. Two total pumps in parallel.

Hydraulic Model Setup

The hydraulic model software utilized for this project was WaterCAD 2023 (23.0.0.19). The objective was to maintain a minimum pressure of 45 psi for the highest point in the system, while maintaining pressures under 95 psi at other design junctions elsewhere in the system. A Boosterpaq setup utilizing variable frequency drives was selected for the analysis. The Boosterpaq selected was the Grundfos Hydro MPC-E 2 CRE 32-4-2, 2 pump setup.

The Boosterpaq was input into the WaterCAD model as a one pump curve with one pump in lag using the VSP Battery function. This is shown as VSPB-1 in the model. Node J4 was set as the target pressure node of 45psi, which is the node that represents Map 107, Lot 88 on Tucker Shore Drive.

The pipes within the hydraulic model are all 4” PVC with a roughness coefficient of 150. Lengths and elevations were established using various methods of information that was gathered from survey, as-builts, proposed design plans and geo-location imagery.

Hydraulic Model Results

With the target pressure of 45 psi and the control node of J4 set for VSPB-1, it was determined for the peak flow condition that both pumps would need to run. The pressures in this system would vary between 45 psi to 67 psi, which is comfortably in the acceptable design pressure parameters. Pipe velocities throughout the development are under 5.0 ft/s during the peak flow scenario, except for the pipes from the tank to the pump house, and immediately leaving the pump house to the first tee located at node J-1 (The existing intersection of Elaine Drive and Pond Road). These pipes have a flow velocity of 6.38 ft/s, which will only occur during peak flow conditions and is still considered an acceptable flow velocity.

Hydraulic Model Conclusion

The pump selected will work to better service the existing Sunray Shores community, and proposed upgrades to 4-inch water mains throughout the development. This system also has potential capacity to handle additional future demands, should further development occur in the area. These extents of these potential demands have not been explored in detail.

Proposed Pumping System

The water booster pump system shall use advanced variable frequency drives and electronic controller technology to maintain a minimum discharge water pressure of 45 psi to the highest user at a demand flow of 103 gpm. Pump systems that use pump control valves or pressure reducing valves to maintain a constant water pressure shall not be considered equal.

The packaged pump system shall have one primary pump. The pumps shall be Hydro MPC-E 2 CRE 32-4-2 pumps or approved equal. Motors shall be 15 HP, 3-phase, 460-480V, 60 Hz. The pumps shall be vertical multi-stage centrifugal design. The pump suction/discharge chamber, motor stool, and pump shaft coupling shall be constructed of cast iron. The impellers, pump shaft, diffuser chambers, outer discharge sleeve, impeller seal rings, and seal ring retainers shall be constructed of stainless steel.

The motors shall have a NEMA C face and shall operate at a nominal 3650 RPM with a minimum service factor of 1.15. Drive-end motor bearings shall be designed to absorb thrust and shall be adequately sized to ensure long motor life. The variable frequency drive shall be capable of operating the pump at varying RPM's to maintain the system design pressure with varying flows from 0 gpm to 250 gpm.

A total of 185 gallons of hydro-pneumatic storage shall be implemented to provide usuable volume during low-flow periods within the booster system. The tank shall be a pre-charged steel water and well pressure booster expansion tank with a ASME replaceable butyl bladder. The tank shall have NPT epoxy lined system connection and a standard tire valve to facilitate the on0site charging of the tank to meet system requirements, a pressure gauge and bladder integrity monitor. The tank will be constructed in accordance with the most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code. The recommended model for this pump station is a Wessels type FXA-700 Tank or approved equal.

The system electronic controller shall operate the pumps to maintain the design pressure while using minimum energy and alternating between pumps to maintain relatively equal pump operating hours. As flow begins, one of the pumps will start at low speed. As demand increases, the pump will speed up until it reaches full RPM. At this point the second pump will start. The speed of the two (2) pumps will vary together until they reach full RPM. Pumps will changeover automatically to maintain the system pressure depending on demand, time, and fault. When water demand is zero, the system shall shut off. If the system runs continuously, the lead pump shall alternate every 24 hours. The controller shall accept a low-suction pressure or other suction fault input to shut down the system. The controller shall have a keypad and LCD display screen. System functions will be programmable through the keypad. These programmable functions and information shall include, but not be limited to:

1. Pump Status
2. Elapsed running hours for each pump
3. System pressure set-point
4. Actual system pressure
5. Pump speed (percent)
6. Pump min. and max. speed (percent)
7. System faults
8. Pressure transducer design settings
9. Pump priority
10. Current pump rotation order
11. Friction loss Compensation (set-point)
12. High and low discharge shut-down limit
13. Low-suction pressure shut-down limit
14. Analog input for remote set-point control
15. Digital input for remote stop/start
16. Clock program (multiple set-points)

The controller shall be mounted in a control cabinet with a NEMA 3R enclosure rating with the keypad and display screen mounted through the outer door. The control cabinet shall be UL 508 listed as an assembly. In addition to the electronic pump controller, the control cabinet shall include circuit breakers for each pump and the control circuit and control relays for alarm functions. Control cabinet options shall include, but not be limited to:

1. Dry run protection
2. Lightning protection

The entire packaged pumping system shall be mounted on a 304 stainless steel fabricated skid. The control cabinet shall be mounted on a 304 stainless steel fabricated control cabinet stand attached to the system skid.

The suction and discharge manifolds shall be fabricated of 316 stainless steel. Both manifolds shall be designed to attach to the system piping at either end of the manifold. Each manifold

shall include a liquid filled pressure gauge. The suction manifold shall have as standard a pressure switch or pressure sensor to detect low suction pressure. The discharge manifold shall include a stainless steel pressure transducer with a 4-20 mA output. The pressure transducer shall be factory installed and wired.

Isolation valves shall be installed on the suction and discharge of each pump. A check valve shall be installed on the discharge of each pump.

All systems shall be factory tested for performance and hydrostatic tested to 300 psi.

Emergency Operations

An emergency automatic transfer switch is proposed for the system to provide power to the booster station in the event of a power outage. A backup generator will be located outside the building and will be fueled by propane.

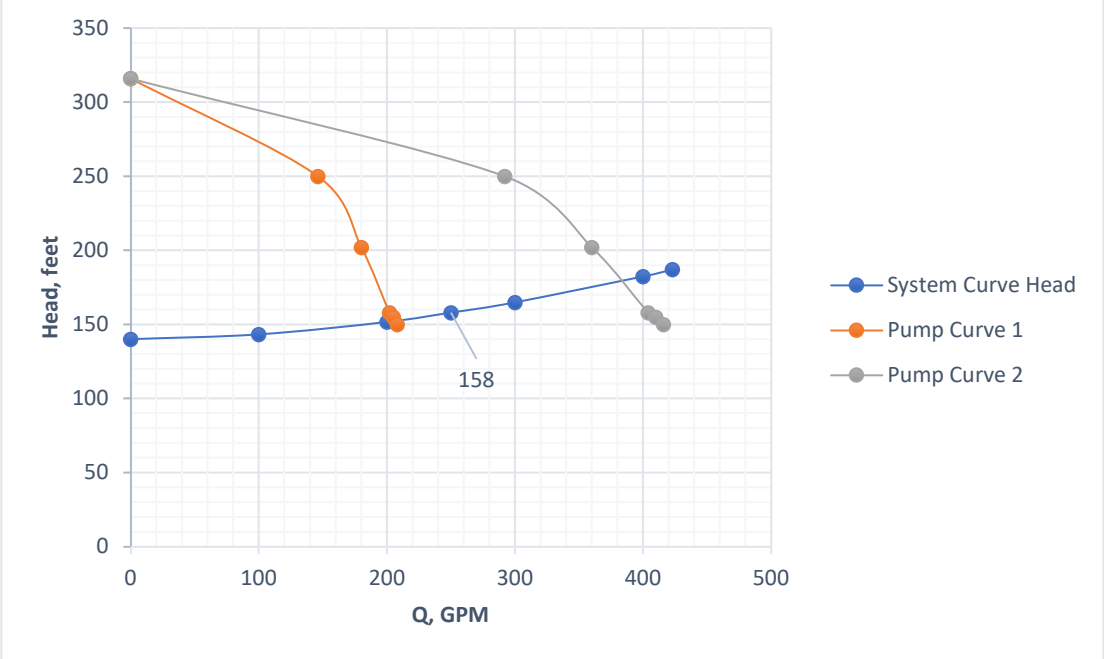
SYSTEM CURVE CALCULATIONS

Static Head:	140	Pump Elevation

System Curve Head, ft	Peak Flow, gpm	41% Peak Demand, gpm
140	0	0
143.3	100	41
151.7	200	82
158	250	103
164.9	300	123
182.4	400	164
187.1	423	173.43

Peak Flow Design Condition

Pump Curve Head, ft	Speed-1 pump, Q gpm	Speed- 2 pumps, Q gpm
316	0	0
250	146	292
202	180	360
158	202	404
155	205	410
150	208	416



NPSH CALCULATOR

Elevation	489.9	ft	
Temperature	60	Fahrenheit	
h_{atm}	14.4	psi	atmospheric pressure
h_{vap}	0.3	psi	water vapor pressure
h_z	0	ft	static pressure
h_f	2	psi	friction losses
h_{saf}	3	ft	safety factor

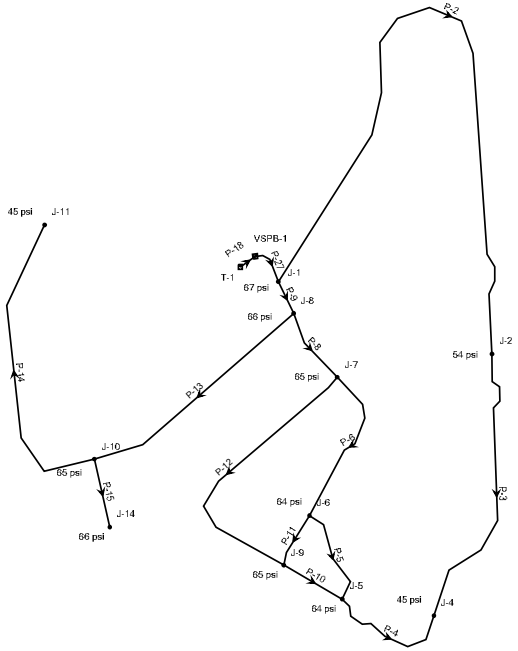
$NPSHa=h_{atm}-h_{vap}+h_z-h_f-h_{saf}$

$NPSH_a$	24.95	ft	
$NPSH_r$	7.7	ft	HYDRO MPC-E 2 CRE 32-4-2

24.95> 7.7 OK

WATERCAD ANALYSIS

Scenario: Base



FlexTable: Junction Table

Label	Notes	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	Tee at Pond Road/Elaine Drive	479.09	5	634.15	67
J-2	Low Point - Elaine Dr Lot 106	504.50	32	629.47	54
J-4	High Point - Tucker Shore Lot 88	525.00	33	629.01	45
J-5	Tee at Nancy Dr and Linda Dr	480.20	20	629.05	64
J-6	Tee at June Circle and Nancy Dr	481.40	30	629.09	64
J-7	Tee at Linda and Nancy Dr	479.93	10	630.12	65
J-8	Tee at Sunset and Pond	478.79	5	632.14	66
J-9	Tee at June Cir and Linda Dr	479.98	30	629.08	65
J-10	Tee - Sunset and Unknown Allet	478.20	40	629.41	65
J-11	End of 4".High Point on Sunsert. Blow Off	525.00	40	628.52	45
J-14	BLOW-OFF	477.69	5	629.41	66

FlexTable: Pipe Table

Label	Start Node	Stop Node	Diameter (in)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Length (User Defined) (ft)
P-2	J-1	J-2	4.0	PVC	150.0	57	1.45	2,325
P-3	J-2	J-4	4.0	PVC	150.0	25	0.63	1,073
P-4	J-4	J-5	4.0	PVC	150.0	-8	0.21	640
P-5	J-5	J-6	4.0	PVC	150.0	-14	0.36	287
P-6	J-6	J-7	4.0	PVC	150.0	-51	1.29	630
P-8	J-7	J-8	4.0	PVC	150.0	-98	2.51	361
P-9	J-8	J-1	4.0	PVC	150.0	-188	4.81	108
P-10	J-5	J-9	4.0	PVC	150.0	-14	0.36	231
P-11	J-9	J-6	4.0	PVC	150.0	-7	0.17	204
P-12	J-9	J-7	4.0	PVC	150.0	-38	0.96	1,103
P-13	J-8	J-10	4.0	PVC	150.0	85	2.17	640
P-14	J-10	J-11	4.0	PVC	150.0	40	1.02	842
P-15	J-10	J-14	4.0	PVC	150.0	5	0.13	197
P-18	T-1	VSPB-1	4.0	PVC	150.0	250	6.38	20
P-27	VSPB-1	J-1	4.0	PVC	150.0	250	6.38	93

FlexTable: Tank Table

Label	Zone	Elevation (Base) (ft)	Elevation (Minimum) (ft)	Elevation (Initial) (ft)	Elevation (Maximum) (ft)	Volume (Inactive) (MG)	Flow (Out net) (gpm)	Hydraulic Grade (ft)
T-1	<None>	0.00	488.90	494.90	500.90	0.00	250	494.90

HYDRO MPC-E 2 CRE 32-4-2

Submittal Data

PROJECT:	UNIT TAG:	QUANTITY:
	TYPE OF SERVICE:	
REPRESENTATIVE:	SUBMITTED BY:	DATE:
ENGINEER:	APPROVED BY:	DATE:
CONTRACTOR:	ORDER NO.:	DATE:

Hydro MPC-E 2 CRE 32-4-2

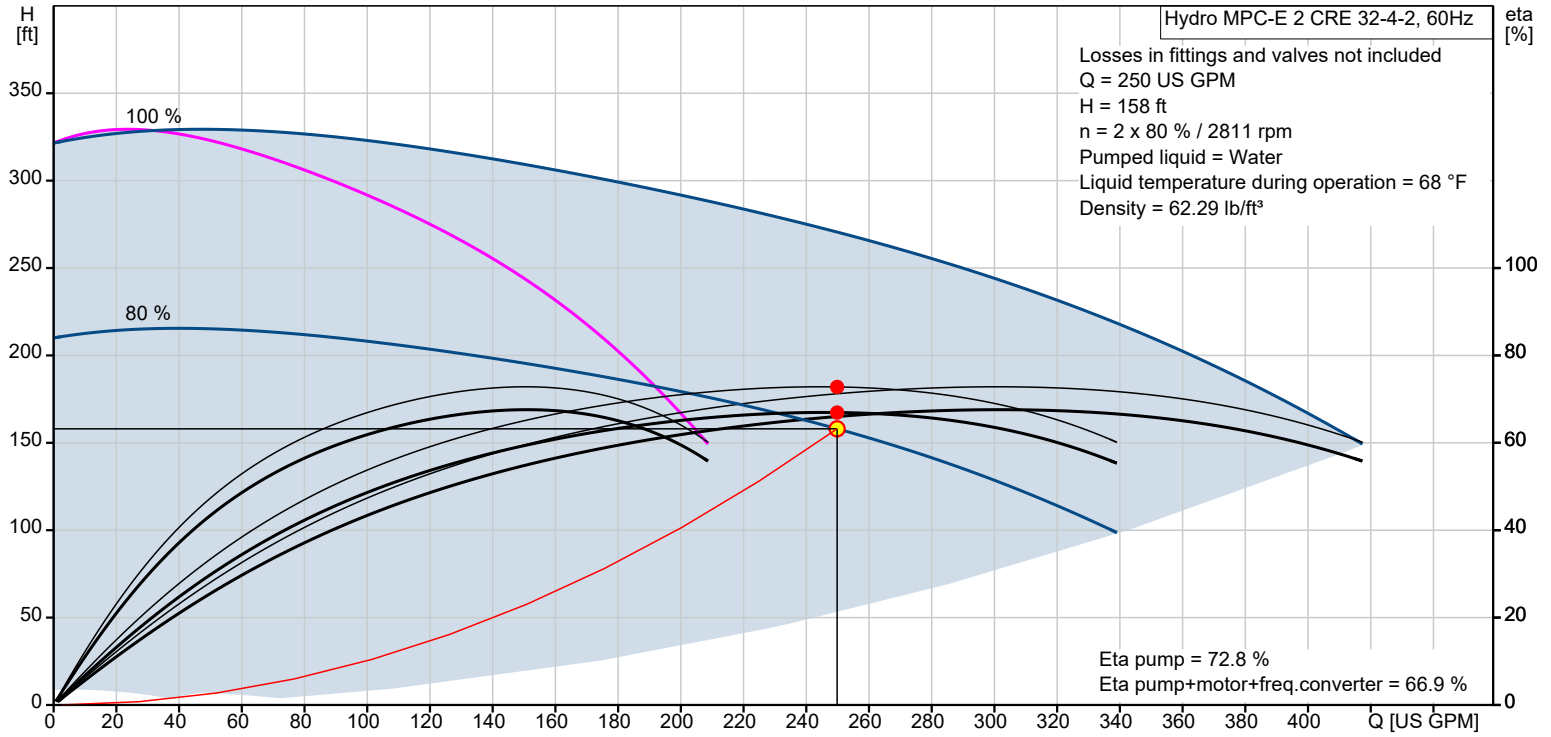
Advanced and energy efficient pressure boosting system for boosting of clean water. Available with 2-6 parallel connected pumps, Integrated advanced controller and all necessary fittings

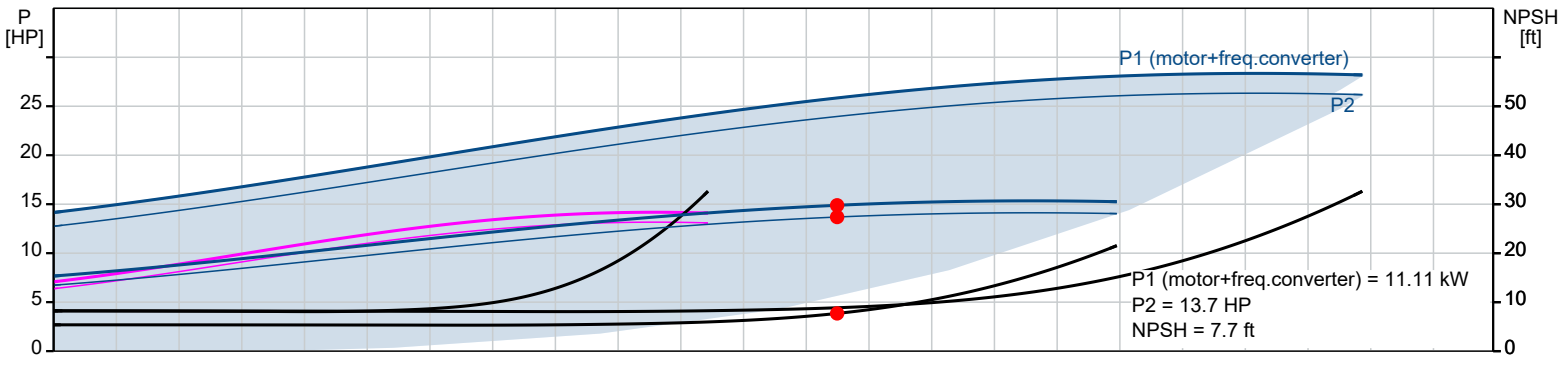
Note! Product picture may differ from actual product

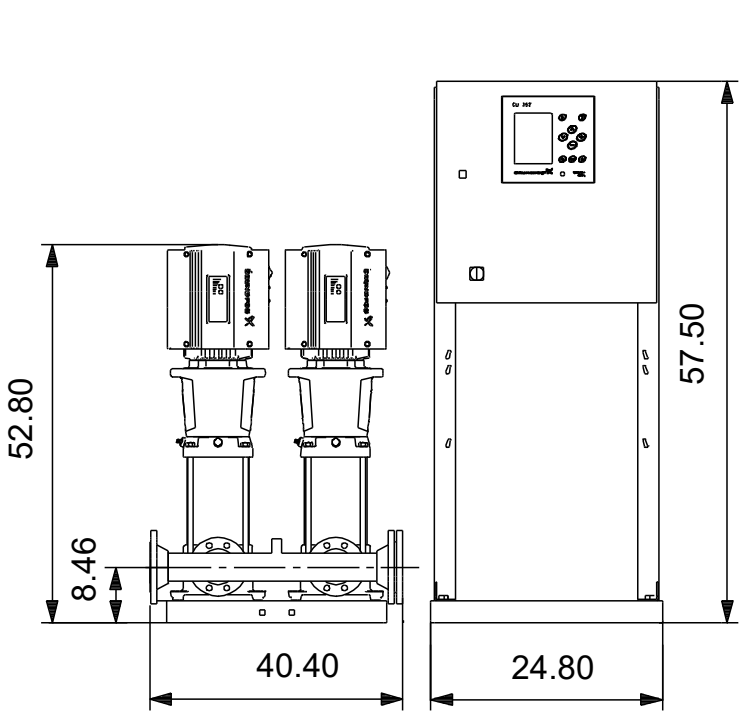
Conditions of Service	
Flow:	250 US GPM
Head:	158 ft
Efficiency:	66.9 %
Liquid:	Water
Temperature:	68 °F
NPSH required:	7.7 ft
Specific Gravity:	1.000

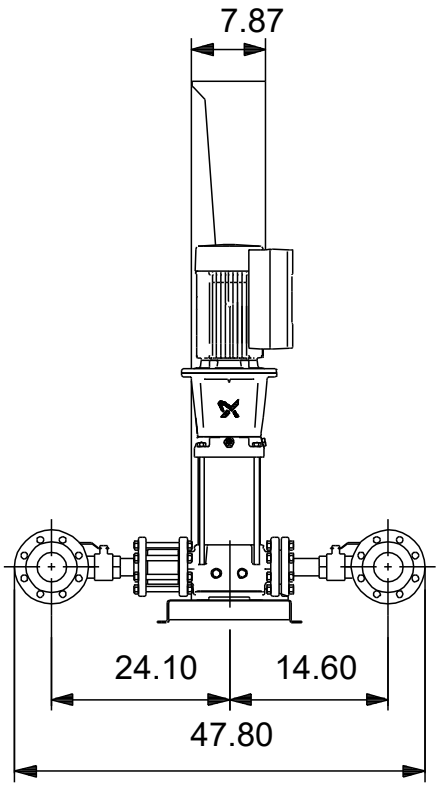
Pump Data	
Liquid temperature range:	41 .. 179.6 °F
Maximum ambient temperature:	104 °F
Product number:	99688751

Motor Data	
Mains frequency:	60 Hz
Enclosure class:	IP54









Materials:

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Date: 20/03/2024

Qty.	Description
1	**Hydro MPC-E 2 CRE 32-4-2**

Note! Product picture may differ from actual product

Product No.: 99688751

Pressure booster system supplied as compact packaged assembly certified and listed by UL (Category QCZJ - Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.

Approvals:
NSF61/NSF372 - Drinking Water and Low Lead approval. OSHPD Seismic certification available on MPC E CR(CUE) systems.

All pumps are speed-controlled.
Each pump is equipped with an integrated variable frequency drive motor (MLE motor).

- Hydro MPC-E maintains constant pressure through continuous adjustment of the speed of the pumps.
- The system performance is adapted to the demand through cutting in/out the required number of pumps and through parallel control of the pumps in operation.
- Pump changeover is automatic and depends on load, operating hours and fault.
- All pumps in operation will run at equal speed.

The system consists of these parts:
- vertical multistage centrifugal pumps, type CRE 32-4-2.
- Pump rotating parts in contact with the pumped liquid are made of ANSI 304 stainless steel as standard and available as ANSI 316 stainless steel as an option.

Pump bases and pump heads are made of cast iron (Class 30) as standard and ANSI 316 stainless steel as an option.
The pumps are equipped with the service-friendly cartridge type mechanical shaft seal HQQE (SiC/SiC/EPDM).
- Suction manifold and discharge manifold made of 316 stainless steel.
- Base frame made of 304 stainless steel.
- One non-return valve (check valve), and two isolating valves for each pump.
- Adapter with isolating valve for connection of diaphragm tank.
- Pressure gauge and pressure transducer on each suction and discharge manifold.

Dry-running protection is standard with use of pressure transducer on suction manifold.
- Steel control panel with UL Type 3R (MPC E CRE) or Type 12 MPC E CR(CUE) enclosure rating, including main disconnect switch, all required fuses, motor protection, switching equipment, and microprocessor-controlled CU 352.

Diaphragm tank is available as an accessory.

Pump operation is controlled by CU352 controller, specifically designed to control parallel operation of multiple pumps with the following

features/functions:

- PID controller with adjustable PI parameters (Kp + Ti)
- Constant pressure at setpoint, independent of inlet pressure
- Stop function (no flow shutdown)
- Automatic cascade control of pumps for optimum efficiency.
- Selection of min. time between start/stop, automatic pump changeover and pump priority
- Automatic pump test function to prevent idle pumps from seizing up
- Standby pump allocation capability
- Redundant primary sensor capability
- Manual operation
- Proportional pressure control
- Multi-Sensor zone control with up to six zones
- Differential Pressure/Temperature control using two seperate sensors (i.e. discharge - suction substraction)
- Secondary Fall-back sensor will revert to secondary (local) sensor upon primary (remote) sensor failure
- Digital Pulse water meter reading (log accumulated flow)

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Qty.	Description
1	- Forced pump changeover - Clock program - Soft pressure build-up - External setpoint influence (via analog input) - Emergency run (via digital input) - Password protection - Possibility of digital remote-control functions (via digital inputs): - system on/off - max., min. or user-defined duty - up to 6 alternative setpoints. - Digital inputs and outputs can be configured individually Pump and system monitoring functions: - minimum and maximum limits of measured values (flow, level, temp., etc.) - built in data logging capability - non return valve (check valve) failure detection - high system pressure protection - low system pressure protection - pump curve data loaded into controller to provide end of curve protection - alarm log with the previous 24 warnings/alarms - potential-free changeover contacts for operation and fault. - Grundfos bus communication with optional gateway connections for all popular communication protocols - Ethernet connection (built-in web server) Pre-fabricated and tested packaged pump system including pumps, piping, and wiring complete with Control MPC. There are options to upgrade the pressure boosting system. Flow media: Water Flow (Plant): 423 US GPM Flow (Pump): 250 US GPM Head: 158 ft Nom. current of plant: 36.8 A Nominal power: 14.8 HP

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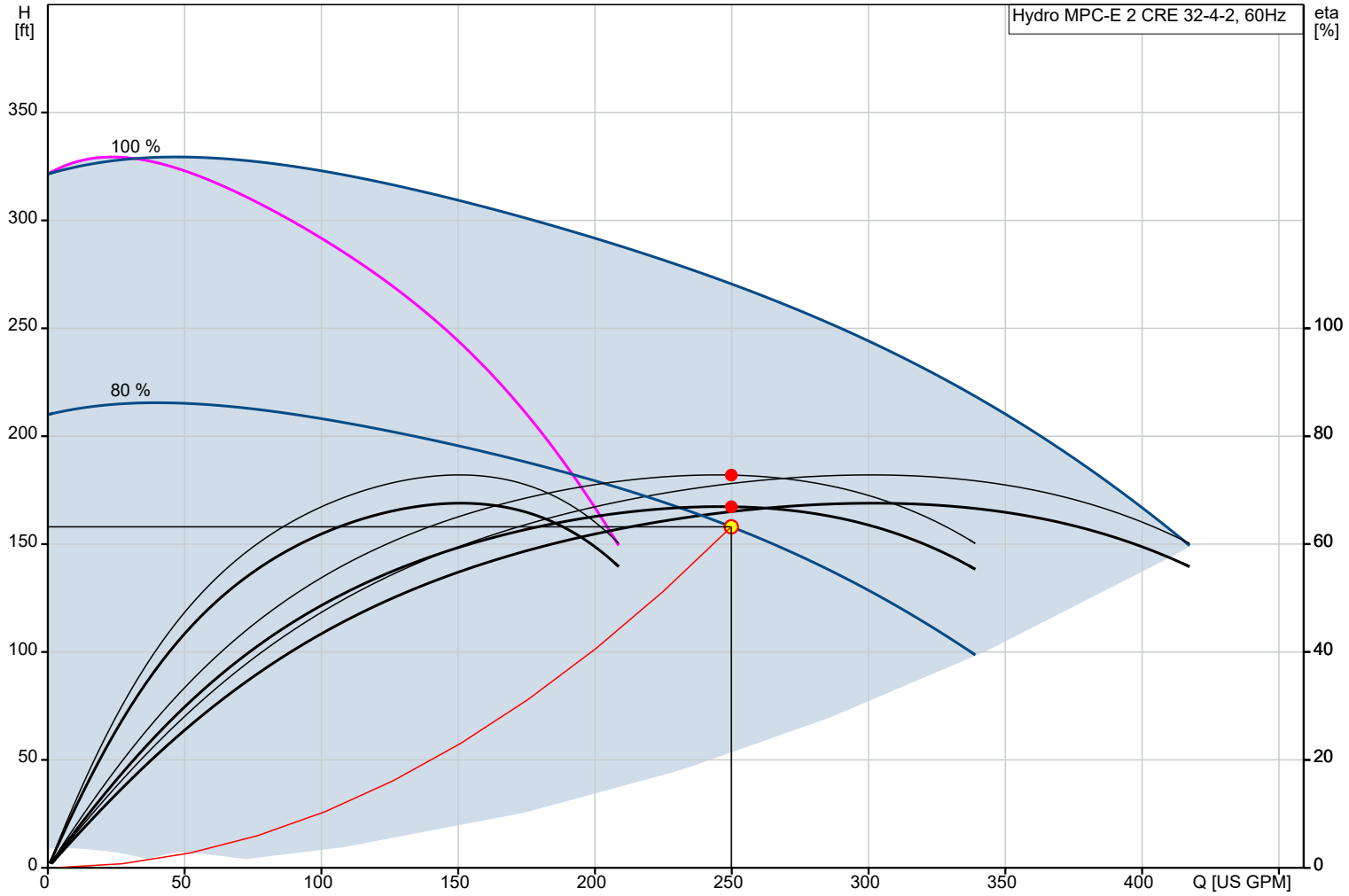
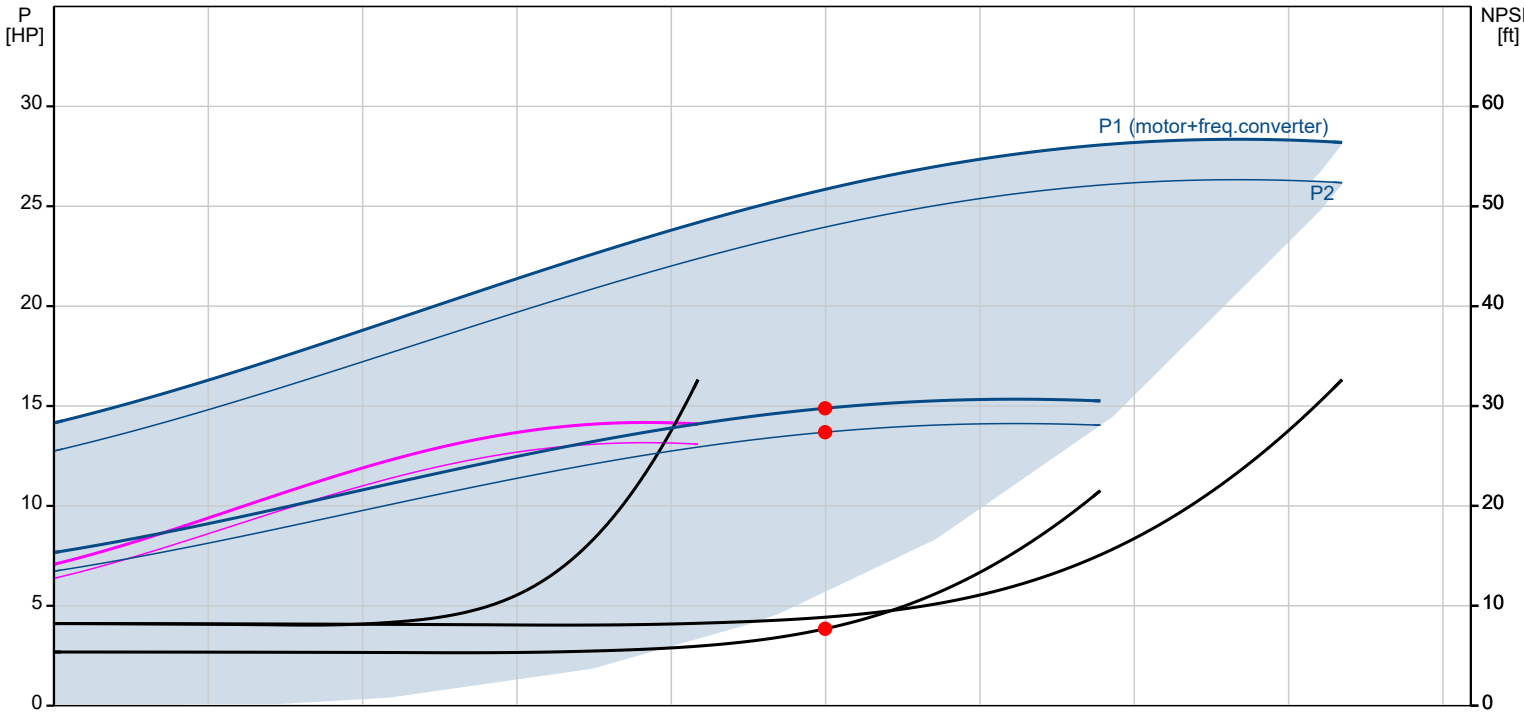
99688751 Hydro MPC-E 2 CRE 32-4-2 60 Hz



Losses in fittings and valves not included
H = 158 ft
Pumped liquid = Water
Density = 62.29 lb/ft³
Eta pump+motor+freq.converter = 66.9 %

Q = 250 US GPM
n = 2 x 80 % / 2811 rpm
Liquid temperature during operation = 68 °F
Eta pump = 72.8 %



P1 (motor+freq.converter) = 11.11 kW
P2 = 13.7 HP
NPSH = 7.7 ft

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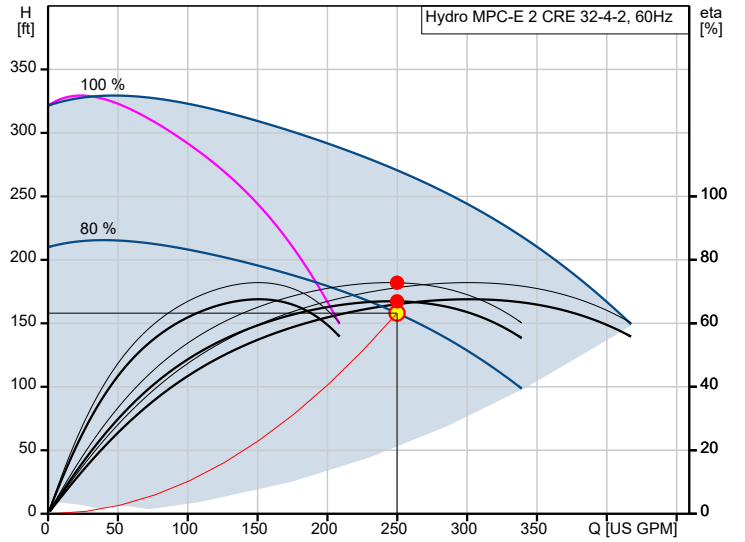
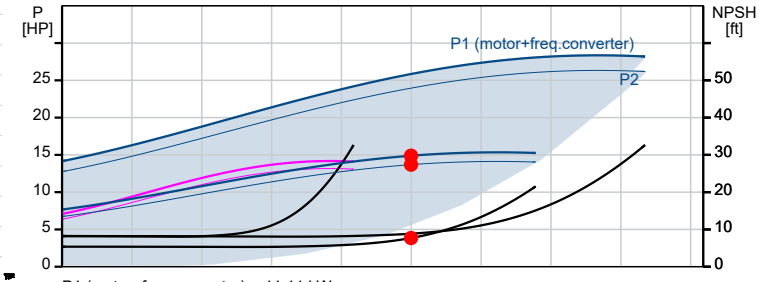
Description	Value
General information:	
Product name:	Hydro MPC-E 2 CRE 32-4-2
Product No:	99688751
EAN number:	5713832923991
Technical:	
Actual calculated flow:	250 US GPM
Max flow:	423 US GPM
Resulting head of the pump:	158 ft
Maximum head:	334.3 ft
Approvals:	CULUS,PROP65
Main pump name:	CRE 32-4-2
Main pump No:	99535872
Non-return valve position:	Outlet
Number of pumps:	2
Materials:	
Manifold:	Stainless steel
Manifold:	EN 1.4571
Manifold:	AISI 316 TI
Base:	Stainless steel
Base:	EN 1.4301
Base:	ASTM 304
Installation:	
Range of ambient temperature:	41 .. 104 °F
Maximum operating pressure:	232.06 psi
Manifold inlet:	ANSI 4"
Manifold outlet:	ANSI 4"
Pressure rating for connection:	PN 16
Earth connection:	PE
System design:	D
Liquid:	
Pumped liquid:	Water
Liquid temperature range:	41 .. 179.6 °F
Selected liquid temperature:	68 °F
Density:	62.29 lb/ft³
Electrical data:	
Power (P2) main pump:	14.8 HP
Rated power - P2:	15 HP
Mains frequency:	60 Hz
Rated voltage:	3 x 460-480 V
Rated current:	17.3 A
Rated current of system:	36.8 A
Enclosure class (IEC 34-5):	IP54
Radio interference supression:	EMC DIRECTIVE(2014/30/EU)
Number of phases of main pump:	3
Controls:	
Control type:	E
Dry running protection, mechanical:	PRESSURE SENSOR 0-10 BAR
Controller:	CU 352
Tank:	
Diaphragm tank:	N
Others:	
Net weight:	895 lb
Gross weight:	1180 lb
Shipping volume:	158 ft³
Sales region:	Namreg
Config. file no:	98272425
Config.file Control MPC:	98271946
Config.file Hydro MPC:	98272054
Country of origin:	US
Custom tariff no.:	8413.70.2040



Q = 250 US GPM
n = 2 x 80 % / 2811 rpm
Density = 62.29 lb/ft³
Losses in fittings and valves not included
Liquid temperature during operation = 68 °F
Eta pump+motor+freq.converter = 66.9 %

H = 158 ft
Pumped liquid = Water
Eta pump = 72.8 %



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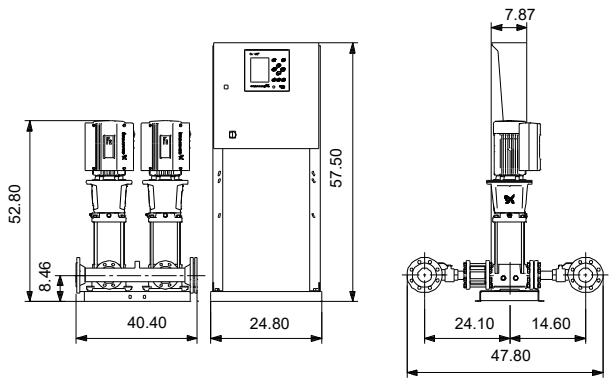

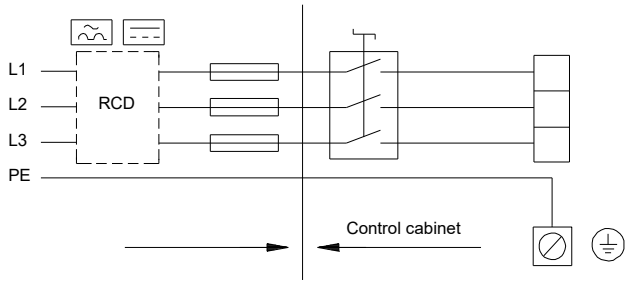

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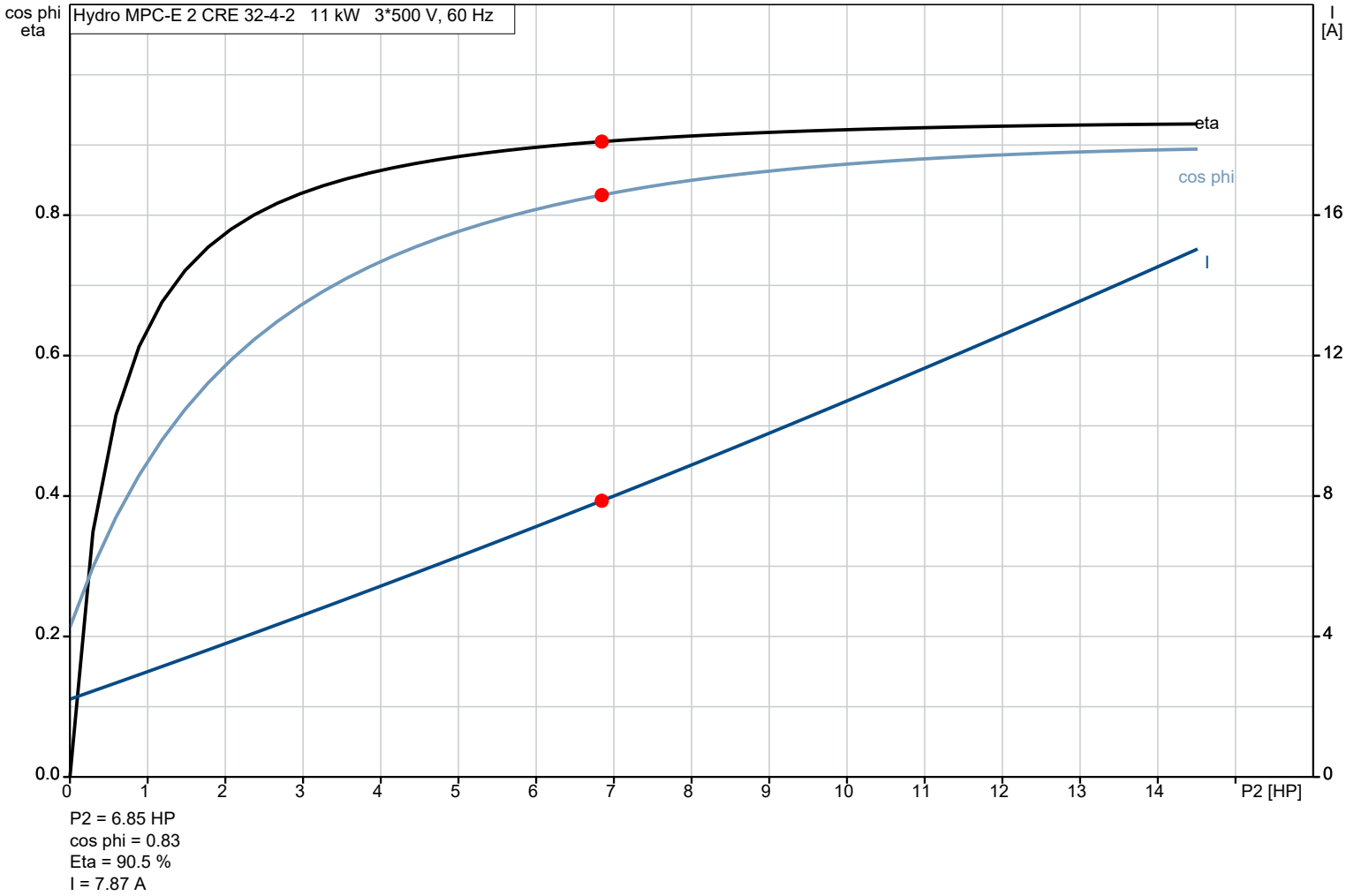
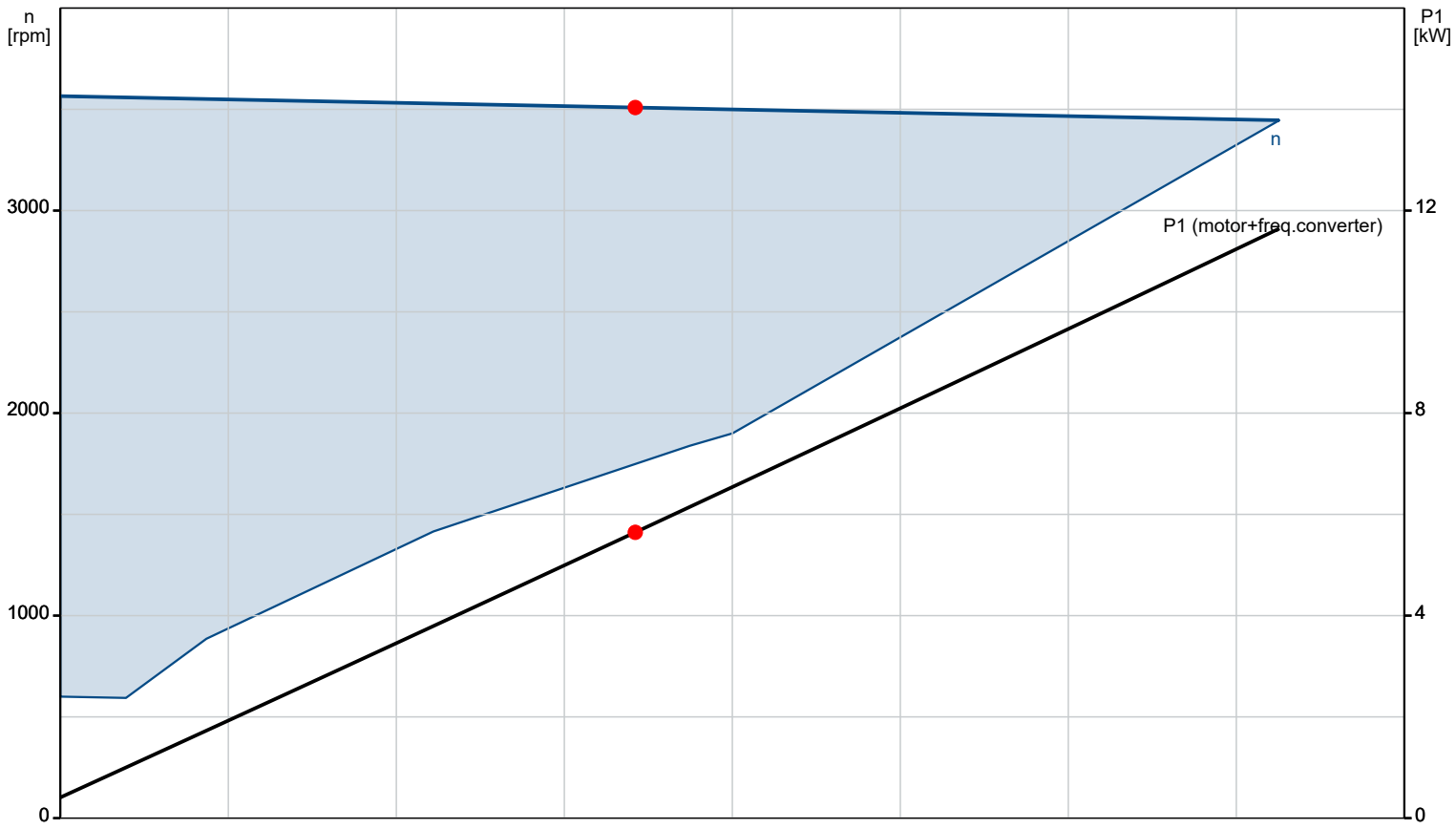
Date: 20/03/2024

99688751 Hydro MPC-E 2 CRE 32-4-2 60 Hz



P2 = 6.85 HP
cos phi = 0.83
Eta = 90.5 %
I = 7.87 A

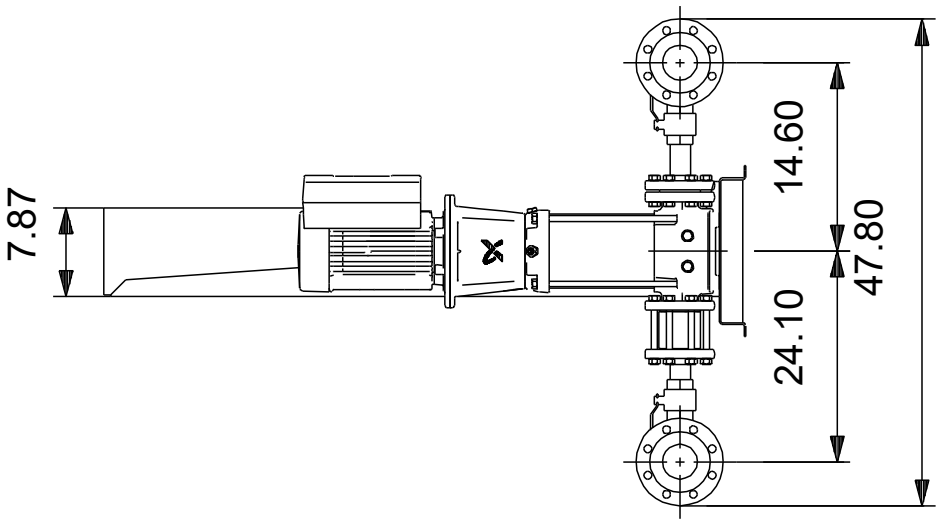


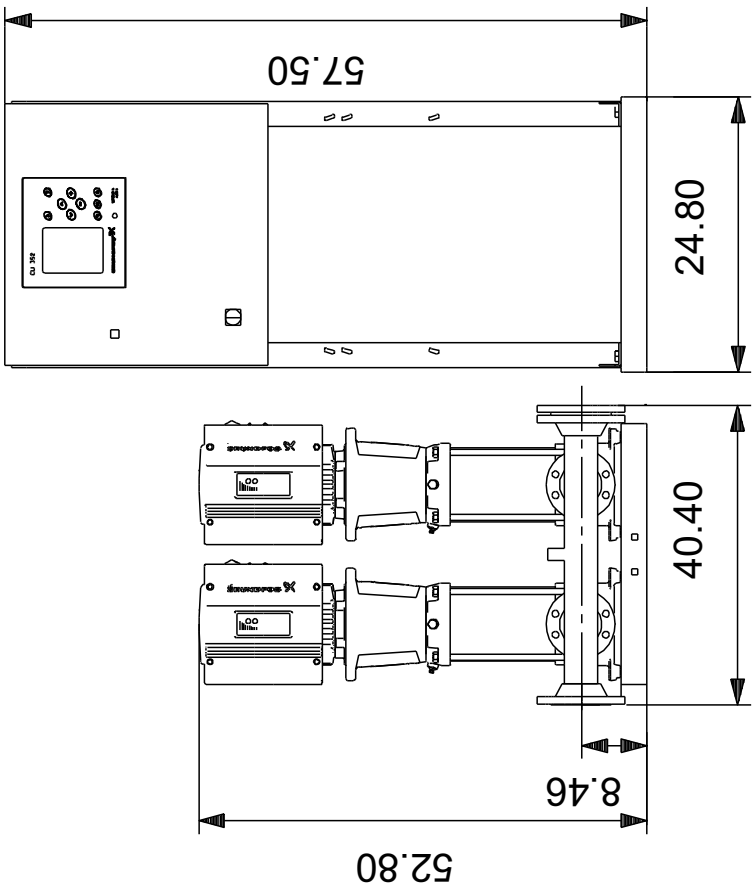
P1 (motor+freq.converter) = 5.645 kW
n = 100 % / 3509 rpm

Company name: Horizons Engineering
Created by:
Phone:

Date: 20/03/2024

99688751 Hydro MPC-E 2 CRE 32-4-2 60 Hz



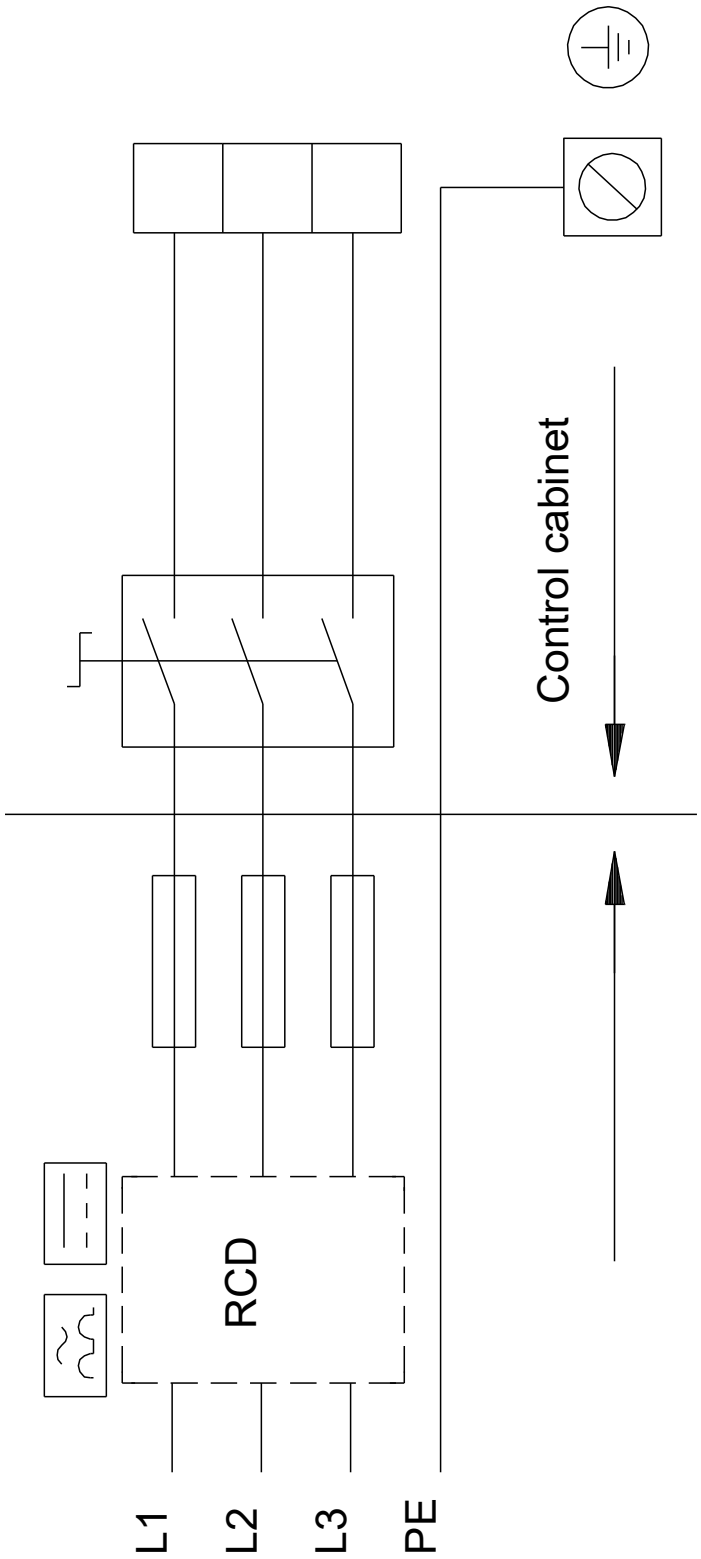


Note! All units are in [in] unless others are stated.
Disclaimer: This simplified dimensional drawing does not show all details.

Company name: Horizons Engineering
Created by:
Phone:

Date: 20/03/2024

99688751 Hydro MPC-E 2 CRE 32-4-2 60 Hz



Note! All units are in [in] unless others are stated.

GRUNDFOS

Company name: Horizons Engineering
Created by:
Phone:

Date: 20/03/2024

Order Data:

Position	Your pos.	Product name	Amount	Product No	Total
		Hydro MPC-E 2 CRE 32-4-2	1	99688751	

WESSELS FXA-700 HYDRO-PNEUMATIC TANK

SINCE 1908
wessels company

SUBMITTAL

FXA-SERIES

HYDRO-PNEUMATIC TANK

Models: FXA-700
Submittal Sheet No. C-1005B Date: 11/17

Job Name	_____	Submitted By	_____	Date	_____
Location	_____	Approved By	_____	Date	_____
	_____	Order No.	_____	Date	_____
Engineer	_____	Notes	_____		
Contractor	_____		_____		
Sales Rep.	_____		_____		

Description

Wessels type FXA-700 tank is an ASME replaceable bladder type pre-charged hydro-pneumatic tank for commercial and industrial well and water systems, booster systems, or other potable water applications. This is designed to deliver water under pressure between pump cycles to provide sufficient flow to meet demands. The water is contained in a butyl bladder. All FXA hydro-pneumatic tanks can be installed vertically or horizontally.

Construction

Shell: Carbon Steel
Bladder: Heavy Duty Butyl
FDA Approved
NSF 61 Listed
System Connection: Epoxy Lined

Performance Limitations

Maximum Design Temperature: 240°F
Maximum Design Pressure: 200 PSIG*

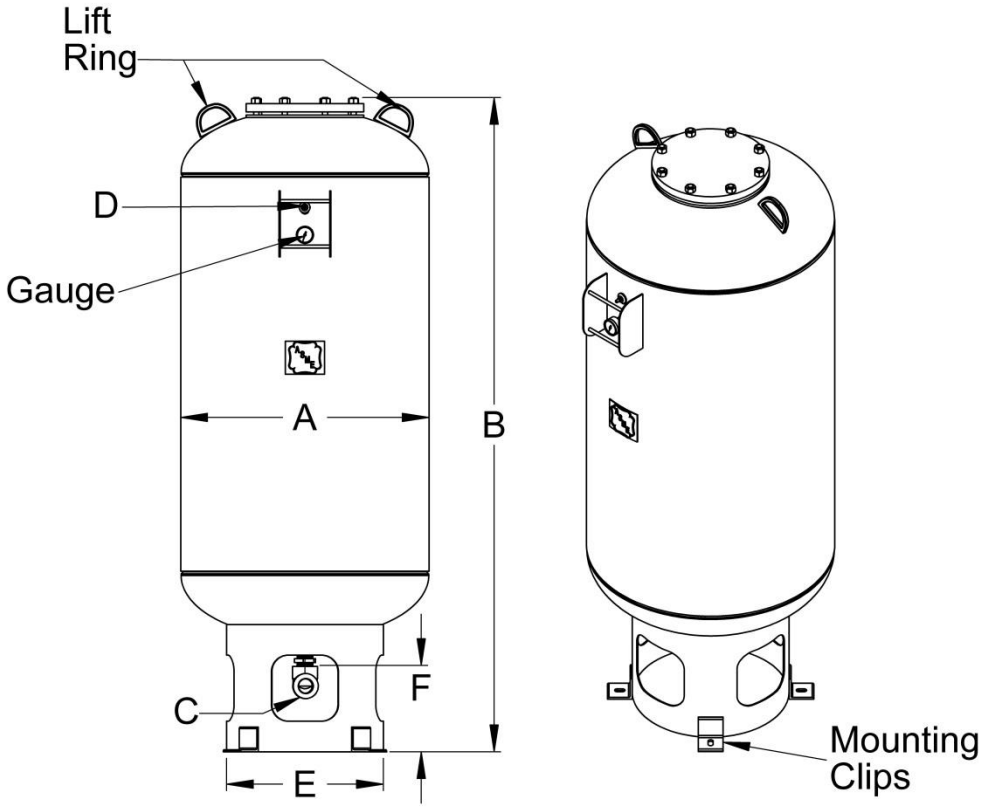
NSF
61 Listed Materials

Model Number	Part Number	Tank Volume (Gallons)	Tagging Information	Quantity
FXA 700	21040715	185		

Typical Specification

Furnish and install, as shown on plans, a _____ gallon _____" diameter X _____" (high) pre-charged steel hydro-pneumatic tank with heavy-duty butyl bladder. The tank shall have bottom NPT system connections and a 0.302"-32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet system requirements. The tank shall have a ¼" NPT connection for relief valve and air pressure gauge. The tank will have a lifting ring and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with most recent addendum of Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code.

The tank shall be Wessels model number FXA-700 or approved equal.



FXA-700

Dimensions & Weights

Model Number	Dimensions in Inches							Approx. Ship Wt. (lbs)
	A	B	System Connection C	Charging Valve D	E	F	Pressure Gauge	
FXA 700	30	80	1 1/2	0.302-32 NC	19	13	1/4	600

Notes

- Tanks are factory pre-charged at 30 psi and field adjustable.

BADGER METER MODMAG M2000 ELECTROMAGNETIC FLOW METER

ModMAG®
M-Series® | Electromagnetic Flow Meters

Electromagnetic Flow Meters

M2000

DESCRIPTION

The Badger Meter ModMAG® M2000 is the result of years of research and field use of electromagnetic flow meter technology. Based on Faraday's law of induction, these meters can measure water, wastewater, water-based fluids and other liquids that meet minimum electrical conductivity.

Designed, developed and manufactured under strict quality standards, this meter features sophisticated, processor-based signal conversion with accuracies of ±0.20% of rate ±1 mm/s. The wide selection of liner and electrode materials helps provide maximum compatibility and minimum maintenance over a long operating period.

The meter is best suited for bidirectional flow measurement of fluids with a conductivity > 5 µS/cm (> 20 µS/cm for demineralized water). The meter has high accuracy, is easy to use, and can be chosen for a wide variety of applications. The backlit, four-line display shows all actual flow measuring data, daily and complete information, including alarm messages. The standard transmitter has 4 programmable digital outputs, one digital input, power output and different interfaces. Integrated system self checkup makes putting into operation and service easier. For service purpose, the meter configuration can be kept or transferred to another meter without a new parametering via the optional back-up parameter function.

APPLICATION

The M2000 transmitter can be integrally mounted to the sensor or can be remote-mounted, if necessary and has many advantages over other conventional technologies. The meter targets a variety of applications and is well suited for the diverse water and wastewater treatment industry. The M2000 meter can accurately measure fluid flow—whether the fluid is water or a highly corrosive liquid, very viscous, contains a moderate amount of solids, or requires special handling. Today, electromagnetic meters are successfully used in industries including building automation, oil and gas, food and beverage, pharmaceutical, water and wastewater, and chemical.

STRAIGHT PIPE REQUIREMENTS

Run sufficient straight-pipe at the sensor inlet and outlet for optimum meter accuracy and performance. An equivalent of 3…7 diameters of straight pipe is required on the inlet (upstream) side to provide a stable flow profile. Two (2) diameters are required on the outlet (downstream) side.

In applications with limited space, the M2000 can be installed with zero straight pipe requirements and fulfils the accuracy according OIML R49 and MID Annex MI-001.

FEATURES

- Available in sizes 0.25…78 in. (6…2000 mm)
- Accuracy of ±0.2% of reading ±1 mm/s
- Flow Range 0.03…12 m/s
- Pulsed DC magnetic field for zero point stability
- Integral and remote signal converter availability
- Power Supply of 100…240V AC / 12…32V DC
- Corrosion-resistant liners for long life
- Zero Straight Run (0 x DN) OIML/MID
- User friendly programming procedure
- Empty pipe detection
- Power loss totalization
- Digital signal processor (32-bit)
- Non-volatile programming memory
- LCD display
- Rotating cover
- IP67 Housing
- Calibrated in state-of-the-art facilities
- Modbus® RTU or Modbus TCP/IP, HART, M-Bus, EtherNet/IP, BACnet/IP, BACnet MS/TP (BTL certification), Profibus DP
- Integrated data logger
- Verifications device
- NSF/ANSI/CAN 61 and 372 listed
- CSA / AWWA C715 certified
- BEACON®/AquaCUE® connectivity

Badger Meter

MAG-DS-01047-EN-30 (September 2023)

Product Data Sheet

ELECTRODES

When looking from the end of the meter into the inside bore, the two measuring electrodes are positioned at three o'clock and nine o'clock. M2000 electromagnetic meters have an "empty pipe detection" feature. This is accomplished with a third electrode positioned in the meter at twelve o'clock.

If this electrode is not covered by fluid for a minimum five-second duration, the meter displays an "empty pipe detection" condition, sends out an error message, if desired, and stops measuring to maintain accuracy. When the electrode again becomes covered with fluid, the error message disappears and the meter resumes measuring.

As an option to using grounding rings, a grounding electrode (fourth electrode) can be built into the meter during manufacturing to assure proper grounding. The position of this electrode is at six o'clock.

OPERATION

The flow meter is a stainless steel tube lined with a non-conductive material. Outside the tube, two DC powered electromagnetic coils are positioned opposing each other. Perpendicular to these coils, two electrodes are inserted into the flow tube. Energized coils create a magnetic field across the whole diameter of the pipe.

As a conductive fluid flows through the magnetic field, a voltage is induced across the electrodes. This voltage is proportional to the average flow velocity of the fluid and is measured by the two electrodes. The M2000 transmitter receives the sensor's analog signal, amplifies that signal and converts it into digital information. At the processor level, the signal is analyzed through a series of sophisticated software algorithms. After separating the signal from electrical noise, it is converted into both analog and digital signals that are used to display rate of flow and totalization.

With no moving parts in the flow stream, there is no pressure lost. Also, accuracy is not affected by temperature, pressure, viscosity or density and there is practically no maintenance required.

SPECIFICATIONS

NOTE: Permanently connected equipment requires the special considerations to satisfy the CEC and the Canadian deviations in the standard, including overcurrent and fault protection as required.

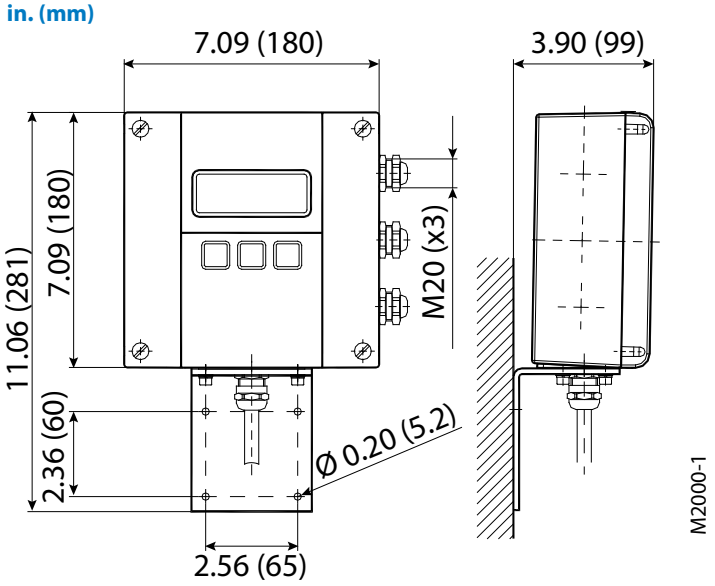
NOTE: DN represents nominal diameter in mm.

Transmitter Specifications

Flow Range	0.10…39.4 ft/s (0.03…12 m/s)
Accuracy	± 0.20% m.v. ± 1 mm/s OIML/MID: 2…28 in. (DN50…800) with 0d up and 0d downstream ±1% ≥ 0.5 ft/s (0.15 m/s)
Repeatability	± 0.1%
Power Supply	**AC Power Supply:** 100…240V AC (±10%); Typical Power: 20V A or 15W; Maximum Power: 26V A or 20W **Optional DC Power Supply:** 12…32V DC (±10%); Typical Power: 10W; Maximum Power: 14W
Analog Output	4…20 mA, 0…20 mA, 0…10 mA, 2…10 mA (programmable and scalable) Voltage sourced 24V DC isolated. Maximum loop resistance < 800 Ohms.
Digital Output	Four total, configurable 24V DC sourcing active output (up to 2),100 mA total, 50 mA each; sinking open collector output (up to four), 30V DC max, 100 mA each; solid-state relay (up to 2), 48V DC, 500 mA max, either polarity
	Absolute Digital Encoded output for connectivity to AquaCUE or BEACON cellular endpoints
Digital Input	Max 30V DC (programmable – positive zero return, external totalizer reset or preset batch start)
Frequency Output	Scalable up to 10 kHz, open collector up to 1 kHz, solid-state relay
Misc Output	High/low flow alarm (0…100% of flow), error alarm, empty pipe alarm, flow direction, preset batch alarm, 24V DC supply, ADE
Communication	RS232 Modbus RTU; RS485 Modbus RTU, HART, Profibus DP, BACnet MS/TP, Modbus TCP/IP, EtherNet/IP and BACnet/IP require separate daughterboards
Pulse Width	Scalable up to 10 kHz, passive open collector up to 10 kHz, active switched 24V DC. Up to two outputs (forward and reverse). Pulse width programmable from 1…1000 ms or 50% duty cycle.
Processing	32-bit DSP
Empty Pipe Detection	Field tunable for optimum performance based on specific application
Excitation Frequency	1 Hz, 3.75 Hz, 7.5 Hz or 15 Hz (factory optimized to pipe diameter)
Noise Dampening	Programmable 0…30 seconds
Low Flow Cut-Off	Programmable 0…10% of maximum flow
Galvanic Separation	250V
Fluid Conductivity	Minimum 5.0 µS/cm (minimum 20 µS/cm for demineralized water)
Fluid Temperature	**With Remote Transmitter:** PFA, PTFE & ETFE 302° F (150° C) **With Meter-Mounted Transmitter:** Rubber 178° F, (80° C), PFA, PTFE & ETFE 212° F (100° C)
Ambient Temperature	– 4…140° F (–20…60° C)
Relative Humidity	Up to 90 percent non-condensing

Pollution Degree	2
Installation Category	II
Altitude	8202 ft (2500 m)
Flow Direction	Unidirectional or bidirectional two separate totalizers (programmable)
Totalization	Programmable/resettable
Units of Measure	Ounce, pound, liter, US gallon, imperial gallon, barrel, hectoliter, mega gallon, cubic meter, cubic feet, acre feet
Display	4 x 20 character display with backlight
Programming	Three-button, external manual or remote
Transmitter Housing	Cast aluminum, powder-coated paint
Mounting	Meter mount or remote wall mount (bracket supplied)
Locations	Indoor and outdoor
Meter Enclosure Classification	**Standard:** NEMA 4X (IP67); **Optional:** Submersible NEMA 6P (IP68) depth of 2 m for 72 hr), remote transmitter required
Junction Box Enclosure Protection	For remote transmitter option: powder-coated die-cast aluminum, NEMA 4 (IP67)
Cable Entries	M20 cable glands (3)
Optional Stainless Steel Grounding Rings	**Meter Size** / **Thickness of one ring** / **Thickness of one ring (DIN Flanges)** Up through 10 in. / 0.135 in. (3.429 mm) / 0.12 in. (3 mm) 12…78 in. / 0.187 in. (4.750 mm) / 0.12 in. (3 mm)
NSF/ANSI/CAN 61 and 372 Listed WRAS/ACS	Models with hard rubber liner, 4 in. size and larger; PTFE liner, all sizes WRAS (hard rubber), ACS (PTFE)
OIML R49-1 MID MI-001 AWWA C715	Size range: DN50…800 / 2…28 in. Minimum straight inlet flow: 0 DN /outlet flow: 0 DN Forward and reverse (bi-directional) flow on any orientation Ratio (Q3/Q1) up to 250 Accuracy Class 1
Token Features	Data Logging (Blue token); Store/Restore (Red token); Firmware Upgrade (Black token)

M2000 Transmitter Dimensions in. (mm)



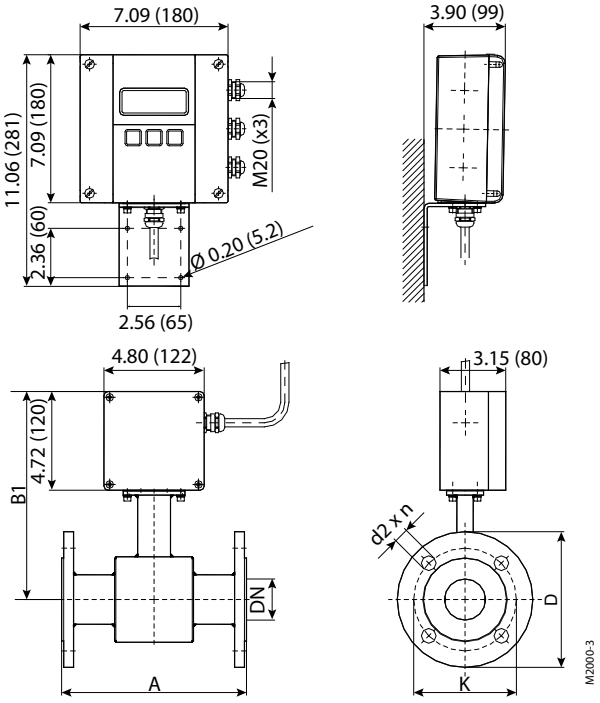
Sensor Type II Specifications

The electromagnetic sensor type II is not only available in a number of different flange process connections (DIN, ANSI, JIS, AWWA) but also in a number of liners like hard rubber, PTFE, PFA or ETFE. The sensor is configurable with up to 4 electrodes for measuring, empty pipe and grounding electrodes. Available in sizes from DN 6 TO DN 2000 and nominal pressures up to PN 100, the sensor type II is best suited for a variety of applications in the industry and the water/waste water industry.

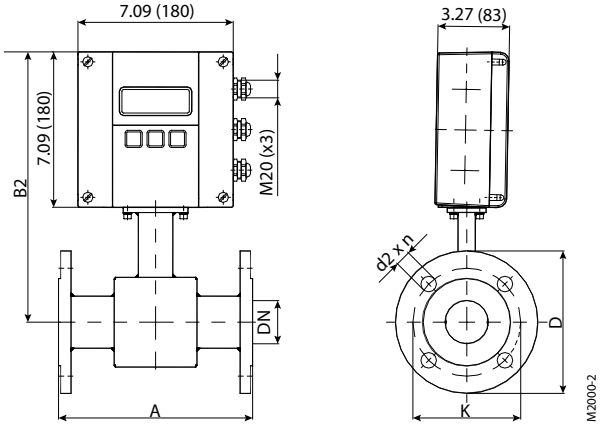
Size	1/4…78 in. (DN 6…2000)		
Flanges	**Standard:** ANSI B16.5, AWWA, ISO 1092-1, JIS and more in carbon steel; **Optional:** 304 or 316 stainless steel		
Nominal Pressure	Up to 1450 psi (100 bar)		
Pressure Rating	Line sizes 1/4…24 in: In accordance with ASME B16.5 Class 150 or Flange Rating Class 300 Line sizes 26…78 in: AWWA C-207 Class D or Class E Flange Rating		
Protection Class	NEMA 4X (IP67), optional NEMA 6P (IP68)		
Minimum Conductivity	5 µS/cm (20 µS/cm for demineralized water)		
Liner Material	Hard rubber	1…78 in. (DN 25…2000)	32…176° F (0…80° C)
	PTFE	1/2…24 in. (DN 15…600)	–40…302° F (–40…150° C)
	ETFE	12 in. (DN 300) and larger	–40…302° F (–40…150° C)
	PFA	1/4…3/8 in. (DN 6…10)	—
Housing	**Standard:** Carbon steel welded; **Optional:** 316 or 304 stainless steel		
Electrode Materials	**Standard:** Hastelloy C22; **Optional:** 316 stainless steel, gold/platinum plated, tantalum, platinum/rhodium		
Lay Length	1/4…3/4 in. (DN 6…20)	6.7 in. (170 mm)	
	1…2 in. (DN 25…50)	8.9 in. (225 mm)	
	2-1/2…4 in. (DN 65…100)	11.0 in. (280 mm)	
	5…8 in. (DN 125…200)	15.8 in. (400 mm)	
	10…14 in. (DN 250…350)	19.7 in. (500 mm)	
	16…28 in. (DN 400…700)	23.6 in. (600 mm)	
	30…40 in. (DN 750…1000)	31.5 in. (800 mm)	
	48…56 in. (DN 1200…1400)	39.4 in. (1000 mm)	
	64 in. (DN 1600)	63.0 in. (1600 mm)	
	72 in. (DN1800)	70.9 in. (1800 mm)	
	78 in. (DN2000)	78.7 in. (2000 mm)	

Sensor Type II Dimensions

Remote Version in. (mm)



Mounted Version in. (mm)



IMPORTANT: *Flange Sizes ≤ 24 in., Standard: ANSI B16.5 Class 150 RF forged carbon steel; Optional: 300 lb forged carbon steel, 316 or 304 stainless steel*
Flange Sizes > 24 in., Standard: AWWA Class D Flanges RF forged carbon steel

Flange ANSI Class 150
Up to 24 in. ASME B16.5 / > 24 in. AWWA Class D (ASME 16.47)

Size DN		A Standard		A ISO*		B1		B2		D		K		d2 x n	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1/4	6	6.7	170	—	—	9.0	228	11.3	288	3.5	89	2.4	61	0.6 x 4	16 x 4
5/16	8	6.7	170	—	—	9.0	228	11.3	288	3.5	89	2.4	61	0.6 x 4	16 x 4
3/8	10	6.7	170	—	—	9.0	228	11.3	288	3.5	89	2.4	61	0.6 x 4	16 x 4
1/2	15	6.7	170	7.9	200	9.4	238	11.7	298	3.5	89	2.4	61	0.6 x 4	16 x 4
3/4	20	6.7	170	7.9	200	9.4	238	11.7	298	3.9	99	2.8	71	0.6 x 4	16 x 4
1	25	8.9	225	7.9	200	9.4	238	11.7	298	4.3	109	3.1	79	0.6 x 4	16 x 4
1-1/4	32	8.9	225	7.9	200	10.0	253	12.3	313	4.6	117	3.5	89	0.6 x 4	16 x 4
1-1/2	40	8.9	225	7.9	200	10.0	253	12.3	313	5.0	127	3.9	99	0.6 x 4	16 x 4
2	50	8.9	225	7.9	200	10.0	253	12.3	313	6.0	152	4.8	122	0.8 x 4	19 x 4
2-1/2	65	11.0	280	7.9	200	10.7	271	13.0	331	7.0	178	5.5	140	0.8 x 4	19 x 4
3	80	11.0	280	7.9	200	10.7	271	13.0	331	7.5	191	6.0	152	0.8 x 4	19 x 4
4	100	11.0	280	9.8	250	10.9	278	13.3	338	9.0	229	7.5	191	0.8 x 8	19 x 8
5	125	15.7	400	9.8	250	11.7	298	14.1	358	10.0	254	8.5	216	0.9 x 8	22 x 8
6	150	15.7	400	11.8	300	12.2	310	14.6	370	11.0	279	9.5	241	0.9 x 8	22 x 8
8	200	15.7	400	13.8	350	13.3	338	15.7	398	13.5	343	11.8	300	0.9 x 8	22 x 8
10	250	19.7	500	17.7	450	14.3	362	16.6	422	16.0	406	14.3	363	1.0 x 12	25 x 12
12	300	19.7	500	19.7	500	16.7	425	19.1	485	19.0	483	17.0	432	1.0 x 12	25 x 12
14	350	19.7	500	21.7	550	17.7	450	20.1	510	21.0	533	18.8	478	1.1 x 12	28 x 12
16	400	23.6	600	23.6	600	18.7	475	21.1	535	23.5	597	21.3	541	1.1 x 16	28 x 16
18	450	23.6	600	23.6	600	19.7	500	22.0	560	25.0	635	22.8	579	1.3 x 16	32 x 16
20	500	23.6	600	23.6	600	20.7	525	23.0	585	27.5	699	25.0	635	1.3 x 20	32 x 20
24	600	23.6	600	23.6	600	23.1	588	25.5	648	32.0	813	29.5	749	1.4 x 20	35 x 20
28	700	23.6	600	27.6	700	24.6	625	27.0	685	36.5	927	34.0	864	1.4 x 28	35 x 28
30	750	31.5	800	29.5	750	25.6	650	28.0	710	38.8	986	36.0	914	1.4 x 28	35 x 28
32	800	31.5	800	31.5	800	26.9	683	29.3	743	41.8	1062	38.5	978	1.6 x 28	41 x 28
36	900	31.5	800	35.4	900	28.5	725	30.9	785	46.0	1168	42.8	1087	1.6 x 32	41 x 32
40	1000	31.5	800	39.4	1000	31.1	790	33.5	850	50.8	1290	47.3	1201	1.6 x 36	41 x 36
42	1050	39.4	1000	41.3	1050	32.5	825	34.8	885	53.0	1346	49.5	1257	1.6 x 36	41 x 36
48	1200	39.4	1000	47.2	1200	35.4	900	37.8	960	59.5	1511	56.0	1422	1.6 x 44	41 x 44
54	1350	39.4	1000	53.1	1350	38.4	975	40.7	1035	66.3	1684	62.8	1595	1.9 x 44	48 x 44
56	1400	39.4	1000	55.1	1400	39.4	1000	41.7	1060	68.8	1748	65.0	1651	1.9 x 48	48 x 48
Other sizes on request															

IMPORTANT: ISO* sensor lay length according to ISO 20456

Flange ANSI Class 300 ASME B16.5

Size DN		A Standard		A ISO*		B1		B2		D		K		d2 x n	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1/2	15	6.7	170	7.9	200	9.4	238	11.7	298	3.8	95	2.6	67	0.6 x 4	16 x 4
3/4	20	6.7	170	7.9	200	9.4	238	11.7	298	4.6	117	3.3	83	0.8 x 4	19 x 4
1	25	8.9	225	7.9	200	9.4	238	11.7	298	4.9	124	3.5	89	0.8 x 4	19 x 4
1-1/4	32	8.9	225	7.9	200	10.0	253	12.3	313	5.3	133	3.9	99	0.8 x 4	19 x 4
1-1/2	40	8.9	225	7.9	200	10.0	253	12.3	313	6.1	155	4.5	114	0.9 x 4	22 x 4
2	50	8.9	225	7.9	200	10.0	253	12.3	313	6.5	165	5.0	127	0.8 x 8	19 x 8
2-1/2	65	11.0	280	7.9	200	10.7	271	13.0	331	7.5	191	5.9	149	0.9 x 8	22 x 8
3	80	11.0	280	7.9	200	10.7	271	13.0	331	8.3	210	6.6	168	0.9 x 8	22 x 8
4	100	11.0	280	9.8	250	10.9	278	13.3	338	10.0	254	7.9	200	0.9 x 8	22 x 8
5	125	15.7	400	9.8	250	11.7	298	14.1	358	11.0	279	9.3	235	0.9 x 8	22 x 8
6	150	15.7	400	11.8	300	12.2	310	14.6	370	12.5	318	10.6	270	0.9 x 12	22 x 12
8	200	15.7	400	13.8	350	13.3	338	15.7	398	15.0	381	13.0	330	1.0 x 12	25 x 12
10	250	19.7	500	17.7	450	14.3	362	16.6	422	17.5	445	15.3	387	1.1 x 16	28 x 16
12	300	19.7	500	19.7	500	16.7	425	19.1	485	20.5	521	17.8	451	1.3 x 16	32 x 16
14	350	19.7	500	21.7	550	17.7	450	20.1	510	23.0	584	20.3	514	1.3 x 20	32 x 20
16	400	23.6	600	23.6	600	18.7	475	21.1	535	25.5	648	22.5	572	1.4 x 20	35 x 20
18	450	23.6	600	23.6	600	19.7	500	22.0	560	28.0	711	24.8	629	1.4 x 24	35 x 24
20	500	23.6	600	23.6	600	20.7	525	23.0	585	30.5	775	27.0	686	1.4 x 24	35 x 24
24	600	23.6	600	23.6	600	23.1	588	25.5	648	36.0	914	32.0	813	1.6 x 24	41 x 24
Other sizes on request															

IMPORTANT: ISO* sensor lay length according to ISO 20456

Flange EN 1092-1 / PN 10

Size DN		A Standard		A ISO*		B1		B2		D		K		d2 x n	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
8	200	15.7	400	13.8	350	13.3	338	15.7	398	13.4	340	11.6	295	0.9 x 8	22 x 8
10	250	19.7	500	17.7	450	14.3	362	16.6	422	15.6	395	13.8	350	0.9 x 12	22 x 12
12	300	19.7	500	19.7	500	16.7	425	19.1	485	17.5	445	15.7	400	0.9 x 12	22 x 12
14	350	19.7	500	21.7	550	17.7	450	20.1	510	19.9	505	18.1	460	0.9 x 16	22 x 16
16	400	23.6	600	23.6	600	18.7	475	21.1	535	22.2	565	20.3	515	1.0 x 16	26 x 16
18	450	23.6	600	23.6	600	19.7	500	22.0	560	24.2	615	22.2	565	1.0 x 20	26 x 20
20	500	23.6	600	23.6	600	20.7	525	23.0	585	26.4	670	24.4	620	1.0 x 20	26 x 20
24	600	23.6	600	23.6	600	23.1	588	25.5	648	30.7	780	28.5	725	1.2 x 20	30 x 20
28	700	23.6	600	27.6	700	24.6	625	27.0	685	35.2	895	33.1	840	1.2 x 24	30 x 24
32	800	31.5	800	31.5	800	26.9	683	29.3	743	40.0	1015	37.4	950	1.3 x 24	33 x 24
36	900	31.5	800	35.4	900	28.5	725	30.9	785	43.9	1115	41.3	1050	1.3 x 28	33 x 28
40	1000	31.5	800	39.4	1000	31.1	790	33.5	850	48.4	1230	45.7	1160	1.4 x 28	36 x 28
48	1200	39.4	1000	47.2	1200	35.4	900	37.8	960	57.3	1455	54.3	1380	1.5 x 32	39 x 32
56	1400	39.4	1000	55.1	1400	39.4	1000	41.7	1060	65.9	1675	62.6	1590	1.7 x 36	42 x 36
Other sizes on request															

IMPORTANT: ISO* sensor lay length according to ISO 20456

Flange EN 1092-1 / PN 16

Size DN		A Standard		A ISO*		B1		B2		D		K		d2 x n	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1/4	6	6.7	170	—	—	9.0	228	11.3	288	3.5	90	2.4	60	0.6 x 4	14 x 4
5/16	8	6.7	170	—	—	9.0	228	11.3	288	3.5	90	2.4	60	0.6 x 4	14 x 4
3/8	10	6.7	170	—	—	9.0	228	11.3	288	3.5	90	2.4	60	0.6 x 4	14 x 4
1/2	15	6.7	170	7.9	200	9.4	238	11.7	298	3.7	95	2.6	65	0.6 x 4	14 x 4
3/4	20	6.7	170	7.9	200	9.4	238	11.7	298	4.1	105	3.0	75	0.6 x 4	14 x 4
1	25	8.9	225	7.9	200	9.4	238	11.7	298	4.5	115	3.3	85	0.6 x 4	14 x 4
1-1/4	32	8.9	225	7.9	200	10.0	253	12.3	313	5.5	140	3.9	100	0.7 x 4	18 x 4
1-1/2	40	8.9	225	7.9	200	10.0	253	12.3	313	5.9	150	4.3	110	0.7 x 4	18 x 4
2	50	8.9	225	7.9	200	10.0	253	12.3	313	6.5	165	4.9	125	0.7 x 4	18 x 4
2-1/2	65	11.0	280	7.9	200	10.7	271	13.0	331	7.3	185	5.7	145	0.7 x 8	18 x 8
3	80	11.0	280	7.9	200	10.7	271	13.0	331	7.9	200	6.3	160	0.7 x 8	18 x 8
4	100	11.0	280	9.8	250	10.9	278	13.3	338	8.7	220	7.1	180	0.7 x 8	18 x 8
5	125	15.7	400	9.8	250	11.7	298	14.1	358	9.8	250	8.3	210	0.7 x 8	18 x 8
6	150	15.7	400	11.8	300	12.2	310	14.6	370	11.2	285	9.4	240	0.9 x 8	22 x 8
8	200	15.7	400	13.8	350	13.3	338	15.7	398	13.4	340	11.6	295	0.9 x 12	22 x 12
10	250	19.7	500	17.7	450	14.3	362	16.6	422	15.9	405	14.0	355	1.0 x 12	26 x 12
12	300	19.7	500	19.7	500	16.7	425	19.1	485	18.1	460	16.1	410	1.0 x 12	26 x 12
14	350	19.7	500	21.7	550	17.7	450	20.1	510	20.5	520	18.5	470	1.0 x 16	26 x 16
16	400	23.6	600	23.6	600	18.7	475	21.1	535	22.8	580	20.7	525	1.2 x 16	30 x 16
18	450	23.6	600	23.6	600	19.7	500	22.0	560	25.2	640	23.0	585	1.2 x 20	30 x 20
20	500	23.6	600	23.6	600	20.7	525	23.0	585	28.1	715	25.6	650	1.3 x 20	33 x 20
24	600	23.6	600	23.6	600	23.1	588	25.5	648	33.1	840	30.3	770	1.4 x 20	36 x 20
28	700	23.6	600	27.6	700	24.6	625	27.0	685	35.8	910	33.1	840	1.4 x 24	36 x 24
32	800	31.5	800	31.5	800	26.9	683	29.3	743	40.4	1025	37.4	950	1.5 x 24	39 x 24
36	900	31.5	800	35.4	900	28.5	725	30.9	785	44.3	1125	41.3	1050	1.5 x 28	39 x 28
40	1000	31.5	800	39.4	1000	31.1	790	33.5	850	49.4	1255	46.1	1170	1.7 x 28	42 x 28
48	1200	39.4	1000	47.2	1200	35.4	900	37.8	960	58.5	1485	54.7	1390	1.9 x 32	48 x 32
56	1400	39.4	1000	55.1	1400	39.4	1000	41.7	1060	66.3	1685	62.6	1590	1.9 x 36	48 x 36
Other sizes on request															

IMPORTANT: ISO* sensor lay length according to ISO 20456

Flange EN 1092-1 / PN 25

Size DN		A Standard		A ISO*		B1		B2		D		K		d2 x n	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1/2	15	6.7	170	7.9	200	9.4	238	11.7	298	3.7	95	2.6	65	0.6 x 4	14 x 4
3/4	20	6.7	170	7.9	200	9.4	238	11.7	298	4.1	105	3.0	75	0.6 x 4	14 x 4
1	25	8.9	225	7.9	200	9.4	238	11.7	298	4.5	115	3.3	85	0.6 x 4	14 x 4
1-1/4	32	8.9	225	7.9	200	10.0	253	12.3	313	5.5	140	3.9	100	0.7 x 4	18 x 4
1-1/2	40	8.9	225	7.9	200	10.0	253	12.3	313	5.9	150	4.3	110	0.7 x 4	18 x 4
2	50	8.9	225	7.9	200	10.0	253	12.3	313	6.5	165	4.9	125	0.7 x 4	18 x 4
2-1/2	65	11.0	280	7.9	200	10.7	271	13.0	331	7.3	185	5.7	145	0.7 x 4	18 x 8
3	80	11.0	280	7.9	200	10.7	271	13.0	331	7.9	200	6.3	160	0.7 x 8	18 x 8
4	100	11.0	280	9.8	250	10.9	278	13.3	338	9.3	235	7.5	190	0.9 x 8	22 x 8
5	125	15.7	400	9.8	250	11.7	298	14.1	358	10.6	270	8.7	220	1.0 x 8	26 x 8
6	150	15.7	400	11.8	300	12.2	310	14.6	370	11.8	300	9.8	250	1.0 x 8	26 x 8
8	200	15.7	400	13.8	350	13.3	338	15.7	398	14.2	360	12.2	310	1.0 x 8	26 x 12
10	250	19.7	500	17.7	450	14.3	362	16.6	422	16.7	425	14.6	370	1.2 x 12	30 x 12
12	300	19.7	500	19.7	500	16.7	425	19.1	485	19.1	485	16.9	430	1.2 x 12	30 x 16
14	350	19.7	500	21.7	550	17.7	450	20.1	510	21.9	555	19.3	490	1.3 x 16	33 x 16
16	400	23.6	600	23.6	600	18.7	475	21.1	535	24.4	620	21.7	550	1.4 x 16	36 x 16
18	450	23.6	600	23.6	600	19.7	500	22.0	560	26.4	670	23.6	600	1.4 x 20	36 x 20
20	500	23.6	600	23.6	600	20.7	525	23.0	585	28.7	730	26.0	660	1.4 x 20	36 x 20
24	600	23.6	600	23.6	600	23.1	588	25.5	648	33.3	845	30.3	770	1.5 x 20	39 x 20
28	700	23.6	600	27.6	700	24.6	625	27.0	685	37.8	960	34.4	875	1.7 x 24	42 x 24
32	800	31.5	800	31.5	800	26.9	683	29.3	743	42.7	1085	39.0	990	1.9 x 24	48 x 24
36	900	31.5	800	35.4	900	28.5	725	30.9	785	46.7	1185	42.9	1090	1.9 x 28	48 x 28
40	1000	31.5	800	39.4	1000	31.1	790	33.5	850	52.0	1320	47.6	1210	2.2 x 28	56 x 28
Other sizes on request															

IMPORTANT: ISO* sensor lay length according to ISO 20456

Flange EN 1092-1 / PN 40

Size DN		A Standard		A ISO*		B1		B2		D		K		d2 x n	
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
1/2	15	6.7	170	7.9	200	9.4	238	11.7	298	3.7	95	2.6	65	0.6 x 4	14 x 4
3/4	20	6.7	170	7.9	200	9.4	238	11.7	298	4.1	105	3.0	75	0.6 x 4	14 x 4
1	25	8.9	225	7.9	200	9.4	238	11.7	298	4.5	115	3.3	85	0.6 x 4	14 x 4
1-1/4	32	8.9	225	7.9	200	10.0	253	12.3	313	5.5	140	3.9	100	0.7 x 4	18 x 4
1-1/2	40	8.9	225	7.9	200	10.0	253	12.3	313	5.9	150	4.3	110	0.7 x 4	18 x 4
2	50	8.9	225	7.9	200	10.0	253	12.3	313	6.5	165	4.9	125	0.7 x 4	18 x 4
2-1/2	65	11.0	280	7.9	200	10.7	271	13.0	331	7.3	185	5.7	145	0.7 x 4	18 x 8
3	80	11.0	280	7.9	200	10.7	271	13.0	331	7.9	200	6.3	160	0.7 x 8	18 x 8
4	100	11.0	280	9.8	250	10.9	278	13.3	338	9.3	235	7.5	190	0.9 x 8	22 x 8
5	125	15.7	400	9.8	250	11.7	298	14.1	358	10.6	270	8.7	220	1.0 x 8	26 x 8
6	150	15.7	400	11.8	300	12.2	310	14.6	370	11.8	300	9.8	250	1.0 x 8	26 x 8
8	200	15.7	400	13.8	350	13.3	338	15.7	398	14.8	375	12.6	320	1.2 x 8	30 x 12
10	250	19.7	500	17.7	450	14.3	362	16.6	422	17.7	450	15.2	385	1.3 x 12	33 x 12
12	300	19.7	500	19.7	500	16.7	425	19.1	485	20.3	515	17.7	450	1.3 x 12	33 x 16
14	350	19.7	500	21.7	550	17.7	450	20.1	510	22.8	580	20.1	510	1.4 x 16	36 x 16
16	400	23.6	600	23.6	600	18.7	475	21.1	535	26.0	660	23.0	585	1.5 x 16	39 x 16
18	450	23.6	600	23.6	600	19.7	500	22.0	560	27.0	685	24.0	610	1.5 x 20	39 x 20
20	500	23.6	600	23.6	600	20.7	525	23.0	585	29.7	755	26.4	670	1.7 x 20	42 x 20
24	600	23.6	600	23.6	600	23.1	588	25.5	648	35.0	890	31.3	795	1.9 x 20	48 x 20
Other sizes on request															

IMPORTANT: ISO* sensor lay length according to ISO 20456

Weight and Flow Range

Size		Estimated Weight with M2000	Flow Range	
in.	**DN**	**lb (kg)**	**US**	**Metric**
1/4	6	8 (3.5)	0.0134…5.4 GPM	0.051…20.4 l/min
5/16	8	8 (3.5)	0.0239…9.6 GPM	0.09…36.2 l/min
3/8	10	8 (3.5)	0.0373…14.9 GPM	0.141…57 l/min
1/2	15	10 (4.5)	0.084…33.6 GPM	0.318…127 l/min
3/4	20	10 (4.5)	0.149…60 GPM	0.57…226 l/min
1	25	11 (5)	0.233…93 GPM	0.88…353 l/min
1-1/4	32	13 (6)	0.382…153 GPM	1.45…579 l/min
1-1/2	40	15.5 (7)	0.6…239 GPM	2.26…905 l/min
2	50	19 (8.5)	0.93…373 GPM	3.53…1,414 l/min
2-1/2	65	27.5 (12.5)	1.58…631 GPM	0.358…143 m^3/h
3	80	31 (14)	2.39…956 GPM	0.54…217 m^3/h
4	100	42 (19)	3.73…1,494 GPM	0.85…339 m^3/h
5	125	53 (24)	5.8…2,334 GPM	1.33…530 m^3/h
6	150	60.5 (27.5)	8.4…3,361 GPM	1.91…763 m^3/h
8	200	87 (39.5)	14.9…5,975 GPM	3.39…1,357 m^3/h
10	250	129 (58.5)	23.3…9,336 GPM	5.3…2,121 m^3/h
12	300	204 (92.5)	33.6…13,444 GPM	7.6…3,054 m^3/h
14	350	262 (119)	45.7…18,299 GPM	10.4…4,156 m^3/h
16	400	344 (156)	60…23,901 GPM	13.6…5,429 m^3/h
18	450	397 (180)	76…30,250 GPM	17.2…6,870 m^3/h
20	500	470 (213)	93…37,345 GPM	21.2…8,482 m^3/h
22	550	549 (249)	113…45,188 GPM	25.7…10,263 m^3/h
24	600	617 (280)	134…53,777 GPM	30.5…12,214 m^3/h
28	700	—	183…73,197 GPM	41.6…16,625 m^3/h
30	750	930 (422)	210…84,027 GPM	47.7…19,085 m^3/h
32	800	1171 (531)	239…95,604 GPM	54.3…21,714 m^3/h
36	900	1378 (625)	302…120,999 GPM	69…27,482 m^3/h
40	1000	—	373…149,381 GPM	85…33,928 m^3/h
48	1200	1788 (811)	538…215,109 GPM	122…48,857 m^3/h
56	1400	—	732…292,787 GPM	166…66,499 m^3/h
60	1500	2112 (958)	840…336,108 GPM	191…76,338 m^3/h
64	1600	2339 (1061)	956…382,416 GPM	217…86,856 m^3/h
72	1800	3219 (1460)	1210…483,996 GPM	275…109,927 m^3/h
78	2000	4101 (1860)	1494…597,525 GPM	339…135,713 m^3/h

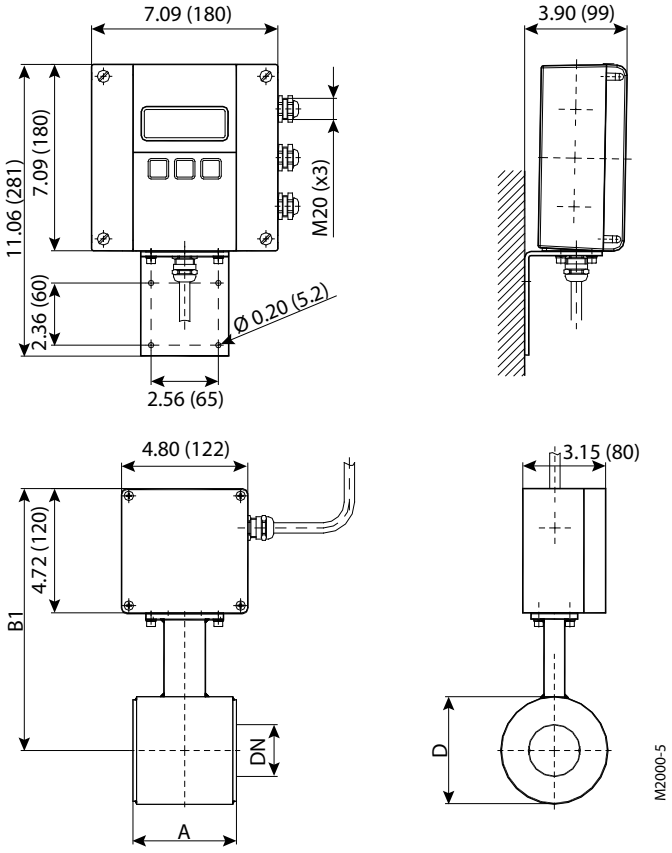
Sensor Type III Specifications

Thanks to its very short lay length, the sensor type III is often the right alternative to a lot of applications. Delivered with a PTFE liner, the sensor type III has a standard nominal pressure of PN 40.

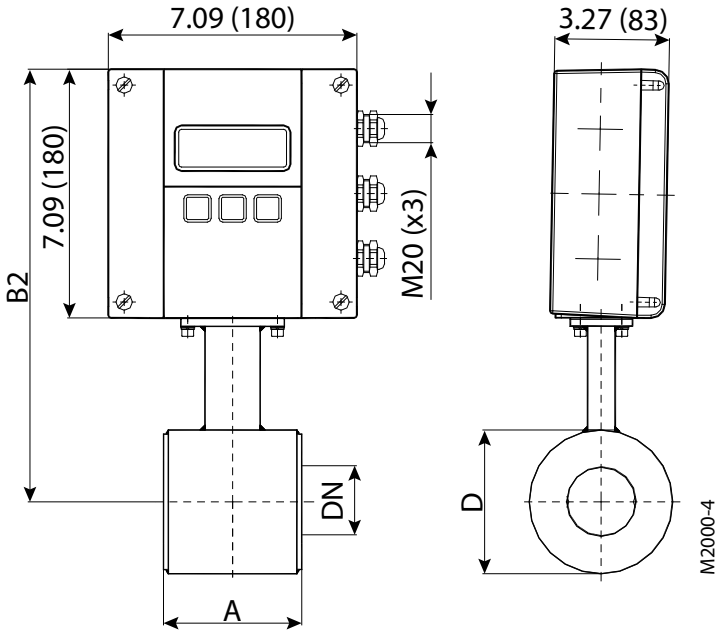
Size	1…4 in. (DN 25…100)	
Process Connection	Wafer connection (in-between flange mounting)	
Nominal Pressure	580 psi (40 bar)	
Protection Class	NEMA 4X (IP67), optional NEMA 6P (IP68)	
Minimum Conductivity	5 µS/cm (20 µS/cm for demineralized water)	
Liner Materials	PTFE	
Electrode Material	Hastelloy C (Standard), Tantal, Platinum / Gold Plated, Platinum / Rhodium	
Housing	Carbon Steel / optional stainless steel	
Lay Length	1…2 in. (DN 25…50)	4 in. (100 mm)
	2-1/2…4 in. (DN 65…100)	6 in. (150 mm)

Sensor Type III Dimensions

Remote Version
in. (mm)



Mounted Version
in. (mm)



in.	DN	A	B1	B2	D
1	25	3.94 (100)	9.37 (238)	7.24 (184)	2.91 (74)
1-1/4	32	3.94 (100)	9.57 (243)	7.44 (189)	3.31 (84)
1-1/2	40	3.94 (100)	9.76 (248)	7.64 (194)	3.70 (94)
2	50	3.94 (100)	9.96 (253)	7.83 (199)	4.09 (104)
2-1/2	65	5.91 (150)	10.47 (266)	8.35 (212)	5.08 (129)
3	80	5.91 (150)	10.67 (271)	8.54 (217)	5.51 (140)
4	100	5.91 (150)	10.98 (279)	8.86 (225)	6.14 (156)
580 psi (40 bar)					

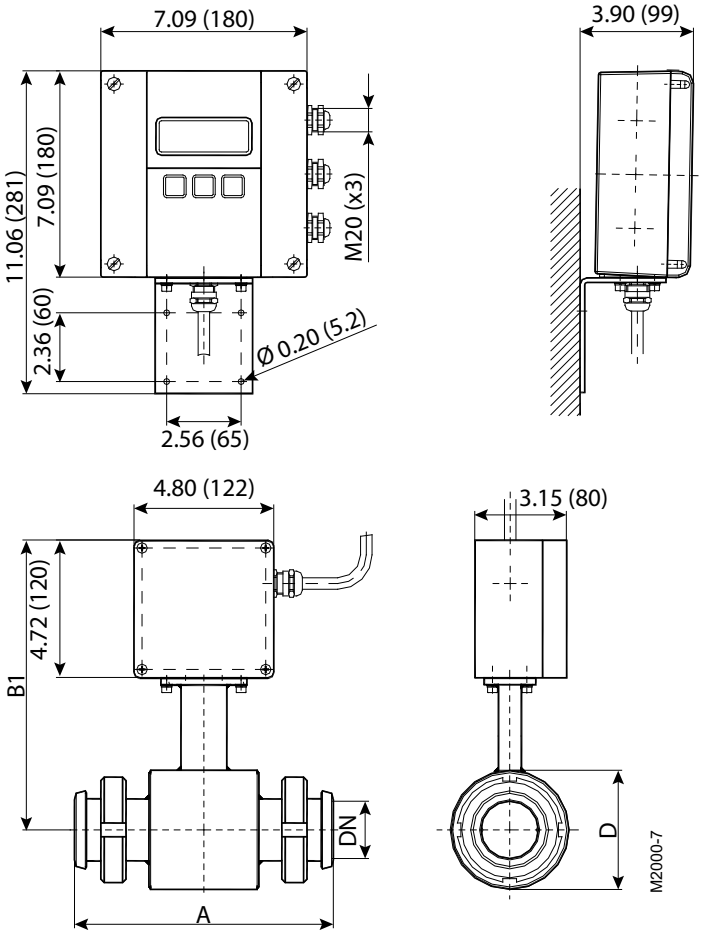
Sensor with Sanitary Process Connections Specifications

The sensor model is available with Tri-Clamp® BS4825/ISO2852, DIN11851, and more process connections. The sanitary sensor is delivered in a stainless steel housing and with PTFE/PFA lining.

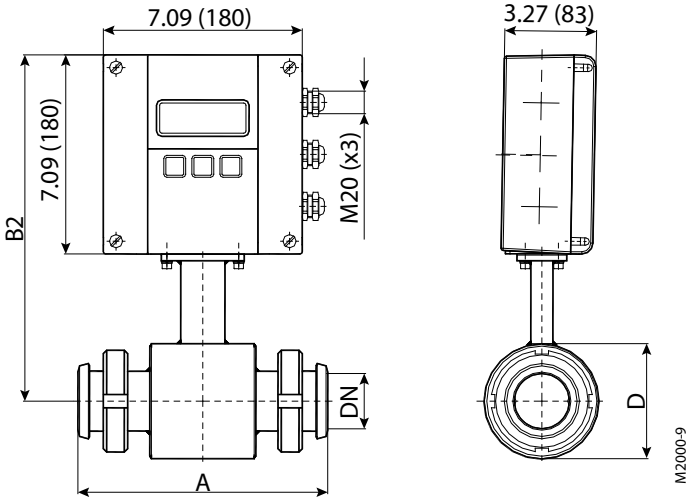
Size	3/8…4 in. (DN 10…100)		
Process Connection	Tri-Clamp BS4825/ISO2852, DIN 11851, customer specified, and more		
Nominal Pressure	145/230 psi (10/16 bar)		
Protection Class	NEMA 4X (IP67), optional NEMA 6P (IP68)		
Minimum Conductivity	5 µS/cm (20 µS/cm for demineralized water)		
Liner Materials	PTFE/PFA	–40…302° F (–40…150° C)	
Electrode Material	**Standard**: Hastelloy C; **Optional**: Tantal, Platinum / Gold plated, Platinum / Rhodium		
Housing	**Standard**: Carbon Steel; **Optional**: Stainless Steel		
Lay Length	Tri-Clamp Connection	3/8…2 in. (DN 10…50)	6 in. (145 mm)
		2-1/2…4 in. (DN 65…100)	8 in. (200 mm)
	DIN 11851 Connection	3/8…3/4 in. (DN 10…20)	7 in. (175 mm)
		1…2 in. (DN 25…50)	9 in. (225 mm)
		2-1/2…4 in. (DN 65…100)	11 in. (280 mm)

DIN 11851 Connection Dimensions

Remote Version
in. (mm)



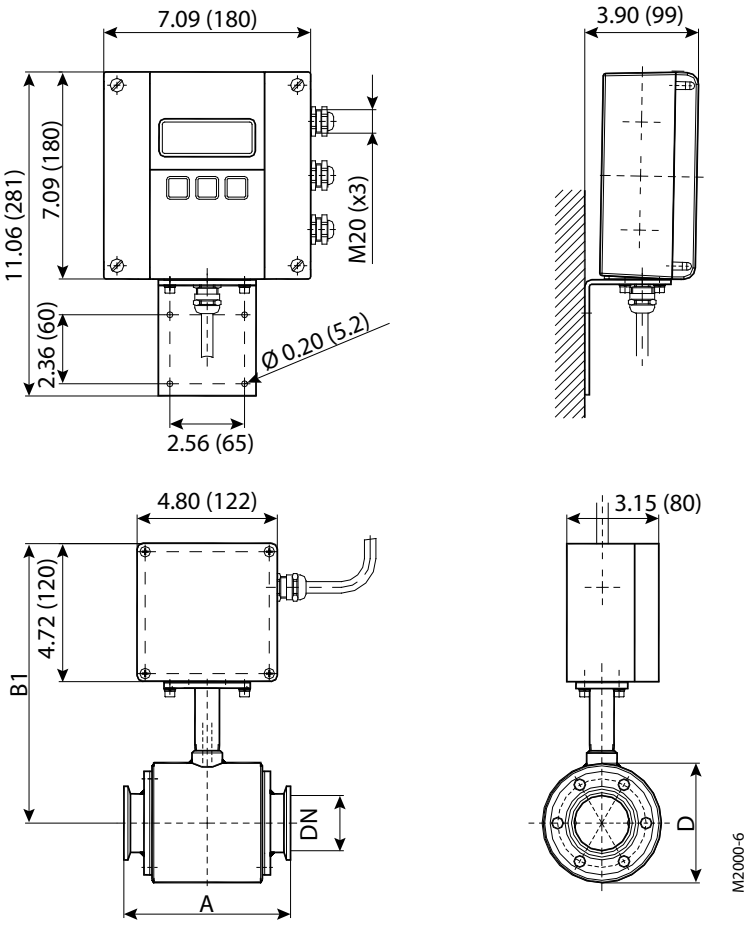
Mounted Version
in. mm



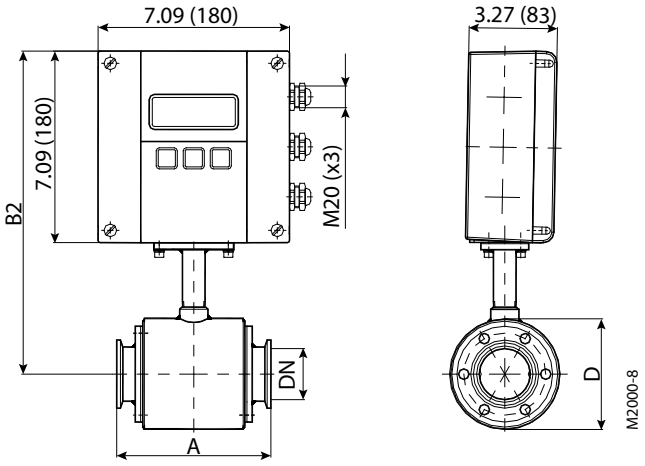
in.	DN	A	B1	B2	D
3/8	10	6.69 (170)	9.37 (238)	7.24 (184)	2.91 (74)
1/2	15	6.69 (170)	9.37 (238)	7.24 (184)	2.91 (74)
3/4	20	6.69 (170)	9.37 (238)	7.24 (184)	2.91 (74)
1	25	8.86 (225)	9.37 (238)	7.24 (184)	2.91 (74)
1-1/4	32	8.86 (225)	9.57 (243)	7.44 (189)	3.31 (84)
1-1/2	40	8.86 (225)	9.76 (248)	7.64 (194)	3.70 (94)
2	50	8.86 (225)	9.96 (253)	7.83 (199)	4.09 (104)
2-1/2	65	11.02 (280)	10.47 (266)	8.35 (212)	5.08 (129)
3	80	11.02 (280)	10.67 (271)	8.54 (217)	5.51 (140)
4	100	11.02 (280)	10.98 (279)	8.86 (225)	6.14 (156)
230 psi (16 bar)					

Tri-Clamp Connection Dimensions

Remote Version
in. (mm)

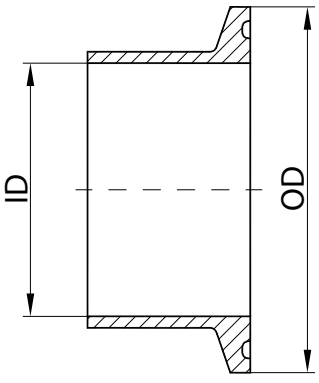


Mounted Version
in. (mm)



in.	DN	A	B1	B2	D
3/8	10	5.71 (145)	8.98 (228)	7.52 (191)	2.91 (74)
1/2	15	5.71 (145)	8.98 (228)	7.52 (191)	2.91 (74)
3/4	20	5.71 (145)	8.98 (228)	7.52 (191)	2.91 (74)
1	25	5.71 (145)	8.98 (228)	7.52 (191)	2.91 (74)
1-1/2	40	5.71 (145)	9.37 (238)	7.91 (201)	3.70 (94)
2	50	5.71 (145)	9.57 (243)	8.11 (206)	4.09 (104)
2-1/2	65	7.87 (200)	10.08 (256)	8.62 (219)	5.08 (129)
3	80	7.87 (200)	10.28 (261)	8.82 (224)	5.51 (140)
4	100	7.87 (200)	10.59 (269)	9.13 (232)	6.14 (156)
150 psi (10 bar)					

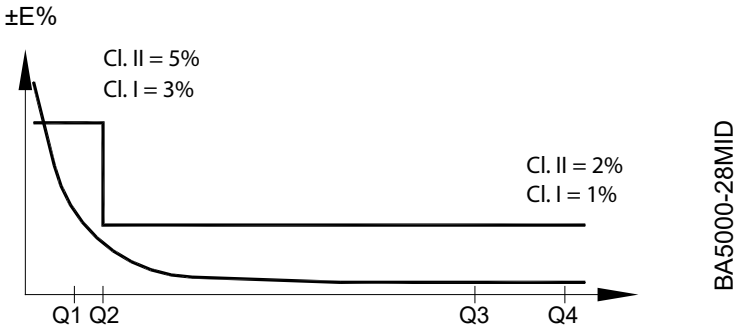
Tri-Clamp Connection



BS4825					ISO2852				
Size	OD		ID		Size	OD		ID	
in.	in.	mm	in.	mm	DN	in.	mm	in.	mm
—	—	—	—	—	10	0.98	25.0	0.55	14.0
1/2	0.98	25.0	0.37	9.4	15	1.99	50.5	0.71	18.1
3/4	0.98	25.0	0.62	15.75	20	1.99	50.5	0.90	22.9
1	1.99	50.5	0.87	22.1	25	1.99	50.5	1.13	28.7
—	—	—	—	—	32	2.52	64.0	1.51	38.4
1-1/2	1.99	50.5	1.37	34.8	40	2.52	64.0	1.74	44.3
2	2.52	64.0	1.87	47.5	50	3.05	77.5	2.22	56.3
2-1/2	3.05	77.5	2.37	60.2	65	3.58	91.0	2.84	72.1
3	3.58	91.0	2.87	72.9	80	4.17	106.0	3.32	84.3
4	4.69	119.0	3.83	97.4	100	5.12	130.0	4.32	109.7
Nominal Pressure 145 psi (10 bar)									

OIML APPROVED METER

The M2000 is type approved according to the international water meter standards OIML R49. The meter is approved as Class I and Class II for the detector sizes 2…28 inches (DN 50…800).

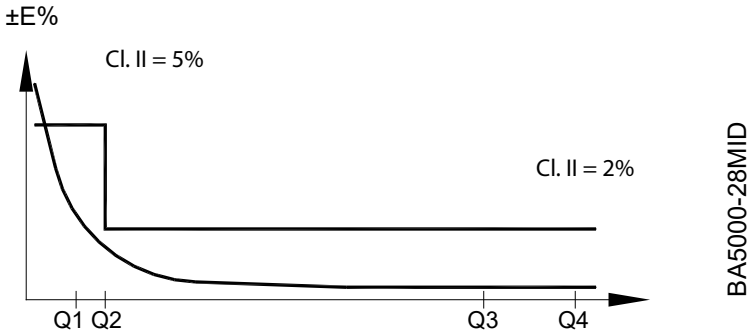


Q2/Q1 = 1.6 and Q4/Q3 = 1.25

Meter Size		Flow Rates [m^3/h]				Ratio Q3/Q1
		Q1	Q2	Q3	Q4	
DN 50	2 in.	0.252	0.4032	63	78.75	250
DN 65	2-1/2 in.	0.4	0.64	100	125	250
DN 80	3 in.	0.64	1.024	160	200	250
DN 100	4 in.	1	1.6	250	312.5	250
DN 125	5 in.	1.6	2.56	400	500	250
DN 150	6 in.	2.52	4.032	630	787.5	250
DN 200	8 in.	4	6.4	1000	1250	250
DN 250	10 in.	6.4	10.24	1600	2000	250
DN 300	12 in.	10	16	2500	3125	250
DN 350	14 in.	10	16	2500	3125	250
DN 400	16 in.	16	25.6	4000	5000	250
DN 450	18 in.	25.2	40.32	6300	7875	250
DN 500	20 in.	25.2	40.32	6300	7875	250
DN 600	24 in.	25.2	40.32	6300	7875	250
DN 800	28 in.	40	64	10000	12500	250
OIML R49	Class 1 and Class 2					

MID APPROVED METER

The M2000 is type approved according to Directive 2004/22/EC of the European Parliament and Council of March 31, 2004 Measuring Instruments (MID) Annex MI-001. The meter is approved for the detector sizes 2…28 inches (DN 50…800).



Q2/Q1 = 1.6 and Q4/Q3 = 1.25

Meter Size		Flow Rates [m^3/h]				Ratio Q3/Q1
		Q1	Q2	Q3	Q4	
DN 50	2 in.	0.252	0.4032	63	78.75	250
DN 65	2-1/2 in.	0.4	0.64	100	125	250
DN 80	3 in.	0.64	1.024	160	200	250
DN 100	4 in.	1	1.6	250	312.5	250
DN 125	5 in.	1.6	2.56	400	500	250
DN 150	6 in.	2.52	4.032	630	787.5	250
DN 200	8 in.	4	6.4	1000	1250	250
DN 250	10 in.	6.4	10.24	1600	2000	250
DN 300	12 in.	10	16	2500	3125	250
DN 350	14 in.	10	16	2500	3125	250
DN 400	16 in.	16	25.6	4000	5000	250
DN 450	18 in.	25.2	40.32	6300	7875	250
DN 500	20 in.	25.2	40.32	6300	7875	250
DN 600	24 in.	25.2	40.32	6300	7875	250
DN 800	28 in.	40	64	10000	12500	250
MID MI-001						

The conformity declaration of above certificate is according to module B (type approval) and D (quality insurance of production).

PART NUMBER CONSTRUCTION

ModMAG® Model M2000

Model Code: [M] [A] [ ] [ ] [ ] [H] [ ] [ ] [ ] [ ] [C] [ ] [ ] [D] [B] [A] [ ] [ ] [ ]

General area

Size

DN 6	1/4 IN.	liner PFA / 304 SST	002
DN 8	5/16 IN.	liner PFA / 304 SST	003
DN 10	3/8 IN.	liner PFA / 304 SST	004
DN 15	1/2 IN.		005
DN 20	3/4 IN.		007
DN 25	1 IN.		010
DN 32	1-1/4 IN.		012
DN 40	1-1/2 IN.		015
DN 50	2 IN.		020
DN 65	2-1/2 IN.		025
DN 80	3 IN.		030
DN 100	4 IN.		040
DN 125	5 IN.		050
DN 150	6 IN.		060
DN 200	8 IN.		080
DN 250	10 IN.		100
DN 300	12 IN.		120
DN 350	14 IN.		140
DN 400	16 IN.		160
DN 450	18 IN.		180
DN 500	20 IN.		200
	22 IN.		220
DN 600	24 IN.		240
DN 700	28 IN.		280
	30 IN.		300
DN 800	32 IN.		320
DN 900	36 IN.		360
DN 1000	40 IN.		400
	42 IN.		420
DN 1200	48 IN.		480
	54 IN.		540
DN 1400	56 IN.		560

Process connection

EN 1092-1 PN 40	FEE
EN 1092-1 PN 25	FED
EN 1092-1 PN 16	FEC
EN 1092-1 PN 10	FEB
ASME Class 300	FAB
ASME Class 150	FAA
TriClamp ISO 2852	TAE
TriClamp BS 4825	TAB
Threads DIN 11851	DAA
Wafer	WAA

Flange and Housing material

Carbon Steel (Standard)	C1
Carbon Steel w/ C5M Paint	C2
304 Stainless Steel Connection / Housing	S3
316 Stainless Steel Connection / Housing	S7
Carbon Steel Process Connections (Std. Paint) / 316 Stainless Steel Housing	C4

Liner Material

Hard Rubber		H
PTFE	for sizes > DN10 (3/8 IN.)	P
PFA	DN 6...DN 10 (1/4... 3/8 IN.) with PFA liner	A
ETFE	for sizes > DN250 (10 IN.)	T

Electrodes / Measuring, Empty pipe, Grounding

Hastelloy C-22 (Standard / Measuring Empty pipe & Grounding)	A
Hastelloy C-22 (Standard / Measuring & Empty pipe)	J
AISI 316/1.4571	B
Tantalum	C
Platinum/Rhodium	D

Grounding rings

No Grounding Rings	X
304 Stainless Steel Grounding Rings	A
316 Stainless Steel Grounding Rings	B

Meter Lay Length

Standard	S
ISO 20456	O

Transmitter, Power Supply, Hardware

100/240V AC; Meter-Mounted	SA	AA	C
100/240V AC; Remote-Mounted	RA	AA	C
12...32V DC; Meter-Mounted	SA	AB	C
12...32V DC; Remote-Mounted	RA	AB	C

Junction Box (for remote mounted version)

Aluminum Enclosure; IP67 (Type 6/4X) Rating		A
Aluminum Enclosure; IP68 (Type 6P) Rating	(submersible option)	B
Stainless Steel Enclosure; IP67 (Type 6/4X) Rating		C
Stainless Steel Enclosure; IP68 (Type 6P) Rating	(submersible option)	D
None | Used for "Sensor-Mounted" Transmitter Configurations		X

Remote Cable Length (for remote mounted version)

15 ft.	5 m	MA
30 ft.	10 m	MB
50 ft.	15 m	MC
65 ft.	20 m	MD
80 ft.	25 m	ME
100 ft.	30 m	MF
115 ft.	35 m	MG
130 ft.	40 m	MH
150 ft.	45 m	MJ
165 ft.	50 m	MK
180 ft.	55 m	MM
200 ft.	60 m	MN
215 ft.	65 m	MP
230 ft.	70 m	MQ
245 ft.	75 m	MR
260 ft.	80 m	MS
280 ft.	85 m	MT
295 ft.	90 m	MU
310 ft.	95 m	MV
330 ft.	100 m	NW
360 ft.	110 m	NB
390 ft.	120 m	ND
425 ft.	130 m	NF
460 ft.	140 m	NH
500 ft.	150 m	NK
None | Used for "Sensor-Mounted" Transmitters Configuration		WW

Input/Output Channel

Standard Input/Output	D	B	A

Communications

Standard Communication (RS232 Modbus RTU)	B
Modbus RTU (RS-485)	L
HART	P
Profibus DP	E
Modbus TCP/IP	G
EtherNet/IP; ODVA	H
M-Bus wired	M
BACnet/IP	N
BACnet MS/TP	Q

Wiring Method

Twist Tight; 5 ft. (1.52 m)	TF
Twist Tight; 10 ft. (3.05 m)	TH
Twist Tight; 25 ft. (7.62 m)	TJ
Twist Tight; 75 ft. (22.86 m)	TK
None | No Endpoint (Standard)	XX

Programming

Gallons/gallons per minute (North America Standard)	NA
Gallons/cubic feet per minute	NC
Gallons/cubic meters per second	ND
Cubic Meters/gallons per minute	NE
Cubic Feet/gallons per minute	NJ
Cubic Feet/cubic feet per minute	NK
Cubic Feet/cubic meters per hour	NL
Liters/gallons per minute	NM
Million Gallons/gallons per minute	NS
Gallons/millions gallons per day	NT
Acre Feet/gallons per minute	NU
Second-Foot Day/cubic feet per second	NV
Standard (Default Metric units based on size)	EA
m^3/s and m^3	EB
m^3/min and m^3	EC
m^3/h and m^3	ED
L/s and L	EE
L/min and L	EF
L/h and L	EG

Testing & Tagging

0.2%	3-Point Calibration; Factory (Standard)	F
0.2%	3-Point Calibration in Factory / Stainless steel Tag	S
0.5%	1-Point Calibration; Factory	L
0.5%	1-Point Calibration in Factory / Stainless steel Tag	M
OIML R49 Cl 1 TYPE CALIBRATED; 3PT; Q1-Q3		N
3rd Party Calibrated		3
3rd Party Calibrated w/ Stainless Steel Tag		T
State of Kansas Certified (North America only)		K

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