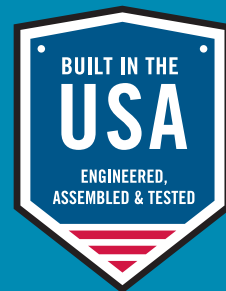


- Custom engineered units to maintain optimum boiler levels and system vacuum requirements
- Four styles to choose from to minimize floor space requirements
- Multi-jet vacuum pumps for quiet, dependable and efficient operation with low water usage
- Centriflo® Boiler Feed Pumps in 3500 or 1750 RPM for efficient and dependable operation pumping hot condensate
- Total unit responsibility with factory assembled and tested pumps, receivers and controls



**Series VCMD, Style CMHD-A**  
**Combination Vacuum & Boiler Feed Unit with mounted vacuum producer (multiple options shown)**

# Domestic® Pump Series VCMD™ Combination Vacuum & Boiler Feed Unit



# A Complete Vacuum & Boiler Feed Package

Dependable vacuum and boiler feed pumps, controlled for optimum boiler steaming level, combine the advantages of a vacuum heating system with efficient boiler feeding. The result is a highly functional unit combining comfortable heating with flexibility in design and energy savings.

## DESIGN FLEXIBILITY

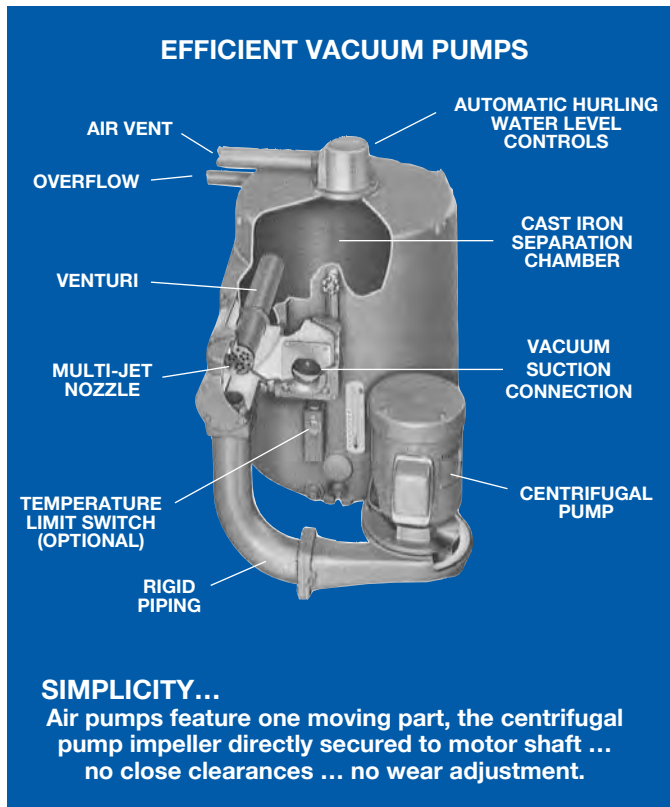
Four unit styles allow maximum flexibility to meet floor space or headroom requirements, low return heights or cast iron receiver requirements.

## DEAERATING INLET CASCADE

Draws dissolved oxygen, carbon dioxide and other gases from the condensate, lengthening the life of system and boiler.



**VCMD Style CMHD-B supplied with separate vacuum pump**



## ORIGINAL EFFICIENCY SUSTAINED

Vacuum producer elements (multi-jet nozzle and venturi) do not move ... retain original efficiency even after years of operation. Minimal water usage contributes to operating cost savings.

## QUALITY CONSTRUCTION, LOW MAINTENANCE

Designed and built for many years of dependable service. No special tools required for maintenance ... all parts easily accessible. Cast Iron Vacuum Pump Receivers for greater durability.

## BUILT-IN QUIETNESS

Vibration free, inherently quiet operation ... no special foundations, vibration eliminators or silencers required.

## AUTOMATIC STAND-BY PROTECTION

Controls can be specified to automatically operate stand-by pumps in emergency to assure heating during unattended periods.

## FAST SYSTEM WARM-UP

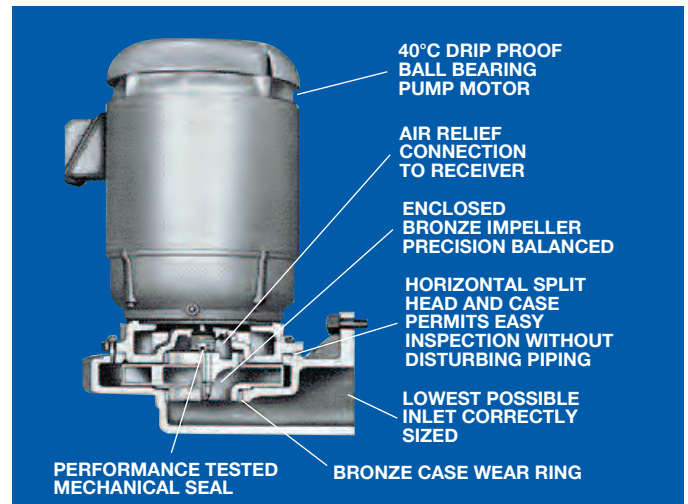
Multi-jet vacuum pumps characteristically remove air far in excess of rated capacity at start of heating cycle, saving fuel and providing even comfortable heating.

## VERTICAL PUMP AND MOTOR ASSEMBLIES

Protects motors from surface water and dirt ... saves floor space and simplifies maintenance.

## LOW NPSH BOILER FEED PUMPS

Bronze fitted centrifugal pumps feature 250°F mechanical shaft seals, renewable wear rings, and stainless steel shafts. Oversize suction passages are specifically designed for handling hot condensate.

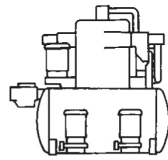


# Designing Combination Vacuum & Boiler Feed Units

## STEP #1 SELECT VCMD STYLE

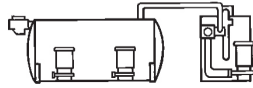
### Domestic® Series VCMD™ Style CMHD-A

Horizontal steel receiver with vacuum pump mounted.



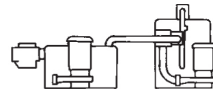
### Domestic® Series VCMD™ Style CMHD-B

Horizontal steel receiver with separate vacuum pump.



### Domestic® Series VCMD™ Style CVM

Rectangular floor mounted cast iron receiver with separate vacuum pump. Consult your DOMESTIC® Representative for design assistance.



## STEP #2 SIZE AND SELECT VACUUM PUMPS

Pumps for normal vacuum systems should be sized per the following chart:

System Size	Capacity
Systems up thru 10,000 Sq. Ft. EDR	0.5 cfm/1000 EDR
Systems above 10,000 Sq. Ft. EDR	0.3 cfm/1000 EDR

The cfm rating should be based of 5½" Hg at 160°F which is representative of actual system conditions and the rating specified by ASHRAE.

After sizing the CFM capacity, select the vacuum pump model from Table A on the next page.

## STEP #3 SIZE AND SELECT BOILER FEED PUMPS

Boiler feed pumps should be sized for approximately two times the boiler condensing rate. This assures constant feeding of hotter water to the boiler thus preventing thermal shock to the boiler, increasing life of the pump, and reducing operating cost.

Table B on the following page, provides preselected pumps based upon the Total Boiler Horsepower served by that pump. Alternatively, actual condensing rates may be computed using the Useful Engineering Data on this page and then doubled to obtain the pump GPM. Pressures tabulated include allowance for 5psi (10" Hg) vacuum in receiver.

## STEP #4 SIZE AND SELECT BOILER FEED RECEIVER

For Styles CMHD-A and CMHD-B, Table B on the following page provides preselected receiver sizes based upon storage of 10 minutes worth of condensate. Using the total Boiler Horsepower being served by the unit the receiver size and the net working capacity can be determined.

For other Styles, use the following chart to determine the desired Net Working Capacity of the Receiver and refer to page 6 to select the required receiver size.

### Multiplier to Determine 10 Minutes Net Storage (Gal.)\*

Unit	Multiplier
1000 Sq. Ft. EDR	5.0
1 Boiler HP	0.7

\*Measured between lower edge of inlet and level at which make-up valve opens.

## STEP #5 SPECIFY COMPLETE UNIT

Specify the unit construction as follows:

- A. Vacuum Pump(s).  
Model Number, cfm @ 5½" Hg at 160°F, Hp and RPM.
- B. Boiler Feed Pump(s).  
Gpm and psi, Hp and RPM (Provide completed BFQ)
- C. Boiler Feed Storage Receiver.  
Series VCMD Style, total capacity and size.
- D. Controls.  
Specify Magnetic Starters, Fusible Disconnects or Circuit Breakers, Control Transformer, Selector Switches, Electric Alternator, and Pilot Lights. Specify control enclosure rating (NEMA 2/UL Listed is the standard option). Consult Bell & Gossett Specification 190B Domestic Pump Boiler Feed Control, to specify Boiler Feed Arrangement.
- E. Optional Accessories.
- F. Power Supply.  
Specify motor and control voltage, phase and hertz.

## STANDARD COMPONENTS

### Boiler Feed Receiver Accessories:

All receiver are equipped with vacuum gauge, water level gauge, air vent check valve, inlet basket strainer, dial thermometer, Make-up Water Assembly consisting of a float switch, solenoid valve and Y strainer, and low water cutoff and overflow control float switches.

### Hurling Water Receivers & Accessories:

Close grained cast iron (except model 160), thermometer, automatic hurling water level controls, diaphragm type vacuum switches, and air suction check valves.

### Vacuum & Boiler Feed Pumps:

Permanently aligned, bronze fitted, vertical design with enclosed bronze impellers, stainless steel shafts, bronze wear rings, and Carbon/Ceramic Mechanical Seals.

### Multi-jet Vacuum Producing Assembly:

Quiet with no noise muffler required, water saving with limited water make-up requirements as opposed to liquid ring type vacuum pumps and easy to maintain with the pump impeller being the only moving part.

### NEMA 2/UL Listed Control Panel:

Mounted and wired with liquid tight conduit. Panel contains Magnetic Motor Starters with thermal overloads and pump selector switches as standard with many other options.

**NOTE:** For Descriptions of Standard and Optional Components as well as Suggested Specifications. See the Guide Specification located in Catalog Section 160.

## USEFUL ENGINEERING TABLES

### Equivalent Values of Pressure, Head and Vacuum

Units	Their Equivalents		
	Ft. Water	Lb./Sq. In.	In Hg
1 Ft. Head, Water	1	.433	.883
1 Lb. per Sq. In. (psi)	2.31	1	2.04
1 in Hg (mercury)	1.13	.491	1

### Equivalent Values of Liquid, Volume and Weight

Units	Their Equivalents			
	Gallons	Cu. Ft.	Cu. In.	Lb. Water <sup>1</sup>
1 Gallon	1	.1337	231	8.334
1 Cubic Foot	7.48	1	1728	62.34
1 Lb. Water <sup>1</sup>	.12	.01604	27.72	1

<sup>1</sup>At 60°F Specific gravity = 1.000, specific heat = 1.0

### Equivalent Values of Power and Heat

Units	Their Equivalents			
	Gpm <sup>2</sup>	Lbs./Hr. <sup>3</sup>	Btuh	Sq. Ft. EDR
1,000 EDR	.50	247.3	240,000	1,000
1 Boiler Horsepower	.072	34.5	33,475	139.4
100,000 Btu per Hr.	.208	103.08	100,000	416.7
100 Lb. Steam per Hr.	.204	100.0	97,017	404.2

<sup>2</sup>Condensate at 160°F. <sup>3</sup>Steam Evaporated from and at 212°F.

**Table A – Vacuum Pump Selection**

CFM@5½" HG at 160°F¹	Motor		Vacuum Unit Model	Hurling Chamber Material	Unit Model Number		
	HP	RPM			Simplex	Duplex²	
5.2	¾	3500	20MJ	Cast Iron	20S¾-35	20D¾-35	
7.6	1	3500			20S1-35	20D1-35	
12.0	1½	3500	50MJ		50S1½-35	50D1½-35	
18.0	2	3500			50S2-35	50D2-35	
26.0	3	3500			50S3-35	50D3-35	
29.4	3	1750			50S3-17	50D3-17	
52.0	5	1750			100S5-17	100D5-17	
74.0	7½	1750	100S7½-17		100D7½-17		
103.0	10	1750	160MJ		Fabricated Steel	160S10-17	160D10-17
149.0	15	1750				160S15-17	160D15-17

¹5½" Hg at 160°F is the rating point specified by ASHRAE. This rating closely depicts the actual performance of a vacuum pump in a steam heating system. For other ratings, consult factory.

²Duplex units deliver double the listed cfm on demand.

**Table B – Boiler Feed Pumps and Style CMHD Receiver Selection**

Total Boiler HP	Pump Capacity (GPM)*	Pump Discharge Pressure (PSIG)	Centriflo® Pump		Receiver Size No. and Net Capacity	Standard Mounted Vacuum Unit Models
			Motor HP (3500 RPM)	Pump No.		
95	15	20	½	616	24" x 36" 65 gal.	None
		25	¾	616		
		30	1	617		
		40	1½	617		
		50	2	620		
		60	3	620		
		70	3	620		
		85	5	620		
150	22	15	½	616	24" x 60" 124 gal.	20MJ
		20	¾	616		
		25	¾	616		
		30	1	617		
		40	1½	617		
		50	2	620		
		60	3	620		
		70	3	620		
85	5	620				
205	30	15	¾	616	30" x 48" 162 gal.	20MJ
		20	¾	616		
		25	1	616		
		30	1½	617		
		40	2	617		
		50	3	620		
		60	3	620		
		70	5	620		
85	5	620				
295	45	15	1	616	30" x 72" 235 gal.	20MJ 50MJ
		20	1	616		
		25	1½	616		
		30	2	620		
		40	3	620		
		50	3	620		
		60	5	620		
		70	5	620		
85	5	620				
440	60	15	1½	626	36" x 72" 344 gal.	50MJ
		20	1½	626		
		25	2	626		
		30	2	626		
		40	3	627		
		50	5	613		
		60	5	620		
		70	5	620		
85	7½	620				
700	90	15	2	626	42" x 84" 551 gal.	50MJ 100MJ
		20	2	626		
		25	3	626		
		30	5	625		
		40	5	613		
		50	5	618		
		60	7½	618		
		70	7½	618		
975	150	15	3	625	48" x 96" 819 gal.	50MJ 100MJ
		20	5	625		
		25	5	625		
		30	5	625		
		40	7½	618		
		50	10	618		
		60	10	618		
		70	15	618		

\*GPM based upon pump feeding one boiler with Total Boiler HP shown in column one. If several Boiler sizes were added up to determine the Total Boiler HP and individual pumps are being furnished to feed the individual boilers, smaller pumps may be used. Consult factory.

# Custom Engineered to Suit Your Needs

## DESCRIPTION OF OPERATION...

### VACUUM PUMP CYCLE

- Responding to system requirements for vacuum, the vacuum switch starts the vacuum pump.
- This pump circulates “hurling” water from the separation chamber through the multi-jet nozzle, venturi, and returns it to the separation chamber.
- The water, forced at high velocity across the gap between the nozzle and venturi entrains air and gases in multiple jet streams, creating a smooth steady vacuum.
- The centrifugal action caused by discharging this mixture tangentially into the separation chamber forces water to the periphery of the chamber while lighter air flows to the center and discharges through the air vent. (The centrifugal action also pressurizes the pump suction thus improving efficiency.)
- The vacuum pump cycle ends when the system vacuum reaches the high level vacuum switch setting (usually 8" Hg).

### BOILER FEED PUMP CYCLE

- Boiler Feed pumps are controlled by the pump controller mounted on the boiler(s).
- How the Boiler Feed Pumps operate depends on the number of Boiler Feed Pumps, Number of Boilers, Control and Piping Arrangement.
- Several of the most common arrangements are shown in Catalog Section 190. Refer to this Section to determine the proper arrangement for your application or consult your DOMESTIC Pump Representative.

### AUTOMATIC BOILER FEED WATER MAKE-UP

- If condensate is lost from the system and the level in the boiler feed receiver reaches a predetermined low level, a float switch will open a solenoid valve to automatically admit city water to the receiver.
- The cold water is then tempered by the hot condensate thus minimizing the possibility of thermal shock to the boiler.
- An optional 3 Valve Bypass around the solenoid valve is available to allow manual feeding of make-up water.

### AUTOMATIC HURLING WATER LEVEL CONTROL

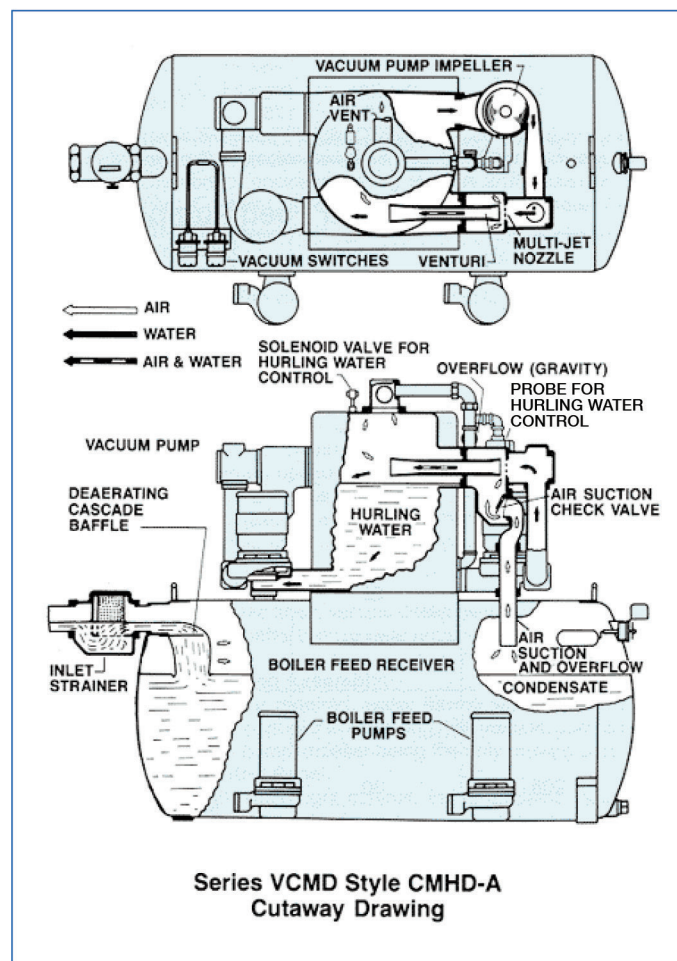
- Evaporation may necessitate addition of hurling water to the separation chamber.
- If this occurs a float switch mounted on the separation chamber will open a solenoid valve to automatically admit city water.
- An optional 3 Valve Bypass around the solenoid valve is available to allow manual feeding of make-up water as well as an Air Gap Fitting to meet local code requirements for a line break to prevent potential backflow contamination of city water.

### HIGH TEMPERATURE CONDENSATE RETURNS

- Use of a vacuum in a system with hot return temperatures (above 190°F) can cause condensate evaporation and potential damage to the vacuum pumps. For example, at the usual vacuum cut-out point of 8" Hg, condensate will evaporate at 197°F. Returns at this temperature could cause the vacuum pumps to operate continuously.
- To protect from this scenario, Temperature Limit Switches are available to cut-out vacuum pump operation when condensate temperatures exceed a preset (usually 180°F) temperature.
- Alternatively, Temperature Limit Switches are available to add cooling water to the hurling chamber dependent on the water temperature in the hurling chamber. This set-up is utilized where it is necessary to maintain system vacuum regardless of condensate return temperature. Usually, the switches open the make-up water solenoid valve when the temperature exceeds 160°F and any excess hurling water overflows to a drain.

### BOILER FEED RECEIVER OVERFLOW CONTROL

- If excess condensate returns overflow the boiler feed receiver, a float switch will actuate a vacuum pump.
- The resulting vacuum will draw excess water through the air suction line into the vacuum pump separation chamber where it overflows to a drain.
- This design eliminates the need for an unloading pump. If the drain is located above the separation chamber drain, the unloading pump can be provided.

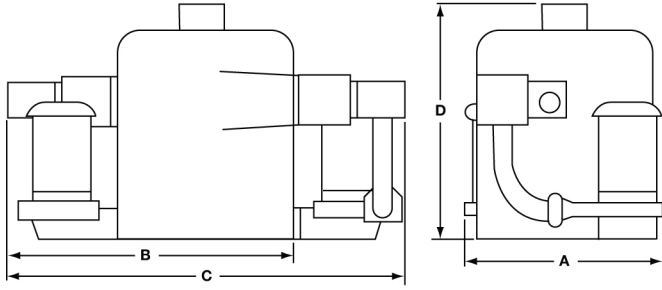


## ROUGH-IN DIMENSIONS (All dimensions in inches)

Not to be used for installation – CERTIFIED DIMENSIONS ON REQUEST.  
Actual dimensions shown will vary based upon pump selection.

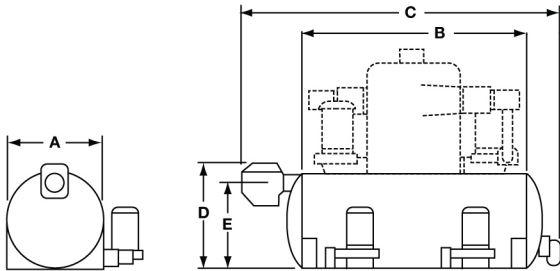
### VACUUM PUMPS

Nos. 20C, 50C & 100 C are cast iron; 160S is steel construction.



Motor HP	¾-1	1½-3	5-7½	10-15
Sep. Chamber	20C	50C	100C	160S
Air Suction	1¼	2	2½	3
Air Vent	1½	2	2½	4
Overflow	1	1½	2	2½
A	17¼	26¾	29¾	41
B	29¾	45¾	50	60¾
C	36½	57½	64½	70½
D	26	36¼	46¼	55

**STYLE CMHD-A** – air pump mounted as shown (dotted line)  
**STYLE CMHD-B** – air pump furnished separately

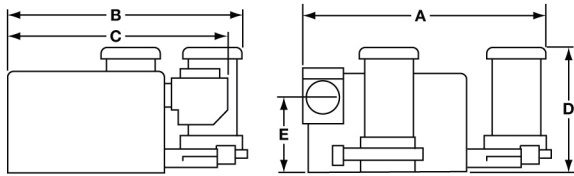


### STYLES CMHD-A & CMHD-B HORIZONTAL STEEL RECEIVERS

Recvr. Net. Cap.	65	104	141	204	302	492	712
Recvr. Total Cap.	77	124	161	234	342	542	805
Inlet	2½	2½	3	3	4	4	6
A	24⅞	24⅞	30⅞	30⅞	36⅞	42⅞	48⅞
B	36	60	48	72	72	84	96
C	62	86	73	97	102	116	147½
D	25⅞	25⅞	31⅞	31⅞	38⅞	44⅞	50¼
E (Inlet Height)	22	22	27⅞	27⅞	34¼	39¼	44⅞
Head & Shell Thickness	⅜	⅜	⅜	⅜	⅜	⅜	⅜

See Catalog Section 140 for further details.

Typical Layout of Receivers 36-120 gal.  
Consult factory for others.



### STYLE CVM CAST IRON RECTANGULAR RECEIVER\*

Recvr. Net. Cap.	12	20	30	41	82	190
Recvr. Total Cap.	23	36	52	75	120	250
Inlet	2	3	3	4	4	4
A	35	44	46	49	58	60
B	35	43	46	49	51	54
C	29¾	35	38½	44½	45¾	46
D	21	21	21	21	24	32
E (Inlet Height)	10	13	14	16	20	25⅞

\*Steel Rectangular Receivers available, consult factory. See Catalog Section 100 for further details.

## BOILER FEED UNIT CONTROLS

Consolitol® Control Cabinets are available to comply with other NEMA and JIC specifications. Panels may be factory mounted and wired with liquid tight flexible metal conduit or furnished separately for wall mounting. Description of Optional Panel Components:

- Magnetic Starters (must be used on all boiler feed units).
- Disconnect Switches or Circuit Breakers
- Control Circuit Disconnect
- Selector Switches
- Electric Alternator
- Transformer
- Pilot Lights
- Audible Alarm
- Elapsed time meters
- Others (consult factory)

NEMA 2 - U.L. Listed panels are the standard when specified.

Boiler feed unit wiring diagrams are based on customer's specification for the number of pumps, number of boilers, piping arrangement, required control sequence and options. Several of the most common piping arrangements and control options are shown in the Bell & Gossett Specification 190B Domestic Pump Boiler Feed Control.



# Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

**For more information on how Xylem can help you, go to [www.xylem.com](http://www.xylem.com)**

We value your feedback. Please take our 3 question survey at [bellgossett.com/survey](http://bellgossett.com/survey) to let us know how we are doing.



Xylem Inc.  
8200 N. Austin Avenue  
Morton Grove, Illinois 60053  
Phone: (847) 966-3700  
Fax: (847) 965-8379  
[www.bellgossett.com](http://www.bellgossett.com)

Bell & Gossett is a trademark of Xylem Inc. or one of its subsidiaries.  
© 2018 Xylem Inc. S-160G March 2018