



The State of New Hampshire  
**DEPARTMENT OF ENVIRONMENTAL SERVICES**



Thomas S. Burack, Commissioner

**WATER CONSERVATION PLAN APPROVAL**

July 10, 2015

Town of Charlestown, Water and Wastewater  
c/o Brenda Ferland, Selectboard Chair  
PO Box 385  
Charlestown, NH 03603

**RE:** Charlestown – Charlestown Water Works (PWS ID #: 0411010)  
Water Conservation Plan

Dear Ms. Ferland:

On June 24, 2015, the New Hampshire Department of Environmental Services (“DES”) Drinking Water and Groundwater Bureau received a Water Conservation Plan (the “WCP”), signed on May 20, 2015, for Charlestown Water Works (“CWW”) located in Charlestown, New Hampshire. Pursuant to RSA 485:61 and Env-Wq 2101, community water systems seeking permits from DES for new sources of groundwater shall submit a water conservation plan to DES. Based on review of the WCP, DES has determined the WCP complies with Env-Wq 2101, *Water Conservation* rules.

Pursuant to Env-Wq 2101, the Town of Charlestown and the Upper Valley Lake Sunapee Planning Commission were provided a copy of the WCP, along with other required materials.

CWW also submitted a request to waive Env-Wq 2101.11(d), the requirement to read service meters and bill quarterly. CWW proposes to continue reading services meters and billing biannually due to lack of resources to increase frequency.

DES approves the WCP and the waiver request based on the following conditions: (\*Note: The WCP submitted includes the Charlestown Water Works and North Charlestown Water Department. This approval is specifically for Charlestown Water Works, but DES supports implementation at both systems as proposed.)

1. A waiver to Env-Wq 2101.11(d), billing quarterly, will expire on **July 10, 2019**. By July 10, 2019, CWW shall implement quarterly billing or submit a waiver request for review including a breakdown of costs associated with billing two additional times a year, the water system’s budget, and additional actions proposed to be taken to encourage water efficiency by water users connected to the system.

2. No later than source activation, service meters shall be read at least biannually.
3. No later than source activation, all source meters, distribution meters, meters measuring water consuming processes, and any transfer meters and data loggers shall be installed.
4. No later than source activation, source meters and any other meters measuring water consuming process prior to distribution shall be read monthly, no sooner than 27 days and no later than 33 days from the last meter reading.
5. No later than source activation, shall a water balance be reported annually to DES. The water balance shall be reported by March 1 for the prior year using the online reporting tool.
6. Residents shall be charged based on the amount of water each residence uses and the rate shall be structured so that the cost per gallon(s) is either constant or increasing with the amount of water used.
7. Within one year of source approval, a leak detection and repair program shall be implemented in accordance with the WCP.
8. Within one year of receiving source approval, a water efficiency and outreach program shall be implemented in accordance with the WCP.
9. Within three years of source approval, a meter maintenance plan shall be implemented in accordance with the schedule proposed in the WCP.
10. The system shall continue reporting monthly production volumes to the NHDES Water Use Registration and Reporting program on a quarterly basis.
11. From the date of this WCP Approval, all new non-metallic pipes installed in the system shall be outfitted with detectable tracer tape or detectable tracer wire, or be GPS located and maintained in a GIS system.
12. Every three years from the date of this approval, a *Water Conservation Plan Ongoing Compliance Reporting Form* shall be submitted to DES documenting how the system has maintained compliance with the WCP. The following records shall be maintained by the water system to include with the report:
  - a. A leak log including the date a leak was discovered, the date a leak was repaired, the type of leak (ex. water main, service line, hydrant, valve), the approximate size of the leak (gpm), and the nearest address to the leak.
  - b. The title of water efficiency materials distributed and the date of distribution.
  - c. Date of installation and replacement of all meters, as well as testing and calibration records.

d. Leak detection survey reports.

13. Revisions to the Plan shall not be implemented without further approval from DES.

The online *Annual Water Balance Reporting Form* and the *Water Conservation Plan Ongoing Compliance Reporting Form* may be located by going to the DES website, [www.des.nh.gov](http://www.des.nh.gov), clicking on the “A-Z List” in the top right corner of the page, and scrolling down to Water Conservation

Please feel free to contact me with any questions at (603) 271-0659 or via e-mail at [stacey.herbold@des.nh.gov](mailto:stacey.herbold@des.nh.gov) .

Sincerely,

A handwritten signature in black ink, appearing to read 'Stacey Herbold', written in a cursive style.

Stacey Herbold  
Water Conservation Program  
Drinking Water and Groundwater Bureau

ec: Rachel Lomanaco, VHB  
David Duquette, CWW  
Upper Valley Lake Sunapee Planning Commission  
Christine Bowman, NHDES  
Steve Roy, NHDES  
(AC)

June 24, 2015

Ref: 57543.01

Ms. Stacey Herbold  
Water Conservation Program  
Drinking Water and Groundwater Bureau  
NH Department of Environmental Services  
29 Hazen Drive, PO Box 95  
Concord, NH 03302-0095



Re: Charlestown, NH Water Department: Water Conservation Plan

Dear Stacey:

Enclosed please find the Water Conservation Plan for the Town of Charlestown, NH ("Charlestown") water system. VHB has prepared this Water Conservation Plan in accordance with the New Hampshire Code of Administrative Rules Section Env-Wq 2101, on behalf of Charlestown.

This Water Conservation Plan is being submitted in support of a proposed new large community water supply ("CWS") production well for the Town of Charlestown for the purpose of meeting future growth, supporting a potential future interconnection of the Charlestown and North Charlestown systems, and reducing reliance on existing wells by installing a new source with improved water quality. Charlestown seeks to obtain a permitted yield of 700 gpm from the new well so that it alone would be able to meet the daily peak demand of the future interconnected system, if necessary.

Included in the Water Conservation Plan is a waiver request to maintain the semi-annual meter reading and billing structure rather than change to a quarterly structure as required by Env-Wq-2101.06(c) and Env-Wq-2101.11(d), respectively.

Please feel free to contact me or Lydia Lee with any questions.

Sincerely,

A handwritten signature in blue ink, appearing to read 'R. Lomonaco', with a long horizontal flourish extending to the right.

Rachel Lomonaco  
Environmental Scientist

Enclosure

cc: David Duquette, Charlestown Water and Wastewater Superintendent  
Christine Bowman, NHDES Drinking Water and Groundwater Bureau

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**Engineers | Scientists | Planners | Designers**

40 IDX Drive, Building 100  
Suite 200  
South Burlington, Vermont 05403  
P 802.497.6100  
F 802.495.5130

# ***CHARLESTOWN, NH***

# ***WATER DEPARTMENT***

Charlestown,  
New Hampshire

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Prepared for **Town of Charlestown**  
PO Box 385  
Charlestown, NH 03603

Prepared by **VHB**  
40 IDX Drive  
Building 100, Suite 200  
South Burlington, VT 05403

**June 24, 2015**



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## Certification

I certify that I have read this Water Conservation Plan, understand the responsibilities of the water system as referenced in the plan and that all information provided is complete, accurate and not misleading.

Owner Name (print): Brenda Ferland  
Owner Signature: Brenda Ferland  
Date: May 20, 2015



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## 1.0 Introduction

On behalf of The Town of Charlestown, NH ("Charlestown"), VHB presents this Water Conservation Plan ("WCP") for Charlestown's existing Community Water System ("CWS") pursuant to the New Hampshire Code of Administrative Rules Env-Wq-2101 (herein referred to as "the Rules"). A new Large Production Well (Bull Run Well #2) is being proposed in order to improve the reliability of the Town of Charlestown's community water supply and to allow for a possible future interconnection with the North Charlestown water supply system.

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## 2.0 Contact Information

In accordance with Env-Wq-2100 the names, mailing addresses, and telephone numbers of the following individuals are provided:

1. Water System Owner:

Town of Charlestown, NH Water and Wastewater  
c/o Brenda Ferland, Selectboard Chair  
PO Box 385  
Charlestown, NH 03603  
Phone: (603) 826-5387 or (603) 826-5535

2. Person for responsible for the design of the WCP:

David Duquette  
Water and Wastewater Superintendent  
Town of Charlestown, NH  
PO Box 385  
Charlestown, NH 03603  
Phone: (603) 826-5387 or (603) 826-5535

Lydia Lee, P.G.  
VHB, Inc.  
40 IDX Drive  
Building 100, Suite 200  
South Burlington, VT 05403  
802-497-6114



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### **3.0 System Overview**

The Charlestown and North Charlestown systems provide potable water and fire protection water to the communities in which they are located with a total of 944 service connections on the Charlestown system, and 133 service connections on the North Charlestown system. Approximately 25 miles of distribution piping is associated with the Charlestown system and six miles of distribution piping exists for the North Charlestown system. The Charlestown system has a 1.0 million gallon storage tank and the North Charlestown system has a 250,000 gallon storage tank, both of which float on the systems and provide distribution pressure by gravity. Pressure reducing stations for the Charlestown system are located on Steven Road, Summit Street, Michael Avenue and Hemlock Road. A single pressure reducing station for the North Charlestown system is located on Salt Shed Road.

The Charlestown system is currently supplied by two wells, referred to as the Bull Run Well #1 and the Clay Brook Well. The Bull Run Well #1 is a 90-foot deep, six-inch diameter drilled gravel-packed well located near the Connecticut River, as depicted on the Site Location and Infrastructure Map (page 1 of Appendix 1). The well was installed in 1991 by Green Mountain Well Company ("GMWC") as a test well but has been used as a production well since 1994. Currently, the Bull Run Well #1 can produce up to 200 gallons per minute ("gpm"), as limited by the capacity of its pump. The well's construction and design limit the maximum capacity to 235 gpm, even with a larger pump, although considerably more yield is available in the aquifer. The Clay Brook Well is a 35-foot deep gravel well and is located in a separate aquifer near the Clay Brook, approximately 1.3 miles from the Bull Run Site. The Clay Brook Well has produced up to 390 gpm in the past, but according to the Town, the Clay Brook Well has a "flashy" yield due to its hydrogeologic connection with the Clay Brook, which experiences seasonal low flows or dry spells.

The North Charlestown water supply system is supplied by two, side-by-side, 190-foot deep gravel wells that withdraw water from the same aquifer as each other. The North Charlestown wells are over three miles north of the Bull Run site and are located in a different aquifer than the Bull Run Well #1 and the Clay Brook well (see Site Location and Infrastructure Map, page 1 of Appendix 1).

#### ***3.1 Proposed New CWS Well and System Interconnection***

The proposed new large production well, Bull Run Well #2, would be connected to the existing Charlestown water system and eventually may also supply the North Charlestown system through



a potential interconnection. No planned date for interconnection has been set. North Charlestown has an existing water system, but connecting the two systems would provide better water quality, reliability, and a backup source for North Charlestown.

The North Charlestown wells supply an adequate yield; however, the water quality from these wells presents an operational concern because the water from the aquifer must be treated to reduce levels of naturally occurring arsenic. Additionally, levels of iron and manganese are close to the secondary maximum contaminant levels ("MCL") following treatment, and their close proximity to a growing industrial area presents the risk of contamination. By connecting to the Charlestown system, North Charlestown would have a backup source of water in the event the existing wells are compromised. Furthermore, the arsenic treatment costs could be reduced by reducing reliance on the North Charlestown wells in lieu of greater use of water from the Bull Run aquifer. The North Charlestown Well locations and the potential interconnection route with the Charlestown system are depicted on the Site Location Map, page 1 of Appendix 1.

VHB and Charlestown have selected a proposed new well site near the existing, high-yielding Bull Run Well #1 based on the results of test borings. The proposed well site is depicted on the maps on pages 1 and 2 of Appendix 1.

Charlestown seeks to obtain a permitted yield of 700 gpm from the proposed new Bull Run Well, so that it alone would be able to meet the peak demand of both systems, if necessary. Charlestown intends to keep the existing Bull Run Well, Clay Brook Well, and North Charlestown Wells connected to the system and operational so that they may contribute to the water supply and serve as redundant sources if needed. Reducing dependence on the North Charlestown wells would reduce costs associated with arsenic treatment, as noted above. Charlestown understands that the maximum combined production from both Bull Run Well #1 and Bull Run Well #2 would be 700 gpm, if the DES issues a source permit based on the proposed pump test results and final hydrogeologic report.

### **3.2 Service Population**

The two water systems serve a total of approximately 1,077 service connections which are broken down by category in Table 1 below (see also pages 1-3 of Appendix 2):



<b>Table 1: Water Service Connections</b>			
<b>Connection Type</b>	<b>Charlestown</b>	<b>North Charlestown</b>	<b>Total</b>
Industrial/Commercial	65	13	77
Municipal	24	3	27
Residential	855	117	973
<b>Total</b>	944	133	1077

In addition to the connections noted in table 1 above, there are six metered irrigation connections within the water systems. None of the current connections receives more than 20,000 gallons per day (“gpd”) of water.

### **3.3 Water Use Trends**

#### **3.3.1 Existing Water Use**

Based on ten years of meter data, the average demand for the existing Charlestown water system is approximately 347,000 gpd (241 gpm), and the maximum daily demand is approximately 647,000 gpd (449 gpm). The average daily demand for the North Charlestown water system is approximately 27,000 gpd (19 gpm) with a maximum demand of approximately 229,000 gpd (159 gpm). Currently, the total average daily demand for an interconnected Charlestown and North Charlestown system would be 260 gpm (374,400 gpd), and the maximum daily demand would be approximately 608 gpm (875,520 gpd). No seasonal fluctuations to the existing water demand are apparent in the meter data. Water usage rates since 2003 have increased slightly but not steadily in Charlestown, and have been stable in North Charlestown. Meter data for the Charlestown and North Charlestown water systems are presented in tables and graphs on pages 4 and 5 of Appendix 2.

#### **3.3.2 Anticipated Growth in Water Use**

Anticipated increases in the Charlestown water system stem from the following expected growth in the community:

- Whelen Industries, which anticipates a water usage increase of up to 80,000 gpd (56 gpm) (daily max) over the next few years,
- VT Department of Transportation, which anticipates a water usage increase of 10,080 gpd (7 gpm) (daily max) in 2014,



- Approximately 100 new connections as a result of the potential new water line interconnection to North Charlestown, corresponding to a daily maximum demand increase of 24,480 gpd (17 gpm),
- Normal growth, which has been estimated at a maximum increase in daily demand of 4,320 gpd (3 gpm) per day based on the average anticipated growth of the system, and
- Connection to North Charlestown existing water system, which would result in a daily maximum demand increase of 228,960 gpd (159 gpm).

### 3.3.3 Capacity of Existing Sources

The maximum daily yield for the Bull Run Well #1 is 288,000 gpd based on a 200 gpm pumping rate (over a 24 hour day), which is limited by the capacity of the pump. The maximum daily yield for the Clay Brook well is 561,600 gpd based on a maximum 390 gpm pumping rate over a 24 hour day. In total, the existing Charlestown system sources have a capacity of 849,600 gpd.

The North Charlestown system has a total source capacity of 125 gpm, or 180,000 gpd over a 24 hour day.

### 3.3.4 Daily Water Use

Charlestown provided VHB with meter data for the Charlestown and North Charlestown water systems from the last ten years. The tabulated data are presented on page 4 of Appendix 2. The average and maximum daily water usage for the Charlestown water system, North Charlestown water system and anticipated growth and current maximum daily yield are summarized in Table 2 below.

<b>Table 2: Daily Water Usage Statistics (2003-2012) *</b>			
	<b>Average Water Use</b>	<b>Maximum Daily Water Use</b>	<b>Maximum Source Yield</b>
Charlestown	241 gpm or 347,190 gpd	449 gpm or 647,000 gpd	590 gpm or 849,600 gpd
North Charlestown	19 gpm or 27,100 gpd	159 gpm or 229,000 gpd	125 gpm or 180,000 gpd
Anticipated Growth	56 gpm or 81,250 gpd	83 gpm or 119,750 gpd	NA



<b>Table 2: Daily Water Usage Statistics (2003-2012) *</b>			
	<b>Average Water Use</b>	<b>Maximum Daily Water Use</b>	<b>Maximum Source Yield</b>
Total Anticipated Water Usage	317 gpm or 455,530 gpd	691 gpm or 995,750 gpd	715 gpm or 1,029,600 gpd

\* Based on the current sources only and does not account for the proposed Bull Run Well #2.

## 4.0 System Management

### 4.1 Source Meters

In accordance with Env-Wq-2101.06(a2, a3 and b), source meters have been and will be sized in accordance with manufacturer’s specifications and selected, installed and maintained in accordance with the Manual of Water Supply Practices M6, *Water Meters-Selection, Installation, Testing and Maintenance* (American Water Works Association, 2012). Specifications for the existing source meters are detailed in Table 3 below (technical specification sheets are provided on pages 1 through 44 of Appendix 3):

<b>Table 3: Existing Source Meter Specifications</b>				
<b>Well ID</b>	<b>Make/Model</b>	<b>Size</b>	<b>Flow Range</b>	<b>Calibration Date</b>
Bull Run Well #1	Neptune, HP Turbine	6 in	20 – 2,500 gpm	12/2/2013
Clay Brook	Foxboro, IDP10	6 in	0 – 500 gpm	12/2/2013
North Charlestown Well 1 (501/001)	ABB, 600T	4 in	0 – 175 gpm	12/2/2013
North Charlestown Well 2 (501/002)	ABB, 600T	4 in	0 – 175 gpm	12/2/2013

The proposed Bull Run Well #2 connection will be designed to meter the flow from the new well individually inside the existing pump house. There are no water consuming processes before the source meters. If water consuming processes are added in the future, the processes must be metered or a distribution meter shall be installed so the amount of water being distributed into the system may be measured.



In accordance with Env-Wq-2101.06(d), source meter readings are electronically recorded on a daily basis. Daily source meter readings are used as the basis for determining water production, which is used in calculating the annual water balance. A D Instruments of Newton, NH manually calibrates the source meters on an annual basis.

## **4.2 Service Meters**

Charlestown completed major system upgrades in 2003, in which new service meters were installed in all service connections. Currently in Charlestown, four un-metered service connections service local cemeteries. In accordance with Env-Wq-2101.05(b), service meters will be installed in all un-metered connections within three years from the date when the Town obtains water source approval for the proposed Bull Run Well #2. In addition, separate irrigation meters can be installed at the request of any customer.

### **4.2.1 Service Meter Readings**

Currently, Charlestown's system operators read service meters electronically with a handheld 'walk-by' unit or physically by accessing meter pits and basements on a biennial basis. According to the system operators, it takes approximately seven days to read all the service meters within the service area. The water system does not have the resources to complete service meter readings on a quarterly basis, which, pursuant to Env-Wq-2101.06(c), would be required within two years of install of all service meters (which Charlestown already has) or five years from the date of source approval of the proposed Bull Run Well #2. The water system hereby applies for a waiver regarding this rule (see Section 9.0 for further details).

### **4.2.2 Service Meter Change Out**

Charlestown will implement a meter change out program which will adhere to current industry best practices; replacement of 10 percent of the service meters annually. All service meters will be replaced with Neptune T-10 meters fitted with an E-Coder R900i meter interface unit which allows for electronic 'walk-by' meter readings. Technical specification sheets for service meters and meter interface units are included on pages 44 through 48 of Appendix 3.

Also, Charlestown will continue to assess the condition of service meters during regular biennial meter readings. The current meter readings are compared to the average readings from previous cycle statistics to determine if water usage is unusually high or low to determine.





Charlestown visually inspects service meters which registered unusual readings to assess if a leak is occurring and if replacement equipment is necessary.

Charlestown sends deactivated service meters that registered unusual usage readings to T-sales for accuracy testing. To date, all meters sent out for calibration have been within the calibrated range.

In accordance with Env-Wq-2101.06(a)(1) and (b), service meters have been and will be sized in accordance with manufactures specifications and selected, installed and maintained in accordance with the Manual of Water Supply Practices M6, *Water Meters-Selection, Installation, Testing and Maintenance* (American Water Works Association, 2012). Currently, the in-use service meters are Neptune Technology Group, Inc. T-10 meters which meet the American Water Works Association (“AWWA”) C700 Standard and are ANSI/NSF 61 certified. If replacement meters are warranted (see Meter Change out Section below).

#### **4.3 Water Balance and Leak Detection**

In accordance with Env-Wq-2101.07(a), Charlestown currently conducts ongoing leak detection surveys. Daily source meter and zone pressure monitor readings are assessed to pinpoint unusual usages to determine if leaks are present and in what general location (see section 4.3.2 for further details). Leak detection surveys are completed in accordance with the Manual of Water Supply Practices M36, *Water Audits and Leak Detection* (American Water Works Association, 2009).

In accordance with Env-Wq-2101.07(b)(1) Charlestown will repair all leaks identified by the leak detection surveys within 60 days of discovery unless a waiver is obtained in accordance with Env-Wq-2101.07(b)(2).

##### **4.3.1 System Design**

System pipes have been mapped using Global Positioning System (“GPS”), and the data have been converted to a GIS database, which is updated regularly. A map summarizing the Charlestown water system is included on page 1 of Appendix 1. Table 4 summarizes the piping materials which comprise the water system.



<b>Table 4: Water Service Pipe Material</b>		
<b>Pipe Material</b>	<b>Charlestown (ft.)</b>	<b>North Charlestown (ft.)</b>
Ductile Iron	31,244	13,764
Cast Iron	75,371	1,953
C900 Plastic	10,751	12,243
Asbestos Concrete	2,503	0
Copper	1,182	0
SDR Plastic	543	0
Unknown	9,559	3,943
<b>Total</b>	<b>131,153</b>	<b>31,903</b>

#### **4.3.2 Leak Detection Survey Methods**

System operators examine overall water usage calculations and information from zone pressure monitors, which are installed in each pressure reducing station and are monitored daily, to determine areas suspected of leakage (substantial relative decrease in pressure over a daily time scale). These water usage calculations are completed on a daily basis.

In emergency situations, system operators either use acoustical equipment to locate large leaks or contract Granite State Rural Water (“GSRW”) to complete a survey if more technical assistance is required. Charlestown also contracts GSRW for ongoing leak detection surveys. Over the past seven years, GSRW has surveyed approximately 45 percent of the combined Charlestown and North Charlestown water systems. The ongoing survey has identified some major leaks, which Charlestown has subsequently repaired, resulting in a substantial reduction of system’s total water usage. GSRW primarily utilizes acoustical leak detection equipment and conducts surveys in accordance with the “Manual of Water Supply Practices M36, *Water Audits and Loss Control Programs*” (American Water Works Association, 2009).

#### **4.3.3 Leak Detection Survey Results**

GSRW completed the most recent leak detection survey in April, May, June, August and October of 2013. Several leaks were detected and subsequently repaired. A letter summarizing the leaks found is included on page 9 of Appendix 2. A list of repairs is included on page 10 of Appendix 2.



#### **4.4 Water Balance**

In accordance with Env-Wq-2101.08(a), Charlestown conducts formal water balance calculations for the Charlestown and North Charlestown systems on a biennial basis. Charlestown combines the results for the Charlestown and North Charlestown water systems for the water balance calculations. Therefore, the data and discussion in this section pertain to both systems in combination. In addition, water usage data is compiled monthly and assessed on an ongoing basis.

In accordance with Env-Wq-2101.08(b), the water system will continue to submit an annual water balance (system input volume- authorized metered consumption) results to the NH DES no later than the first day of March, following the year to which the water audit pertains. In accordance with Env-Wq-2101.09 (a), if the percentage of water losses exceeds 15 percent of the total water introduced to the water system, the water system will prepare a water audit in accordance with the Manual of Water Supply Practices M36, *Water Audits and Leak Detection* (American Water Works Association, 2009) and submit a response plan to the NH DES. The response plan will identify how the water system intends to reduce the percentage of water losses to below 15 percent within two years. In accordance with Env-Wq-2101.09(e), the water system will implement the response plan as approved by the NH DES in accordance with the NH DES approved schedule.

##### **4.4.1 Water Balance Results**

Formal water balance tabulations are completed for the combined Charlestown and North Charlestown systems on a biennial basis. Results from the previous four water audits (2.0 years) are provided on page 6 of Appendix 2. The average percentage of non-revenue water for the previous year (two cycles) is 14.2 percent. VHB revised the reported unbilled metered use values to include quantities for system flushing, system cleaning, firefighting and unbilled cemetery use which were estimated by the water operators during the usage periods (estimated included on page 10 of Appendix 2).

As this is an old water system, leaks are inevitable; however, system operators have been diligently working in conjunction with certified sub-contractors to identify leaks in a proactive and ongoing basis. According to estimates provided by the system operators, leaking lines have accounted for the majority of the water losses (pages 9 and 10 of Appendix 2). As described previously, the operators assess the water usage data on a daily basis and can determine in a short timeframe if a leak is present. Once leaks are identified, they are repaired in a timely



fashion. Since 2010, the combined water systems have decreased water production by approximately 23,400,000 gallons annually due to the repair of leaks and system breaks (see pages 7 to 8 of Appendix 2). See Section 3.4 for Leak detection methods and recent survey results.

#### ***4.5 Pressure Management***

System pressure is measured by pressure monitors along the water system main line. The monitors are fitted with a high/low pressure alarm system which will notify the operator if pressures are out of compliance. The existing minimum distribution pressure is 28 pounds per square inch ("psi") and the existing maximum distribution pressure is 115 psi. The area of maximum distribution pressure is localized at the bottom of a very steep hill.

In accordance with Env-Wq-2101.09(a), the water system routinely assesses the high-pressure zone in the system to verify that leaks are not preferentially occurring. According to the water system operators, the daily pressure monitoring that is conducted and the on-going leak detection surveys that are performed would have identified leaks in this area, were any to occur. However, no leaks have been detected in this area in the past, which indicates that this localized high-pressure area does not adversely affect the water system operations and is not prone to leaks. According to the operators, reducing the distribution pressure in this area would be costly and disruptive to the system, and is not being proposed because the area is not leak-prone.

#### ***4.6 Intentional Water Loss***

The system water quality is improved by biennial system flushing using fire hydrants or two-inch blow-off nozzles in areas where fire hydrants do not exist. It is estimated that approximately 450,000 gallons of water are used during each flushing event. Water looping is not optimal and would work in opposition to the purpose of the system flushing. In addition the water system provides adequate yield to compensate for the water loss associated with the flushing events.

In addition, storage tanks are allowed to overflow on a biennial basis. It is estimated that approximately 100,000 gallons of water are lost during each overflow event. These tanks are also skimmed regularly. Professional cleaning and vacuuming also occurs every five years. Tank mixing systems are effective, yet costly to install and maintain and are therefore, not utilized by Charlestown.



In addition, the water system provides adequate yield to compensate for the water loss associated with overflow events.

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## **5.0 Consumption Management**

### ***5.1 Conservation Rate Structure and Billing***

In accordance with the Water System Ordinance (2006, revised 2013), "all domestic, commercial and industrial water service... will be rendered through service meters. All water passing through and recorded by a service meter shall be charged for, whether used or wasted as a result of leaks or neglect and the property owner shall be liable and charged for the amount of all water recorded by the meter in conformity with the current schedule of water rates."

In accordance with Env-Wq-2101.11(a and b), the water system's rate structure is based on a unitized price of water and the amount of water used by each connection to the water system, as measured by regular service meter readings. The water system also charges a flat fee to each customer during each billing cycle. Irrigation meters are billed at the same rate as regular water consumption. The rates will not vary with seasons or with amount of water consumed. A Water Rate Sheet is provided on page 1 of Appendix 4, which details the currently used billing structure.

Water system billing is currently completed on a biennial basis. The water system does not have the resources to complete billing on a quarterly basis, which would be required within two and five years of obtaining DES approval for the proposed Bull Run Well #2 pursuant to Env-Wq-2101.11(d). The water system hereby applies for a waiver regarding this rule (see Section 8.0 for further details).

### ***5.2 Educational Outreach Initiative***

In accordance with Env-Wq-2101.12(a), the water system shall notify municipal governments within its service area upon approval of the new water source pursuant to Env-Wq-2101.25 (see Section 7).

In accordance with Env-Wq-2101.12(b) the system has developed, and can provide a Water Meter Accuracy and Leak Testing document which will aid customers in performing their own water audit in order to promote water conservation. A copy of this document is provided on pages 2 - 3 of Appendix 4.



Pursuant to Env-Wq-2101.12(b), the water system shall distribute the Water Meter Accuracy and Leak Testing document (Appendix 4, page 2 – 3) and the NHDES Introduction to Water Use Management and Water Efficiency Practices Fact Sheet (Appendix 4, pages 4 - 5) to customers three times annually; once each with the biannual billing documentation and once with the annual Consumer Confidence Report.

The water system does not plan to become a Water Sense partner and will not offer a rebate program for the replacement of older water using fixtures.

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## **6.0 Zoning Ordinance and Bylaws**

Connections to the water system are not subject to any water efficiency ordinances or bylaws beyond the existing plumbing code.

The Town has approved a Drinking Water Protection District Ordinance (1998) which details what land uses are restricted within the Protection District. The Planning Board and the Board of Selectmen are charged with interpreting and enforcing this ordinance. A copy of this document is included on pages 6 through 10 of Appendix 4.

The Town has also approved a Water System Ordinance (dated 2006, revised 2013) which details water use restrictions under a water supply shortage or other water emergency which is detailed in the following section. A copy of this document is included on pages 11 through 30 of Appendix 4.

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## **7.0 Water Use Restrictions**

In accordance with the Town of Charlestown Water Supply Ordinance (dated 2006, revised 2013), upon the declaration of a water supply shortage or other water emergency, the Town of Charlestown is authorized to determine and implement a certain restriction necessary to conserve and maintain adequate reserves of the public water supply. Notification of intent to implement or terminate water use restrictions shall be posted in two public locations and published in a newspaper of general



circulation within the Town of Charlestown or by such other means reasonably determined to notify all affected water users.

Provided there is a declaration as noted above, the following levels of restriction will apply immediately after the public notification period:

1. Level 1
  - i. The public is requested to refrain voluntarily from landscape watering and to limit the amount of water used outdoors for other purposes.
  - ii. Landscape watering shall not occur between the hours of 8AM and 7PM.
2. Level 2
  - i. Landscape watering by odd numbered addresses is allowed on odd numbered days
  - ii. Landscape watering by even numbered addresses is allowed on even numbered days.
  - iii. Landscape watering shall not occur between the hours of 8AM and 7PM.
3. Level 3
  - i. Landscape watering by odd numbered addresses is allowed on Mondays and Thursdays.
  - ii. Landscape watering by even numbered addresses is allowed on Tuesdays and Fridays.
  - iii. Landscape watering shall not occur between the hours of 8AM and 7PM.
  - iv. Use of automated landscape sprinkler systems is prohibited
4. Level 4
  - i. Landscape watering is prohibited
  - ii. The filling of swimming pools is prohibited
  - iii. Washing of streets, driveways, sidewalks or other impervious areas is prohibited.
  - iv. Washing of cars or boats shall be prohibited.

Any person failing to comply with the imposed restrictions shall be subject to a fine and/or civil penalties in accordance with the Town of Charleston Water Ordinance. These restrictions will be enforced by the Town of Charlestown.



In addition, the Town of Charlestown has an established Emergency Action Plan (2009) that outlines responsibilities and procedures in the event contamination is detected in the water supply or if the potential for contamination has been identified. Charlestown's Emergency Action Plan is included on pages 31 through 44 of Appendix 4.

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## **8.0 Reporting and Implementation**

The water system will submit a water balance form electronically to NH DES annually documenting how compliance with the requirements of Env-Wq-2101 is being achieved. The electronic form can be located at the following link:

<https://www.surveymonkey.com/s/annualwaterbalance>

Activities outlined in the Water Conservation Plan will be completed by water system personnel under the supervision of a certified water system operator.

### ***8.1 Public Notification***

In accordance with Env-Wq-2101.25, within 10 working days of submitting the Water Conservation Plan to the NH DES, the water system shall provide a copy of the application and report by certified mail to:

1. Town of Charlestown Selectboard  
c/o Brenda Ferland, Selectboard Chair  
PO Box 385  
216 Main Street  
Charlestown, NH 03603
  
2. Upper Valley Lake Sunapee Regional Planning Commission  
10 Water Street, Suite 225  
Lebanon, NH 03766

In accordance with Env-Wq-2101.25(d), certified copies of the mail return receipt shall be forwarded to the NH DES.





No wholesale customers are included in the water system and therefore do not require certified notification.

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## **9.0 Waiver Requests**

The Charlestown and North Charlestown water systems do not have the resources to complete meter readings and billing on a quarterly basis, which would be required within two and five years of the date when the proposed Bull Run Well #2 is approved by the DES, pursuant to Env-Wq-2101.06(c) and Env-Wq-2101.11(d). The water system hereby applies for a waiver regarding these requirements.

Currently the water system employs three people to maintain, monitor, and repair the Charlestown water system, the North Charlestown water system, and the Charlestown wastewater system. In order to secure the man-power to complete quarterly meter readings, which takes approximately seven days per quarter to complete, another operator would be required. The Town believes that hiring a fourth employee would place an undue financial burden on the water system and Town that is not sustainable.

The Town believes that billing on a quarterly basis also would be prohibitively costly. The select board office clerk requires approximately two days to draft the bills and another day to produce and mail the bills. Postage for any billing cycle tallies to approximately \$600; duplicate billing and follow-up calls are not accounted for in this tally. The Town of Charlestown maintains that by effectively doubling the billing cycle, implementation of quarterly billing would place a burden on the Town personnel and financial resources that is not cost-effective and that would not be recouped by any resulting improvement in bill collections, leak detection, or water conservation.

By committing to daily water usage assessments (source meters and zone pressure monitors), completing ongoing leak detection surveys, a best practice service meter change out program and on-going education outreach initiative the Town of Charlestown's position is that quarterly system readings and billing are not necessary in order to conserve water. The Town's belief is that leaks can be identified and assessed based on daily readings and acoustical identification, and can be subsequently repaired. Continuing this current practice will maintain the integrity of the system



without imposing an undue burden on the Town or water system. In addition, Charlestown believes that:

- the health and safety of the served population will not be compromised by the approval of this waiver;
- the operational and economic consequences of complying with the rule outweigh any benefit to be obtained from complying with the rule;
- Charlestown currently invests, and will continue to invest, energy and money into the leak detection surveys, education outreach and system repairs, which would provide a greater overall rate of water conservation than increasing the billing cycle; and
- granting the waiver will not violate the intent of RSA 485:61 or Env-Wq-2101 because quarterly system readings are not necessary in order to conserve water.

Charlestown requests a waiver to maintain biennial meter readings and billing for the Charlestown and North Charlestown water systems for 4 years after source approval of the proposed Bull Run #2 well. At the end of the 4 year waiver period, the need for the waiver will be reassessed and renewed, if necessary.

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## **10.0 Conclusions**

The Charlestown water system is seeking a new CWS well with a proposed yield of 700 gpm to meet the demand of anticipated growth, to have backup water sources, to provide greater reliability and source water quality, and to support a possible future interconnection with the North Charlestown CWS. VHB has presented this Water Conservation Plan and waiver request in accordance with Env-Wq-2101 to demonstrate current and future system compliance.



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## References

American Water Works Association; "Manual of Water Supply Practices M6, Water Meters-Selection, Installation, Testing and Maintenance." Dated 2012.

American Water Works Association; "Manual of Water Supply Practices M36, Water Audits and Loss Control Programs. Dated 2009.

New Hampshire Code of Administrative Rules, Part Env-Wq-2101, Water Conservation; Use Registration and Reporting. Effective May 14, 2005, amended December 3, 2013.

Town of Charlestown, New Hampshire; Drinking Water Protection District Ordinance. Dated March 10, 1998.

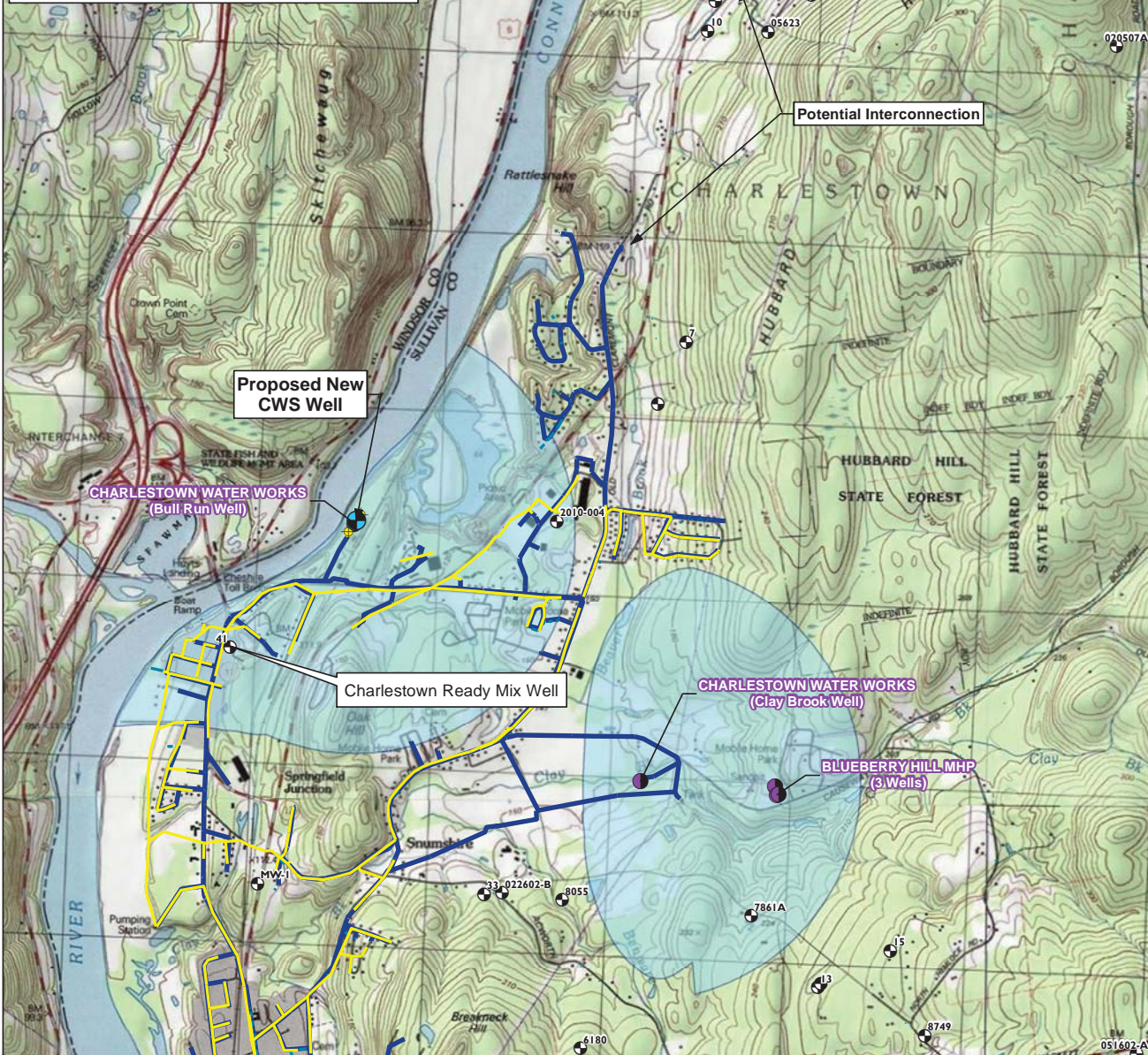
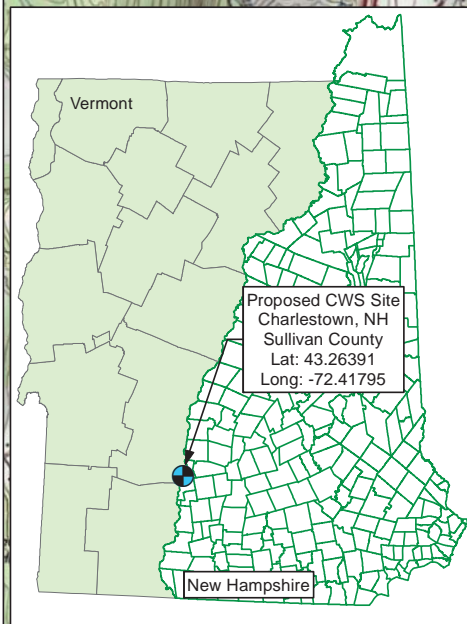
Town of Charlestown, New Hampshire; Water System Ordinance. Dated May 3, 2006, amended June 5, 2013.

Town of Charlestown, New Hampshire; Public Water System Emergency Action Plan and Guide. Dated 2009.

Town of North Charlestown, New Hampshire; Public Water System Emergency Action Plan and Guide. Dated 2009.

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# APPENDIX 1



**Legend**

- Proposed CWS
- Production Well
- Monitor Well
- Private Wells
- Public Wells
- Sewer Pipes
- Drainage Pipes
- Water Pipes
- Existing Well Head Protection Area

**Town of Charlestown, NH  
Proposed New CWS Well  
Site Location and Infrastructure Map**

Prepared by VHB March 20, 2013

2,000 1,000 0 2,000  
Feet

Sources: Background from USA Topos (2012); Production Well and Monitor Wells GPS located and digitized by VHB (2012); Public and Private wells from NH DES (2012); Utilities from the Town of Charlestown (2013); Boundary data from NH GRANIT (2012) and VCGI (2012).

Scale of inset map: 1:2,400,000

**Vanasse Hangen Brustlin, Inc.**



Sources: Orthophotograph from Bing (2012); Streams and waterbodies provided by NHD (2003) and VCGI (2008); Public Roads from NH DOT (2011) and VTTras (2008); Wetlands provided by NWI (2001) and ANR (2010); Private Wells from ANR (2010) and GRANIT (2000); Production Well and Monitor Wells GPS located and digitized by VHB (2012).

**Town of Charlestown, NH  
Existing Gravel Well Assessment  
Site Location Map**  
Prepared by VHB May 23, 2012

0 300 600 Feet

Prepared by: DWM



**Legend**

- Production Well
- Monitor Well
- Private Well
- Stream
- NWI Wetland
- Waterbody
- Contour - 50 foot
- Roads

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# APPENDIX 2

## Water Connections Industrial, Commercial, Municipal

### Charlestown: 944 connections

#### Industrial Business: 19 Meters

Whelen Engineering	Claremont Road			7 meters 3/4" - 2" ser
Alrich Cabinet	OCR			1 meter 3/4" ser.
Cabinet Shop	George Milton Way			1 meter 3/4" ser
Laber Manufacturing	Hammond Road			1 meter 3/4" ser
Optical Solutions	26 Bull Run			1 meter 3/4" ser
Ray Tech	Springfield Road			1 meter 3/4" ser
Carroll Concrete	Springfield Road			1 meter 4" ser ??
Bomar Pompanette	Southwest Street	ID	BF	4 meters 3/4" - 1 1/2" ser
Design Standards Co.	Claremont Road	ID	BF	1 meter 2" ser
C&E Precision	Cummings Ave			1 meter house service 3/4"

#### Commercial Trades: 10 Meters

Cushman Lumber	Springfield Road			2 meters 3/4" ser
Blanc and Bailey	Depot Street , Sp Rd			1 meter 3/4" ser
M&W Soils	PO Box 1466			1 meter 3/4" ser
Ricks Electric	Main Street			1 meter 3/4" ser
Nickerson Electric	Baldwin Court			1 meter 3/4" ser
Nickerson Self Storage	Baldwin Court			1 meter 3/4" ser
Liberty Utilites	South Main Street			1 meter 3/4" ser
Beaudry Enterprise	OCR			1 meter 3/4" ser
Norm & Son Beaudry	OCR	Construction		1 meter 3/4" ser
Cornerstone Construction	OCR			no meter no service

#### Stores, Auto Repair, Banks, Markets, Services: 20 Meters

Depot Home Center	Depot Street			1 meter 3/4" ser
Blair Auto Repair	Springfield Road			1 meter 3/4" ser
R&K Auto Repair	Main Street			1 meter 3/4" ser
Charlestown Tire	Northwest Street			1 meter 3/4" ser
Cold River Cycles	Sullivan Street			1 meter 3/4" ser
JT's Power Washing	OCR			1 meter house service 3/4"
Lane Road cycle Shop	Lovers Lane			1 meter house service 3/4"
Sporting and Hunting Depot	Woodrise Road			1 meter 3/4" ser
Beaudry Real-estate	OCR			1 meter 3/4" ser
Connecticut River Bank	Main Street			1 meter 3/4" ser
Claremont Savings Bank	Main Street			1 meter 3/4" ser
Dan's Max saver	Main Street			1 meter 3/4" ser
Jiffy Mart	PO Box 1153	Main Street		1 meter 3/4" ser
Ralphs Market	Main Street			1 meter 3/4" ser
Emma's Market	OCR			1 meter 3/4" ser
Charlestown Laundromat	Sullivan Street		BF	1 meter 1 1/2" ser
Red Robin Hotel	OCR			1 meter 3/4" ser
Holiday Inn Express	Springfield Road		BF	1 meter 6" High & Low flow
Fort # 4	Springfield Road			1 meter 3/4" ser
Bed and Breakfast 355	355 Main Street		BF	1 meter 3/4" & 2"

#### Hair Salons 7 Meters

Affordable Hairstyles	Main Street			1 meter 3/4" ser
Village Beauty Salon	Southwest Street			1 meter 3/4" ser
Sheer Success Hairstyles	River Steet			1 meter 3/4" ser
Sheer Inspirations	Kinson Lane			1 meter 3/4" ser
Hour Glass Salon	Southwest Street			1 meter 3/4" ser
Martel Barber Shop	Railroad Street			1 meter 3/4" ser
Unique Inspirations	OCR			1 meter 3/4" ser



Medical: 4 Meters

George Grabe	Main Street	Dentist	BF	1 meter	3/4" ser
Valley Family Physicians	Arbor Way	Office	BF	1 meter	3/4" ser
Charlestown Family Medicine	Main Street	Office		1 meter	3/4" ser
Keady Family Medicine	Main Street	Office		1 meter	3/4" ser

Restaurants: 2 Meters

Sumner House	Main Street			1 meter	3/4" ser
House of Pizza	Main Street			1 meter	3/4" ser

Funeral Homes: 1 Meter

Charlestown Memorial Chapel				1 meter	3/4" ser
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Child Care: 2 Meters

One Step Ahead Daycare	Bridge Street			1 meter	3/4" Ser
Wee Haven Childcare	S. Main Street			1 meter	3/4" Ser

Mobile Home Parks: 8 Parks 15 Meters

Lower Landing Park	21 Homes			1 meters	2" Ser
Great Meadow Park	18 Homes			2 meters	3/4" Ser
Crown Point Park	15 Homes			1 meter	1 1/2" Ser
Twin Maples Park	29 Homes			5 Meters	1" meters
Blueberry Hill Park	24 Homes			1 meter	2" Ser
Twin Valley Park	148 Homes			2 meters	2" & 6" High & Low Flow
Ponderosa Park	47 Homes			1 meter	4" Ser
Sunrise Village	18 Homes			2 meters	3/4" Ser

Municipal Meters: 18 + 5 Ser

Wastewater Treatment Facility	Not Billed	BF		1 meter	2" Ser
Wastewater Head works Facility	Not Billed	BF		1 meter	3/4" Ser
Clay Brook Well	Not Billed	BF		1 meter	3/4" Ser <i>source meter</i>
Bull Run Well	Not Billed			1 meter	3/4" Ser <i>source meter</i>
Ambulance Station		BF		1 meter	3/4" Ser
Fire Station		BF		2 meters	3/4" & 2" Ser
Old Town Hall		BF		2 meters	3/4" & 2" Ser
OSR Pump Station		BF		1 meter	3/4" Ser
Transfer Station		BF		1 meter	1 1/2" Ser
Bakery Building				1 meter	3/4" Ser
Library Building				1 meter	3/4" Ser
Patch Park				1 meter	3/4" Ser
Charlestown Pool				1 meter	3/4" Ser
Highway Garage				1 meter	3/4" Ser
Police Station				1 meter	3/4" Ser
Water Building				1 meter	3/4" Ser

East Street	No Meter			3 Connections	no meters
Pine Crest	No Meter			1 service	
Southwest St. Saint Catherine	No Meter			1 service	

Schools 2

3 meters

North Charlestown: 133 connections

Industrial Business: 4

Mal Tool	PO Box 329	River Road	1 meter
Meadowbrook Grinding	853 River Road		1 meter 3/4" Ser
Air Gas	River Road		3 meters
Tru - Cut	Rt 12A		1 meter 3/4" Ser

Stores, Auto Repair, Banks, Markets, Services: 5

Fastenal Inc.	29 Salt Shed Road		1 meter 3/4" Ser
Morways Auto Salvage	Judland Heights		1 meter 3/4" Ser
Ray Brown Auto Repair	Unity Stage		1 meter 3/4" Ser
J&S Auto Repair			1 meter 3/4" Ser
Dezi's Second Hand Store	Oxbrook Road		1 meter 3/4" Ser

Commercial Trades: 3

St. Pierre Inc.	Jeffrey Drive		1 meter 3/4" Ser
St. Pierre Inc.	Chestnut Drive		1 meter 1 1/2" Ser
SCA	River Street	BF	3 meters 3" - 3/4" Ser
TSV Tennis	OCR		1 meter 3/4" Ser

Hair Salons 1

Ferland Barber Shop	Judland Heights		1 meter 3/4" Ser
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Municipal Meters: 3 & 1 Ser

N Charlestown Well 3 Well Meters	Not Billed		3 meters 3/4" Ser	<i>source meter</i>
N. Charlestown Cemetery	Not Billed		1 Service 3/4" Ser	

School 1

2 meters

Town of Charlestown, NH  
Proposed CWS Well  
Demand Analysis  
Prepared by VHB on March 19, 2012

Bull Run Well							
Year	Yearly Total		Yearly Average			Daily Max	Daily Max
	Gallons	Gallons per Month	Gallons per Day	Gal/Min	Gallons	Gal/Min	
2003	20,444,000	1,703,667	55,973	39	272,000	189	
2004	17,610,900	1,467,575	48,216	34	310,000	215	
2005	19,218,000	1,601,500	52,616	37	261,000	181	
2006	15,857,000	1,321,417	43,414	30	311,000	216	
2007	23,122,000	1,926,833	63,305	44	309,000	215	
2008	17,498,000	1,458,167	47,907	33	300,000	208	
2009	20,433,000	1,702,750	55,943	39	210,000	146	
2010	49,909,000	4,159,083	136,643	95	302,000	210	
2011	53,843,000	4,486,917	147,414	102	297,000	206	
2012	44,110,000	3,675,833	120,767	84	300,000	208	
Min	15,857,000	1,321,417	43,414	30	210,000	146	
Max	53,843,000	4,486,917	147,414	102	311,000	216	
Average	28,204,490	2,350,374	77,220	54	287,200	199	

Clay Brook Well							
Year	Yearly Total		Yearly Average			Daily Max	Daily Max
	Gallons	Gallons per Month	Gallons per Day	Gal/Min	Gallons	Gal/Min	
2003	100,504,000	8,375,333	275,165	191	488,000	339	
2004	99,474,000	8,289,500	272,345	189	538,000	374	
2005	89,041,000	7,420,083	243,781	169	415,000	288	
2006	88,100,000	7,341,667	241,205	168	554,000	385	
2007	93,990,000	7,832,500	257,331	179	524,000	364	
2008	109,854,000	9,154,500	300,764	209	481,000	334	
2009	113,239,000	9,436,583	310,031	215	525,000	365	
2010	104,551,000	8,712,583	286,245	199	562,000	390	
2011	92,765,000	7,730,417	253,977	176	542,000	376	
2012	94,540,000	7,878,333	258,836	180	446,000	310	
Min	88,100,000	7,341,667	241,205	168	415,000	288	
Max	113,239,000	9,436,583	310,031	215	562,000	390	
Average	98,605,800	8,217,150	269,968	188	507,500	352	

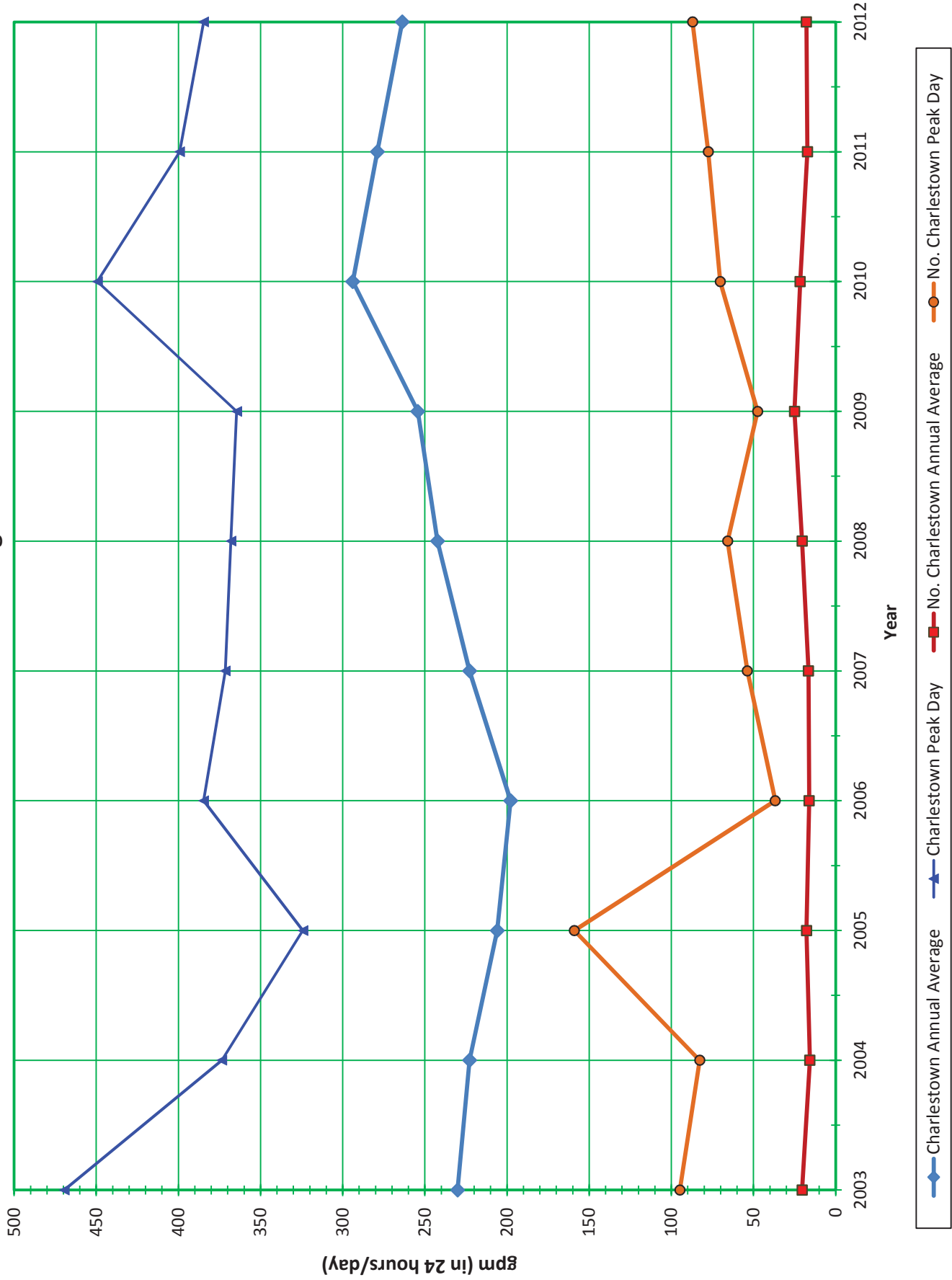
Charlestown Water System - Total Flow*							
Year	Yearly Total		Yearly Average			Daily Max	Daily Max
	Gallons	Gallons per Month	Gallons per Day	Gal/Min	Gallons	Gal/Min	
2003	120,948,000	10,079,000	331,138	230	676,000	469	
2004	117,084,900	9,757,075	320,561	223	538,000	374	
2005	108,259,000	9,021,583	296,397	206	467,000	324	
2006	103,957,000	8,663,083	284,619	198	554,000	385	
2007	117,112,000	9,759,333	320,635	223	535,000	372	
2008	127,352,000	10,612,667	348,671	242	530,000	368	
2009	133,672,000	11,139,333	365,974	254	525,000	365	
2010	154,460,000	12,871,667	422,888	294	647,000	449	
2011	146,608,000	12,217,333	401,391	279	575,000	399	
2012	138,650,000	11,554,167	379,603	264	554,000	385	
Min	103,957,000	8,663,083	284,619	198	467,000	324	
Max	154,460,000	12,871,667	422,888	294	676,000	469	
Average	126,810,290	10,567,524	347,188	241	560,100	389	

\*Note Daily Max Flows at Bull Run and Clay Brook Wells do not occur on same days, so cannot be added together to determine system-wide Max Daily flows. This table presents system-wide flows, representing total usage in the existing Charlestown Water System.

North Charlestown Water System							
Year	Yearly Total		Yearly Average			Daily Max	Daily Max
	Gallons	Gallons per Month	Gallons per Day	Gal/Min	Gallons	Gal/Min	
2003	10,707,600	892,300	29,316	20	136,500	95	
2004	8,248,700	687,392	22,584	16	119,100	83	
2005	9,303,500	775,292	25,472	18	229,000	159	
2006	8,469,900	705,825	23,189	16	52,900	37	
2007	8,671,800	722,650	23,742	16	77,400	54	
2008	10,705,100	892,092	29,309	20	94,600	66	
2009	13,156,600	1,096,383	36,021	25	68,400	48	
2010	11,353,700	946,142	31,085	22	101,100	70	
2011	9,010,800	750,900	24,670	17	111,600	78	
2012	9,340,700	778,392	25,573	18	125,400	87	
Min	8,248,700	687,392	22,584	16	52,900	37	
Max	13,156,600	1,096,383	36,021	25	229,000	159	
Average	9,896,840	824,737	27,096	19	111,600	78	

Anticipated Growth and Total Demand of Combined Systems						
Estimated New Usage (from D. Duquette, 1/17/2013)	Yearly Average			Daily Max	Daily Max	
	Gallons per Month	Gallons per Day	Gal/Min	Gallons	Gal/Min	
Whelen Industries	1,520,833	50,000	35	80,000	56	
VT DOT (in 2014)	152,083	5,000	3	10,000	7	
100 New Connections (new line)	760,417	25,000	17	25,000	17	
Normal Growth - 10 years from 2013	38,021	1,250	1	4,750	3	
Total Anticipated Growth	2,471,354	81,250	56	119,750	83	
Charlestown System: Bull Run Well	2,350,374	77,220	54	311,000	216	
Charlestown System: Clay Brook Well	8,217,150	269,968	188	562,000	390	
Charlestown System subtotal*	10,567,524	347,188	241	647,000	449	
North Charlestown	824,737	27,096	19	229,000	159	
Charlestown and North Charlestown Combined	11,392,261	374,284	260	876,000	608	
Total Growth and Combined System	13,863,615	455,534	317	995,750	691	

# Historic Water Usage



Town of Charlestown & Town of North Charlestown  
 Combined Water Balance

	<b>Start Date</b>	<b>4/10/2012</b>	<b>10/15/2012</b>	<b>4/5/2013</b>	<b>10/11/2013</b>
	<b>End Date</b>	<b>10/16/2012</b>	<b>4/4/2013</b>	<b>10/11/2013</b>	<b>4/7/2014</b>
A	Volume of Production Wells	10,353,824	8,369,826	9,962,540	9,277,433
B	Billed Metered Use	7,545,800	7,191,500	7,366,662	6,634,764
C	Unbilled Metered Use	980,000	680,000	588,000	675,000
	Revised Unbilled Metered Use*			980,000*	1,510,000*
D	Unaccounted for Water	1,828,024	498,326	1,615,878	1,132,669
E	% Unaccounted for Water	17.7	6.0	16.2	12.2
F	Billed Unmetered Use	0	0	0	0
G	Unbilled Unmetered Use	590,000	280,000	124,732	1,950,000
	Revised Unbilled Unmetered Use*			720,000*	1,115,000*
H	Authorized Consumption	9,115,800	8,151,500	9,066,662	9,259,764
I	Source Meter Errors				
J	Water Losses	1,238,024	218,326	895,878	17,669
K	Unauthorized Consumption	164,000	200,000	164,438	0
L	Customer Meter Errors	0	0	0	0
M	Data Handeling Errors	0	0	0	0
N	Apparent Losses	164,000	200,000	164,438	0
O	Real Losses	1,074,024	18,326	731,440	17,669
P	Non-Revenue Water	2,808,024	1,178,326	2,000,610	3,477,669

\* Quantities adjusted to account for system flushing/cleaning, fire fighting and cemetary use.

# Charlestown Water Production Gallons 2013

	January	February	March	April	May	June	July	August	September	October	November	December	Totals
CB	4,684,000	5,820,000	7,866,000	10,747,000	7,524,000	8,335,000	6,451,000	6,333,000	8,354,000	6,520,000	5,532,000	7,195,000	85,361,000
Bull Run	5,705,000	4,093,000	2,987,000	128,000	3,684,000	3,103,000	5,195,000	5,007,000	2,970,000	4,362,000	4,289,000	3,852,000	45,375,000
Total	10,389,000	9,913,000	10,853,000	10,875,000	11,208,000	11,438,000	11,646,000	11,340,000	11,324,000	10,882,000	9,821,000	11,047,000	130,736,000

## North Charlestown Production Gallons

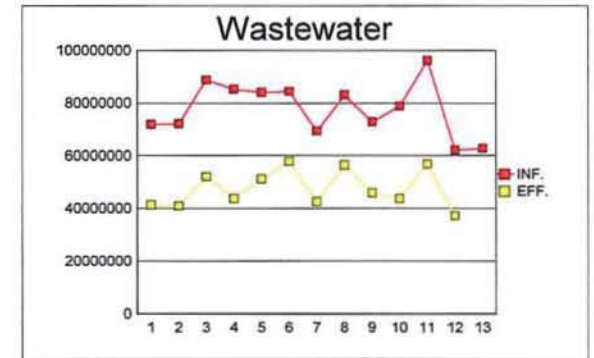
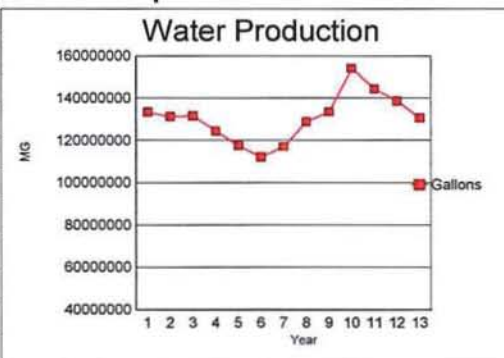
N. Ch	January	February	March	April	May	June	July	August	September	October	November	December	Totals
Well 1	556,000	230,200	307,000	769,700	790,500	69,700	672,700	76,700	567,800	853,100	206,700	284,500	5,384,600
Well 2	559,800	314,000	358,000	92,400	0	674,700	209,800	717,400	204,500	133,700	556,100	484,600	4,305,000
Total	1,115,800	544,200	665,000	862,100	790,500	744,400	882,500	794,100	772,300	986,800	762,800	769,100	9,689,600

## Wastewater Reclaimed Gallons

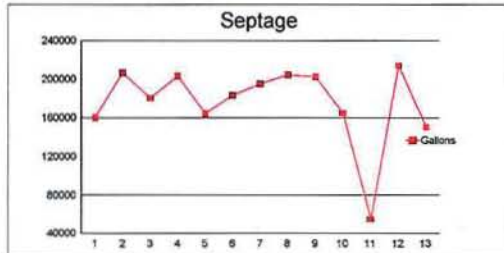
	January	February	March	April	May	June	July	August	September	October	November	December	Totals
Influent	5,480,000	4,905,000	6,236,000	6,320,000	5,984,000	6,193,000	5,566,000	4,225,000	4,311,000	4,233,000	4,266,000	5,072,000	62,791,000
Effluent	3,749,000	3,056,000	3,571,000	4,676,000	1,850,000	5,547,000	3,954,000	2,128,000	1,973,000	1,592,000	2,375,000	1,746,000	36,217,000
Septage	1,650	5,100	8,200	12,800	13,900	8,850	6,810	34,600	11,800	26,850	15,100	5,100	150,760

## Charlestown Thirteen Year Comparison/Flows

Year	Water	Influent	Effluent	Septage
1	133,444,000	72,022,000	41,365,000	160,500
2	131,354,000	72,277,000	41,015,000	206,630
3	131,813,500	88,885,200	52,117,000	180,450
4	124,579,600	85,351,000	43,834,000	203,250
5	117,575,300	84,101,000	51,214,000	164,450
6	112,100,836	84,475,000	57,889,000	183,520
7	117,112,000	69,507,000	42,577,000	195,210
8	129,029,000	83,109,000	56,546,000	204,500
9	133,672,000	72,953,000	45,941,000	202,745
10	154,167,293	78,974,000	43,788,000	164,565
11	144,419,000	96,274,000	56,970,000	54,988
12	138,650,000	62,230,000	37,360,000	214,030
13	130,736,000	62,791,000	36,217,000	150,760



Income Septage 01	\$9,630
Income Septage 02	\$12,398
Income Septage 03	\$10,827
Income Septage 04	\$12,195
Income Septage 05	\$9,867
Income Septage 06	\$11,011
Income Septage 07	\$15,617
Income Septage 08	\$16,360



Income Septage 09	\$16,220
Income Septage 10	\$13,165
Income Septage 11	\$4,399
Income Septage 12	\$17,122
Income Septage 13	\$12,061

# Charlestown Water Production Gallons 2014

	January	February	March	April	May	June	July	August	September	October	November	December	Totals
CB	10,845,000	8,760,000	8,647,000	10,042,000	7,724,000	10,294,000	8,345,000						64,657,000
Bull Run	805,000	1,569,000	3,536,000	1,449,000	3,265,000	152,000	1,685,000						12,461,000
Total	11,650,000	10,329,000	12,183,000	11,491,000	10,989,000	10,446,000	10,030,000	0	0	0	0	0	77,118,000

## North Charlestown Production Gallons

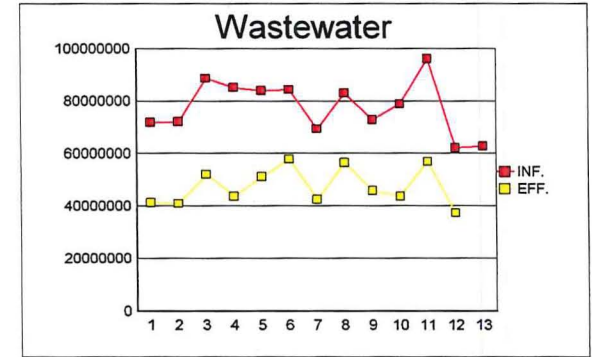
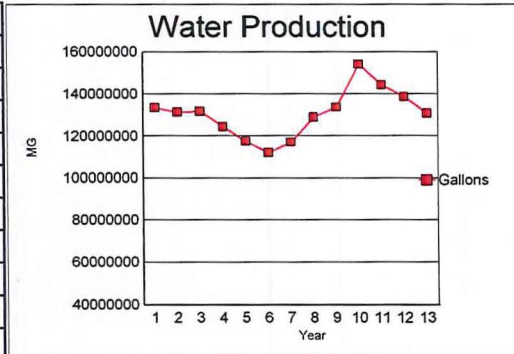
N. Ch	January	February	March	April	May	June	July	August	September	October	November	December	Totals
Well 1	548,500	416,100	493,500	850,200	155,800	1,021,100	778,700						4,263,900
Well 2	282,500	394,800	433,200	204,500	988,900	347,900	601,300						3,253,100
Total	831,000	810,900	926,700	1,054,700	1,144,700	1,369,000	1,380,000	0	0	0	0	0	7,517,000

## Wastewater Reclaimed Gallons

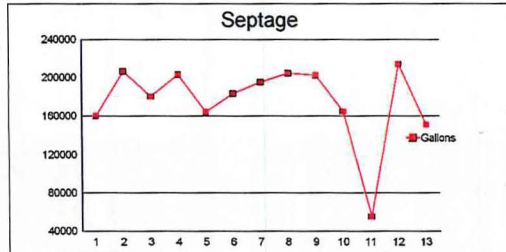
	January	February	March	April	May	June	July	August	September	October	November	December	Totals
Influent	6,409,000	4,796,000	6,822,000	8,610,000	7,460,000	6,087,000	5,741,000						45,925,000
Effluent	4,568,000	3,372,000	4,127,000	5,900,000	5,631,000	3,587,000	3,032,000						30,217,000
Septage	1,800	4,100	31,500	11,600	17,550	0	1,000						67,550

## Charlestown Thirteen Year Comparison/Flows

Year	Water	Influent	Effluent	Septage
1	133,444,000	72,022,000	41,365,000	160,500
2	131,354,000	72,277,000	41,015,000	206,630
3	131,813,500	88,885,200	52,117,000	180,450
4	124,579,600	85,351,000	43,834,000	203,250
5	117,575,300	84,101,000	51,214,000	164,450
6	112,100,836	84,475,000	57,889,000	183,520
7	117,112,000	69,507,000	42,577,000	195,210
8	129,029,000	83,109,000	56,546,000	204,500
9	133,672,000	72,953,000	45,941,000	202,745
10	154,167,293	78,974,000	43,788,000	164,565
11	144,419,000	96,274,000	56,970,000	54,988
12	138,650,000	62,230,000	37,360,000	214,030
13	130,736,000	62,791,000	36,217,000	150,760
14	77,118,000	45,925,000	30,217,000	67,550



Income Septage 01	\$9,630
Income Septage 02	\$12,398
Income Septage 03	\$10,827
Income Septage 04	\$12,195
Income Septage 05	\$9,867
Income Septage 06	\$11,011
Income Septage 07	\$15,617
Income Septage 08	\$16,360



Income Septage 09	\$16,220
Income Septage 10	\$13,165
Income Septage 11	\$4,399
Income Septage 12	\$17,122
Income Septage 13	\$12,061

Income Septage 14	\$5,404
Income Septage + June - Dec 14	
June - Dec	

Leak Detection:

Granite State Rural Water Jay Matuszewski

Developments, Neighborhoods

Michael Ave June 2013 Found two leaks  
Coral Ave  
David Ave  
Emile Ave

Stonebridge April 2013 Found multiple leaks  
Stevens Street  
Birch Drive

Old Claremont Road May 2013  
Lovers Lane

Suspected lines

Main Street waterline August 19 2013 1,000'  
Unity Stage Road August 19 2013 1,800'

Main Street October 9 2013 900'

Jones Road October 9 2013 1,200' Found leak

Twin Maples Park October 9 2013 2,000' Found two leaks



Water Conservation Doc.

Town of Charlestown

UnBilled & Unmetered Water Use			Fires, Flushing, Swimming Pools, Ice Rink	
Date	Location	Amount Gallons	Explanation	Cycle
01/27/13	Coral Ave. Spalding	230,000	3/4" leak many months	
01/01/13 , 03/20/13	Ice Rink	100,000	Flood rink all winter	
01/01/13 , 04/01/13	Blow Offs	1,607,040	3 months @ 6 gpm	
02/05/13	East St. Cemetery	180,000	3/4" leak two weeks	
02/14/13	Fort # 4	120,000	3/4" leak three days	
03/18/13	Bracket Circle	35,000	Fire in home	
03/01/13 , 04/04/13	Unity Stage Road Flushing	80,000	Old line needs flushing	04/04/13
				2,352,040
04/04/13 , 10/09/13	Cemetery Use	250,000	6 curbs 5 months	
04/10/13	St. Pierre N.C.	160,000	3/4" leak two weeks	
04/23/13	Hydrant Flushing	450,000	All Hydrants	
05/04/13	Twin Valley Est.	160,000	3/4" leak two weeks	
05/09/13	1000 OCR	200,000	3/4" leak two months	
09/03/13	OCR Frizell	200,000	2" Service three days	04/04/13
10/15/13	Hydrant Repair	85,000	Drain and Flush	10/09/13
4/04/13 , 10/09/13	Fire Drills and Practice	80,000	Practice	
9/01/13 , 10/09/13	Jetting Sewers and Culverts	15,000	Clean Sewers and Culverts	
0/09/13 , 04/04/14	Transfer Station Fires	20,000	Burn Pile	
4/04/13 , 10/09/13	Unity Stage Road Flushing	80,000	Old line needs flushing	1,700,000
0/09/13 , 11/01/13	Cemetery Use	18,000	6 curbs 1 month	
0/09/13 , 04/04/14	Transfer Station Fires	5,000	Burn Pile	
10/23/13	104 Jones Road	180,000	3/4" leak many months	
10/23/13	Hydrant Flushing	560,000	All Hydrants	
10/24/13	Resivour Overflow	90,000	Skim top off Resivour	
11/26/13	28 Sullivan St.	60,000	Sprinkler frozen and broke	
12/15/13	12" Main Lovers Lane & CEDA	90,000	12" Main Leak	
12/19/13	Fire Twin Valley Park	62,000	Fire in home	
12/20/13	OSR service leak	20,000	Frozen Pipes	
01/02/14	1014 OCR Main Leak	85,000	6" Main Leak	
01/04/14	647 Lovers Lane	70,000	3/4" leak many months	10/09/13
01/21/14	Ice Rink	40,000		04/07/14
0/03/14 , 02/04/14	Hydrant Flushing N.C.	60,000	Flushed River Road	
3/15/14 , 04/04/14	Fenderson Circle	610,000	Leak	1,950,000
04/24/14	189 N. Hemlock Rd	200,000	Service Leak	
05/01/14	Hydrant Flushing	600,000	All Hydrants	
05/15/14	S. Main Street	200,000	Service Leak	
06/03/14	368 Sullivan St.	65,000	Service Leak	
06/06/14	Kinson Lane	120,000	2" Main	
06/01/14	St. Pierre N.C.	60,000	2" service	
07/11/14	St. Pierre N.C.	65,000	2" Service	
08/02/14	Fire Chesire Turnpike	20,000		
09/01/14	Norman Ave	40,000	1.5" Main line	
				1,370,000

Note: According to Charlestown Water System Personnel all leaks referenced in the table above have been repaired.  
 Denotes value which was revised from unbilled unmetered use to unbilled metered use.  
 Shown on the water balance calculations as 'revised' quantities.



# APPENDIX 3



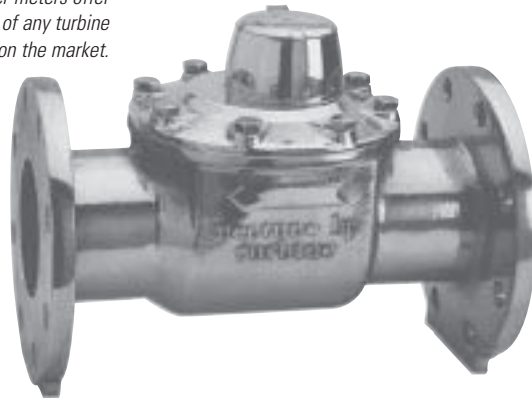
**NEPTUNE®**

Neptune Technology Group Inc.

# High Performance Turbine Meter

Sizes: 1 1/2", 2", 3", 4", 6", 8", and 10"

*High Performance Turbine water meters offer some of the widest flow ranges of any turbine meters on the market.*



HP Turbine water meters offer some of the widest flow ranges of any turbine meters on the market. All HP Turbine water meters meet or exceed the latest performance and accuracy requirements of AWWA C701 and maximum continuous flow rates may be exceeded by as much as 25% for intermittent periods.

## Application

The HP Turbine water meter is designed for applications where flow rates are consistently moderate to high.

## Construction

Each HP Turbine consists of a rugged bronze maincase, an AWWA Class II turbine measuring element, and a roll-sealed register.

The bronze maincase is corrosion resistant, lightweight, and compact. Inlet and outlet connections are flanged. Strainers are available to prevent debris from entering the meter and to reduce the effects of uneven water flow due to upstream piping variations.

The Unitized Measuring Element (UME) allows for quick, easy, in-line interchangeability. Water volume is

measured accurately at all flows by a specially designed assembly. The hydrodynamically balanced thrust compensated rotor relieves pressure on the thrust bearings to minimize wear and provide sustained accuracy over an extended operating life. Direct coupling of the rotor to the gear train eliminates revenue loss due to slippage during fast starts and line surges. A calibration vane allows in-field calibration of the UME to lengthen service life and to ensure accurate registration.

The roll-sealed register eliminates leaking and fogging. A magnetic drive couples the register with the measuring element.

## Warranty

Neptune provides a limited warranty with respect to its HP Turbine water meters for performance, materials, and workmanship.

When desired, owner maintenance is easily accomplished by in-line replacement of major components.

## Systems Compatibility

Adaptability to all present and future systems for flexibility.

## Key Features

### ■ Roll-Sealed Register

- Magnetic drive, low torque registration ensures accuracy
- Impact-resistant register design with flat glass for readability
- 1:1 ratio, low flow indicator identifies leaks
- Bayonet mount allows in-line serviceability
- Tamperproof seal pin deters theft
- Date of manufacture, size, and model stamped on dial face

### ■ Cast Bronze Maincase

- Made from EnviroBrass®II
- Compact design is lightweight and easy to handle
- Sturdy, durable, corrosion resistant
- Resists internal pressure stresses and external damage
- Residual value

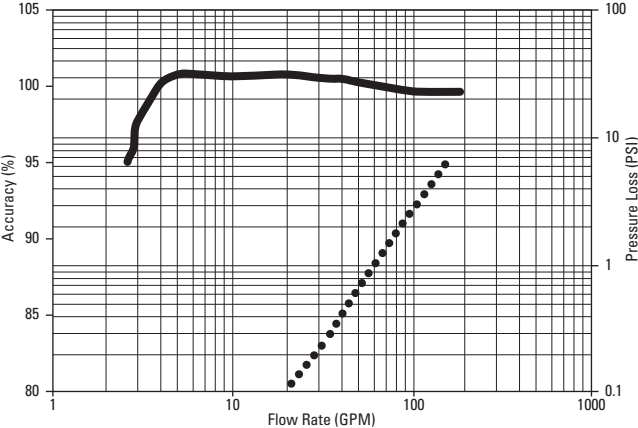
### ■ Turbine Measuring Element

- Excellent low flow sensitivity and wide flow ranges available at 98.5%–101.5% accuracy
- Direct coupling of rotor to gear train prevents slippage and ensures accurate registration
- Interchangeable measuring element allows for in-line service
- Hydrodynamically balanced rotor
- Reusable O-ring gasket on 3" –10" sizes

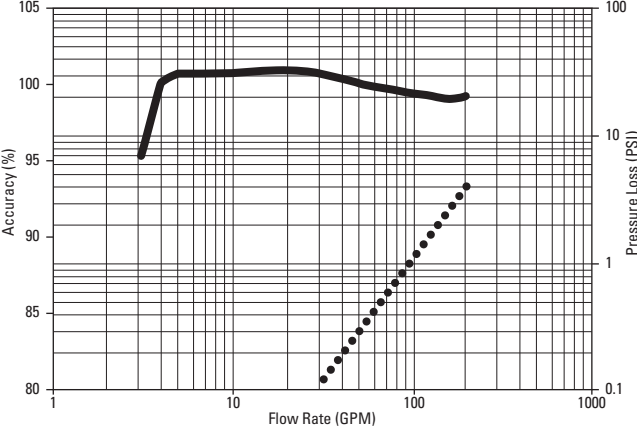
# High Performance Turbine Meter

Sizes: 1 1/2", 2", 3", 4", 6", 8", and 10"

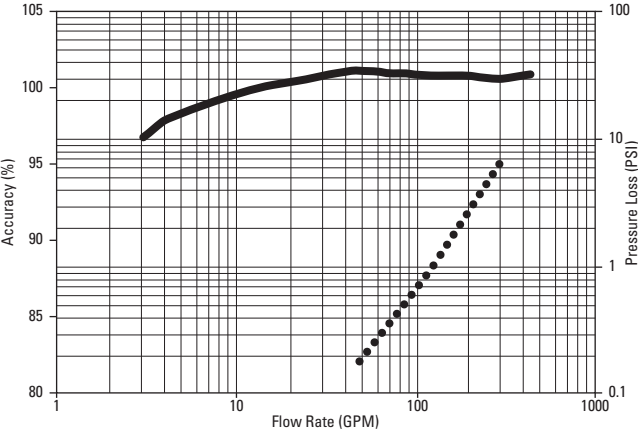
### 1 1/2" Accuracy



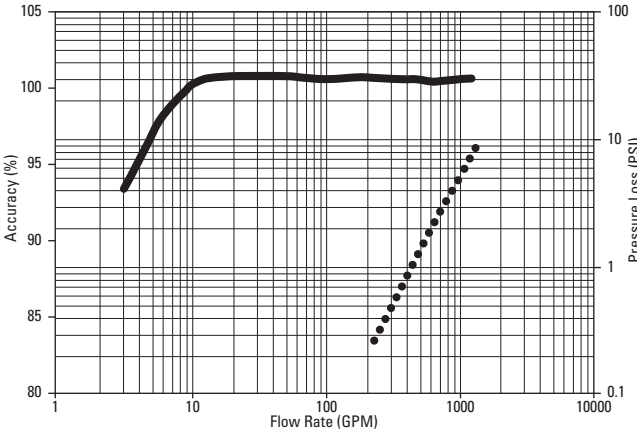
### 2" Accuracy



### 3" Accuracy

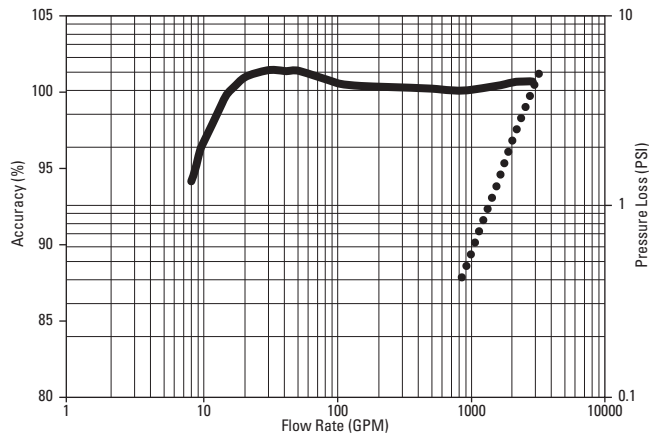


### 4" Accuracy

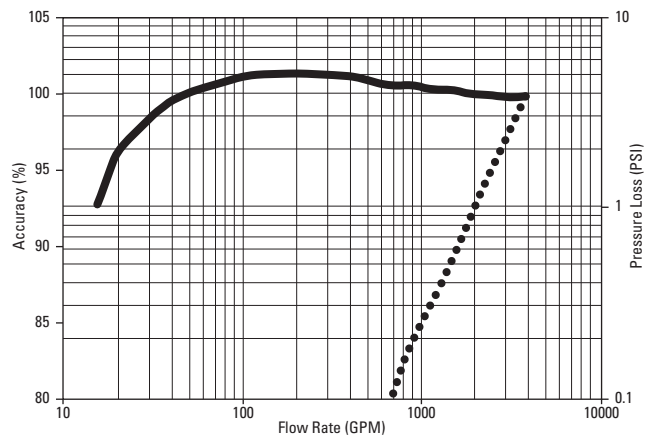


———— Accuracy  
..... Head Loss

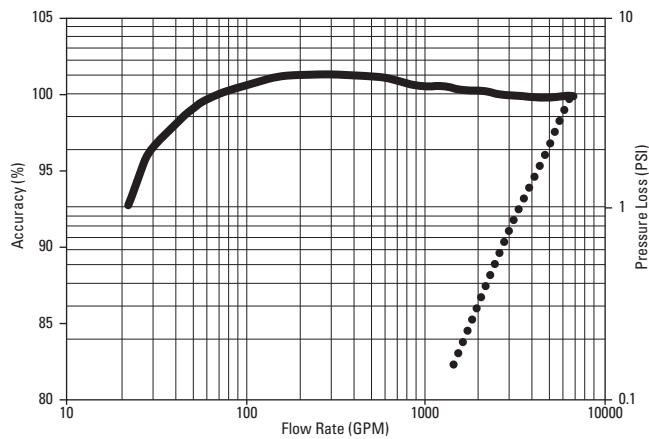
## 6" Accuracy



## 8" Accuracy



## 10" Accuracy



— Accuracy  
..... Head Loss

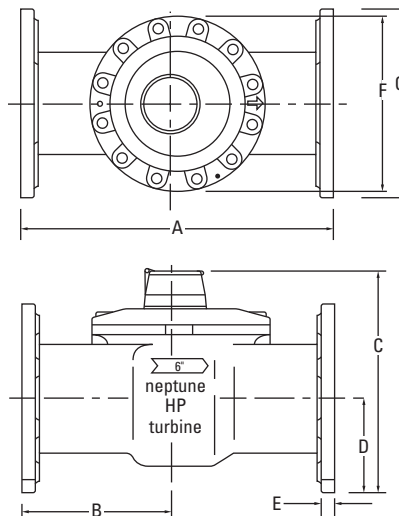
*These charts show typical meter performance. Individual results may vary.*

## Operating Characteristics

Meter Size	Normal Operating Range @100% Accuracy ( $\pm 1.5\%$ )	Maximum Intermittent Flow	AWWA Standard
1 1/2"	4 to 160 US gpm 0.91 to 36.3 m <sup>3</sup> /h	200 US gpm 45.4 m <sup>3</sup> /h	N/A
2"	4 to 200 US gpm 0.91 to 45.4 m <sup>3</sup> /h	250 US gpm 56.8 m <sup>3</sup> /h	4 to 160 US gpm 0.91 to 36.3 m <sup>3</sup> /h
3"	5 to 450 US gpm 1.14 to 102.2 m <sup>3</sup> /h	560 US gpm 127.2 m <sup>3</sup> /h	8 to 350 US gpm 1.8 to 79.5 m <sup>3</sup> /h
4"	10 to 1200 US gpm 2.27 to 272.5 m <sup>3</sup> /h	1500 US gpm 340.7 m <sup>3</sup> /h	15 to 630 US gpm 3.4 to 143.0 m <sup>3</sup> /h
6"	20 to 2500 US gpm 4.55 to 567.8 m <sup>3</sup> /h	3100 US gpm 704.1 m <sup>3</sup> /h	30 to 1400 US gpm 6.8 to 317.9 m <sup>3</sup> /h
8"	35 to 4000 US gpm 7.95 to 908.5 m <sup>3</sup> /h	5000 US gpm 1135.6 m <sup>3</sup> /h	50 to 2400 US gpm 11.4 to 545 m <sup>3</sup> /h
10"	50 to 6500 US gpm 11.36 to 1476.3 m <sup>3</sup> /h	8000 US gpm 1817 m <sup>3</sup> /h	75 to 3800 US gpm 17.0 to 863 m <sup>3</sup> /h

## Registration

Registration (per sweep hand revolution)		
	1 1/2", 2", 3", 4"	6", 8", 10"
1,000 US Gallons		✓
1,000 Imperial Gallons		✓
100 US Gallons	✓	
100 Imperial Gallons	✓	
100 Cubic Feet		✓
10 Cubic Feet	✓	
10 Cubic Metres		✓
1 Cubic Metre	✓	
Register Capacity (6-wheel odometer)		
	1 1/2", 2", 3", 4"	6", 8", 10"
1,000,000,000 US Gallons		✓
1,000,000,000 Imperial Gallons		✓
100,000,000 US Gallons	✓	
100,000,000 Imperial Gallons	✓	
100,000,000 Cubic Feet		✓
10,000,000 Cubic Feet	✓	
10,000,000 Cubic Metres		✓
1,000,000 Cubic Metres	✓	



## Dimensions

Meter Size	A in/mm	B in/mm	C in/mm	D in/mm	E in/mm	F in/mm	G in/mm	Weight lbs/kg
1 1/2"	10 (254)	6 1/2 (165)	7 1/8 (181)	1 3/4 (44)	3/4 (19)	4 1/2 (114)	5 3/8 (137)	19 (8.6)
2"	10 (254)	6 1/2 (165)	7 5/8 (194)	2 1/8 (54)	13/16 (21)	4 1/2 (114)	5 3/8 (137)	20 (9.1)
3"	12 (305)	6 (152)	10 (254)	3 3/4 (95)	5/8 (16)	6 1/4 (159)	7 1/2 (191)	40 (18.1)
4"	14 (356)	6 1/2 (165)	10 7/8 (276)	4 1/2 (114)	3/4 (19)	8 1/8 (206)	9 (229)	52 (23.6)
6"	18 (457)	8 5/8 (219)	13 (330)	5 1/2 (140)	1 (25)	10 1/4 (260)	11 (279)	115 (52.2)
8"	20 (508)	9 5/8 (244)	15 1/2 (394)	6 3/4 (171)	1 1/8 (29)	10 1/4 (260)	13 1/2 (343)	195 (88.4)
10"	26 (660)	12 5/8 (321)	15 1/2 (394)	8 (203)	1 1/4 (32)	10 1/4 (260)	16 (406)	275 (124.7)

## Guaranteed Systems Compatibility

All HP Turbine water meters are guaranteed adaptable to our ARB®V, ProRead AutoDetect, TRICON®/S, TRICON/E3®, and Neptune meter reading systems without removing the meter from service.

## Specifications

- Application: cold water measurement of flow in one direction
- Maximum operating pressure: 175 psi (1206 kPa)
- Maximum operating temperature: 80°F
- Register: direct reading, center sweep, roll-sealed, magnetic drive with low-flow indicator
- Measuring element: AWWA Class II Turbine, hydrodynamically balanced rotor

## Options

- Sizes: 1 1/2", 2", 3", 4", 6", 8", 10"
- Units of measure: U.S. gallons, imperial gallons, cubic feet, cubic metres
- Register Types:
  - Direct reading: Bronze box and cover (standard)
  - Remote reading systems\*: ARBV, ProRead AutoDetect, TRICON/S, TRICON/E3
  - Reclaim
- Companion flanges:
  - 1 1/2" and 2" (oval): bronze or cast iron
  - 3", 4", 6": bronze or cast iron
  - 8" and 10": cast iron
- Strainer:
  - 2"–6" bronze
  - 8"–10" bronze

\* Consult factory for meter performance specifications when fitted with ARB.



www.neptunetg.com

**Neptune Technology Group Inc.**  
1600 Alabama Highway 229  
Tallahassee, AL 36078, USA  
Tel: (800) 645-1892  
Fax: (334) 283-7299

**Neptune Technology Group Inc.**  
7275 West Credit Avenue  
Mississauga, Ontario L5N 5M9, Canada  
Tel: (905) 858-4211  
Fax: (905) 858-0428

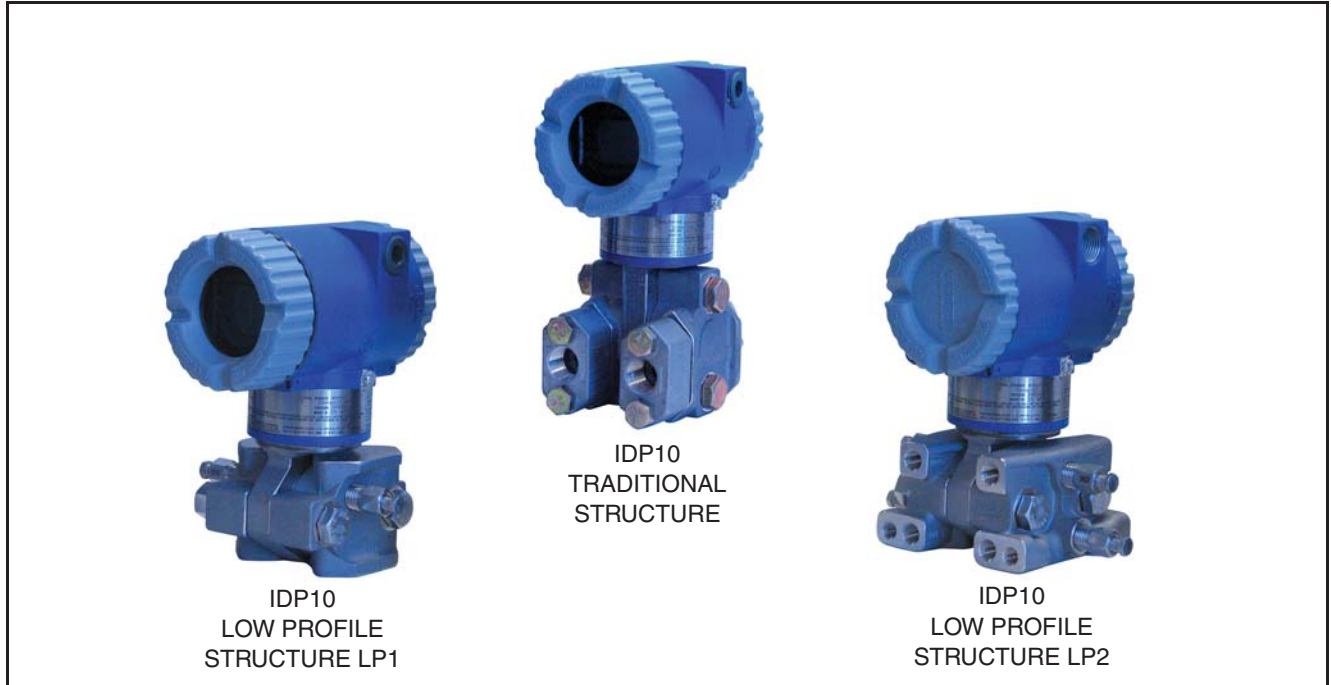
**Neptune Technology Group Inc.**  
Via Gustavo Baz No. 29-C  
Col. Naucalpan Centro  
53000 Naucalpan, Estado de México  
Tel: (525) 358-8737  
Fax: (525) 576-1934

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# I/A Series<sup>®</sup> Electronic Pressure Transmitters

## Model IDP10 with FoxCom<sup>™</sup> Communication Protocol

### for Differential Pressure Measurement



This Intelligent, two-wire d/p Cell<sup>®</sup> Transmitter provides precise, reliable, measurement of differential pressure, and transmits a 4 to 20 mA or a digital output signal using FoxCom Communication Protocol, software selectable, for remote configuration and monitoring.

#### HIGH DEPENDABILITY

- Silicon strain gauge sensors successfully field-proven in many thousands of installations.
- Simple, elegant sensor packaging, with very few parts, achieves exceptionally high reliability.
- Transmitter available with traditional or low profile structures (see photos above).
- Remote configuration with FoxCom Protocol; or locally via the optional LCD indicator.
- Aluminum housing has durable, corrosion-resistant epoxy finish; 316 ss housing also available; both meet NEMA 4X and IEC IP66.
- Can be provided as a sealed measurement system with numerous configurations of direct connect or capillary connected seals available.
- Industry standard 316L ss, Co-Ni-Cr, Hastelloy C, Monel, or Tantalum sensor, depending on transmitter structure selected.
- Complies with NAMUR NE 21 Interference Immunity Requirement.
- Analog output complies with NAMUR 105 overrange and underrange annunciations.
- CE marked; complies with applicable EMC, ATEX, and PED European Directives.
- Complies with Electromagnetic Compatibility Requirements of European EMC Directive 89/336/EEC by conforming to following IEC Standards: EN 50081-2, EN 50082-2, IEC 61000-4-2 through 61000-4-6.
- Designed for hazardous area installations. Versions available to meet Agency flameproof and zone requirements.
- Optional mounting bracket sets allow pipe, surface, or manifold mounting of transmitter.
- Standard 5-year warranty.

## **I/A Series PRESSURE TRANSMITTER FAMILY**

The I/A Series Electronic Pressure Transmitters are a complete family of d/p Cell<sup>®</sup>, gauge, absolute, multirange, multivariable, and premium performance transmitters, as well as transmitters with remote or direct connect seals, all using field-proven silicon strain gauge sensors and common topworks.

Select the electronic module you need to provide just the right level of intelligence for your application and budget. If your needs change, the modular design allows easy migration to other protocols – including HART, FOUNDATION fieldbus, PROFIBUS, and analog 4 to 20 mA or 1 to 5 V dc versions.

### **SELECT THE LEVEL OF TRANSMITTER INTELLIGENCE YOU NEED**

These transmitters are configurable, thus allowing you to select the degree of transmitter intelligence you need for your application - FoxCom Digital or 4 to 20 mA outputs.

#### **FoxCom Digital Output**

Provides Measurement Integration with I/A Series systems, transmission of multiple measurements, and workstation configuration and diagnostics. Also provides digital communications with a PC-based Configurator or optional LCD Indicator with on-board pushbuttons for local configuration and calibration.

#### **FoxCom 4 to 20 mA Output**

Allows direct analog connection to common receivers while still providing full Intelligent Transmitter Digital Communications with a PC-based Configurator, applicable I/A Series system FBMs, or optional LCD Indicator with on-board pushbuttons for configuration and calibration.

### **FoxCom/4 to 20 mA INTELLIGENT MODULE – CONFIGURED FOR FoxCom DIGITAL OUTPUT**

All communications between I/A Series system and transmitter are digital, providing true Measurement Integration and eliminating need to use PC-based configurators and personal computers. You can do all of your configuration and transmitter communications directly from the workstation in the control room.

Measurement from sensor lower range value to upper range value is automatically accomplished independent of the calibrated range, eliminating the need to rerange the transmitter when process conditions change. Since the measurements are digital, they are more accurate because the inaccuracies of the analog input circuit, and the analog-to-digital converter, are eliminated.

Multiple measurements are transmitted digitally, including not only the primary measurement available in both pressure units and plant engineering units, but also the sensor temperature which can be used to monitor, control, or alarm external heat tracing equipment. Complete transmitter diagnostics are also available at the workstation.

Upload and download capability is provided to send transmitter configuration changes from system to transmitter, and from transmitter to system. Also, transmitter databases can be easily uploaded to the system for viewing, verification, comparison, modification, and saving.

### **FoxCom/4 to 20 mA INTELLIGENT MODULE – CONFIGURED FOR 4 to 20 mA OUTPUT**

When 4 to 20 mA output is selected, the following items are accessible from a personal computer running configuration software (PC-based Configurator), applicable I/A Series system FBMs, or the on-board pushbuttons which are part of the LCD Indicator option:

- Measurements
- Diagnostics
- Configuration
- Calibration, including Reranging without Pressure

The PC-based Configurator may be connected to the two-wire loop, uses a bidirectional digital signal superimposed on the 4 to 20 mA analog signal, and does not interrupt the 4 to 20 mA output.

### **WIDE MEASUREMENT RANGE WITH A MINIMUM OF SENSORS**

Five d/p Cell range sensors are provided to cover measurement spans from 0.12 to 21 000 kPa (0.018 to 3000 psi). The high turndown capability of the transmitter means that nearly all d/p applications can be satisfied with only these five ranges, greatly simplifying your spare transmitter and spare parts requirements.

### **HIGH PERFORMANCE**

Transmitters are accurate to  $\pm 0.05\%$  of calibrated span in the digital linear mode, and  $\pm 0.075\%$  of calibrated span in the 4 to 20 mA linear mode, as well as microprocessor-based correction to achieve excellent ambient temperature compensation.



## PROCESS CONNECTORS

Removable, gasketed process connectors allow a wide range of selections, including 1/4 NPT, 1/2 NPT, Rc 1/4, Rc 1/2, and weld neck connections. For highly corrosive chemical processes when a traditional structure is used (see transmitter structures further in document), two 1/2 NPT pvdf inserts (Figure 1) are installed in both 316 ss covers and are used as the process connectors. In these applications, tantalum is used as the sensor diaphragm material.

## SENSOR CORROSION PROTECTION

For traditional structure, choice of 316L ss, Co-Ni-Cr, Hastelloy C, Monel, Gold-Plated 316L ss, and Tantalum materials. High corrosion resistance of Co-Ni-Cr (TI 037-078) means long service life in many difficult applications without the extra cost for exotic materials. See TI 037-75b for process applicability with Co-Ni-Cr and other process wetted materials.

For low profile structures LP1 and LP2, 316L ss and Hastelloy C are offered as sensor materials.

Refer to Transmitter Structures section that follows for description and application of traditional and low profile (LP1 and LP2) structures.

## EASE OF INSTALLATION

Rotatable Topworks allows transmitter installation in tight places, allows indicator to be positioned in preferred direction, and eases field retrofit.

Two Conduit Entrances offer a choice of entry positions for ease of installation and self-draining of condensation regardless of mounting position and topworks rotation.

Wiring Guides and Terminations provide ease of wire entry and support, plenty of space to work and store excess wire, and large, rugged screw terminals for easy wire termination.

## OPTIONAL MOUNTING BRACKET SETS

In addition to the standard style mounting bracket sets optionally offered with these transmitters, a unique universal style mounting bracket has been developed to allow wide flexibility in transmitter mounting configurations consistent with installation requirements. All mounting bracket sets allow mounting to a surface, pipe, or manifold. Refer to Dimensions - Nominal section.

## OPTIONAL LCD DIGITAL INDICATOR)

A two-line digital indicator (Figure 22) with on-board pushbuttons is available to display the measurement with a choice of units. The pushbuttons allow zero and span adjustments, as well as local configuration without the need for a PC-based configurator.

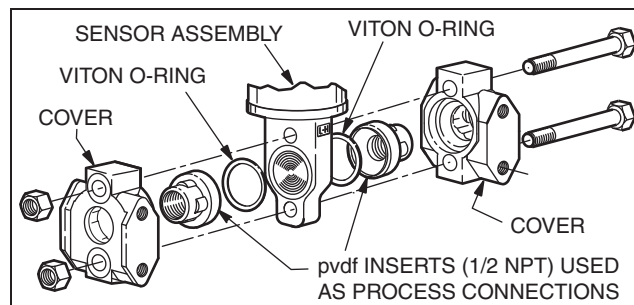


Figure 1. Bottomworks Shown with pvdf Inserts in HI-/LO-Side Covers; Traditional Structure

## UNIQUE PROCESS COVER/CELL BODY DESIGN

Biplanar Construction (Figure 2) maintains the traditional horizontal process connections and vertical mounting by providing a cell body contained between two process covers, while still achieving light weight, small size, and high standard static pressure rating of 25 MPa (3625 psi). This provides easy retrofit of any conventional DP transmitter, and also is easily mounted in the horizontal position with vertical process connections, when required.

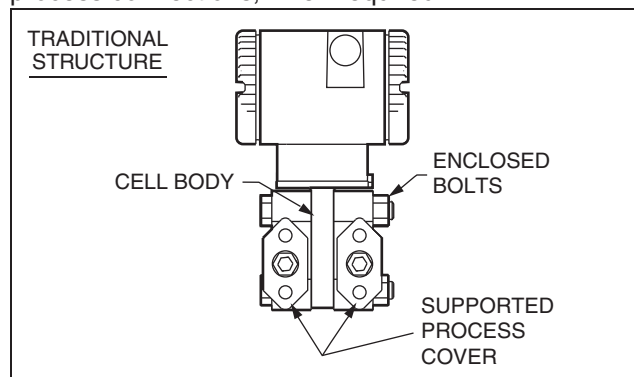


Figure 2. Biplanar Construction Shown with Traditional Horizontal Process Connections

Process Covers (Figure 2) are fully supported by the cell body over their entire height. This prevents bending and results in a highly reliable seal. Also, this provides dimensional stability to the process covers, ensuring that they will always mate properly with 3-valve bypass manifolds.

Process Cover Bolts (Figure 2) are enclosed to minimize corrosion and to minimize early elongation with rapid temperature increases. The design makes it less likely for the transmitter to release process liquid during a fire.

Process Cover Gaskets are ptfе as standard; ptfе provides nearly universal corrosion resistance, and eliminates the need to select and stock various elastomers to assure process compatibility.

Light Weight provides ease of handling, installation, and direct mounting without costly pipe stands.

### TRANSMITTER STRUCTURES

Traditional and low profile structures (LP1 and LP2) are offered to accommodate and to provide flexibility in transmitter installations. See paragraphs below.

#### Traditional Structure

The traditional structure (Figure 3) utilizes the right angle design common to most DP transmitters in use throughout the world. Process connections are oriented 90 degrees from the transmitter centerline.

This traditional structure makes it easy to retrofit any transmitters of similar design.

Sensor cavity venting and draining is provided for both vertical and horizontal transmitter installation, using innovative tangential connections to the sensor cavity (Figures 4 and 5). Optional side vents are offered for sensor cavity venting in the upright position (Figure 6).

An extensive variety of process-wetted materials are available for the process covers on this highly versatile and widely used transmitter.

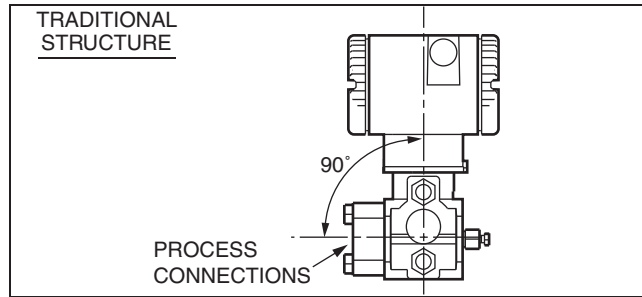


Figure 3. Vertical Mounting Showing Process Connections at 90 degrees

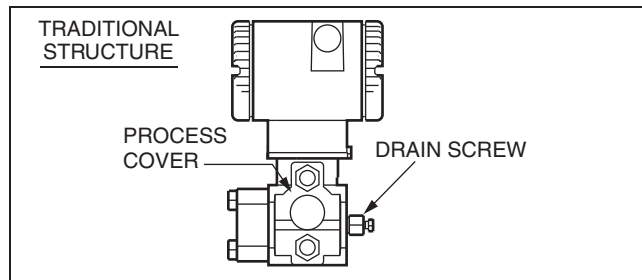


Figure 4. Vertical Mounting - Cavity Draining

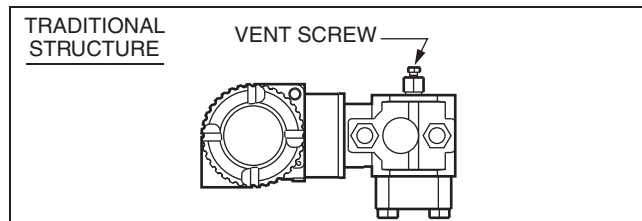


Figure 5. Horizontal Mounting - Cavity Venting, and Self-Draining into Process Line

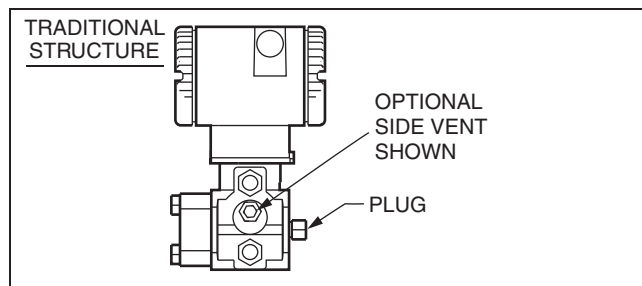


Figure 6. Vertical Mounting - Cavity Venting, and Self-Draining into Process Line

**Low Profile Structures**

The low profile structures utilize an in-line design, placing the process connections in line with the transmitter centerline (Figures 7 and 8). This allows mounting of the transmitter in the upright position with the process connections facing downward, for connection to vertical process piping or for mounting directly to a three- or five-valve manifold.

The low profile structures provide a mounting style similar to that used by competitive Coplanar™ transmitters. This makes it easy to select Foxboro transmitters for both retrofit and new applications where this type of installation is desired.

Transmitters with the low profile structure can be attached directly to existing, installed Coplanar manifolds, such as the Rosemount Model 305RC or Anderson Greenwood Models MC3, MC5G, MC5P, and MT3 by use of an optional adapter plate (Figure 9). Also, when assembled to the same process piping or manifold as a Coplanar transmitter, one of the electrical conduit connections is located within ± one inch of the similar conduit connection on the competitive transmitter, assuring ease of retrofit or conformance with installation design drawings.

All parts making up the low profile versions are identical to the parts in the traditional version except for the process covers and the external shape of the sensor cell body.

For user convenience, two types of low profile structures are offered, type LP1 and LP2. The process covers are the only transmitter parts that differ between structure types LP1 and LP2.

Refer to the sections that follow for further descriptions of low profile structures LP1 and LP2.

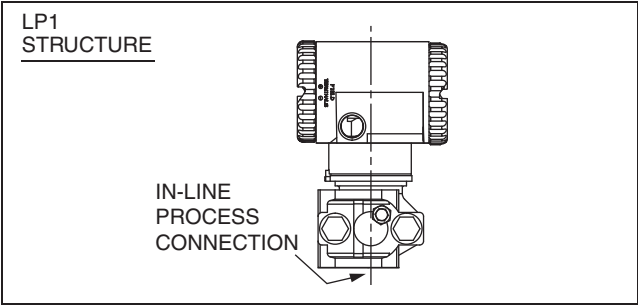


Figure 7. Low Profile Structure - LP1 Shown

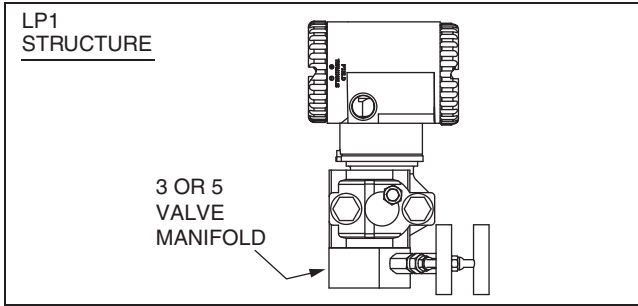


Figure 8. LP1 Shown Directly Mounted to Manifold

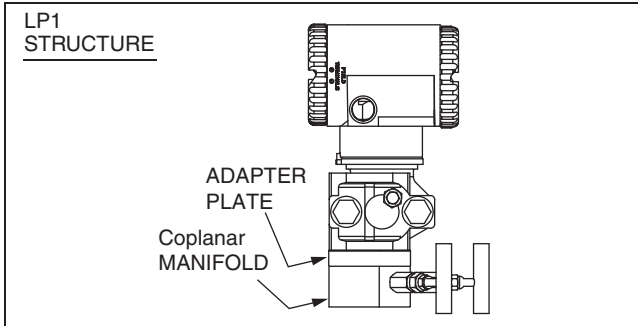


Figure 9. LP1 Shown Mounted to a Coplanar Manifold using an Optional Intermediate Adapter Plate

*Low Profile Structure LP1 – Direct Mount*

Low Profile Structure LP1 is a compact, inexpensive, lightweight design for direct mounting to a separately mounted manifold or process piping. These transmitters are not typically bracket-mounted.

They are supplied as standard with a single vent/drain screw in the side of each process cover. In conjunction with the standard tangential venting and draining design, they are suitable for mounting either vertically (Figure 10) or horizontally, and are suitable for nearly all applications, including liquids, gases, and steam. For horizontal installation, they can simply be “turned over” (rotated 180 degrees - Figures 11 and 12) to orient the high and low pressure sides in the preferred locations. There is no need to unbolt process covers. The topworks housing can also be rotated, as shown, to orient the conduit connections in the desired position.

In the vertical, upright position, they are also self-draining and are ideal for gas flow rate service, when directly mounted to a manifold located above the horizontal pipeline. The vent screw can be omitted for this or other applications, if desired.

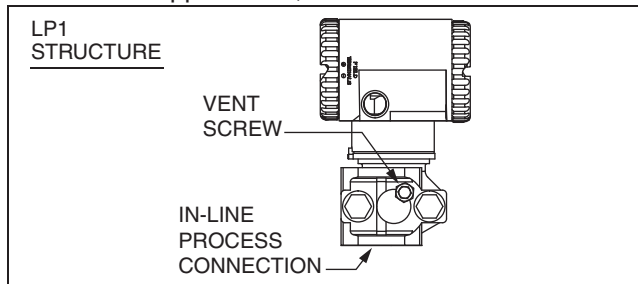


Figure 10. Upright Mounting

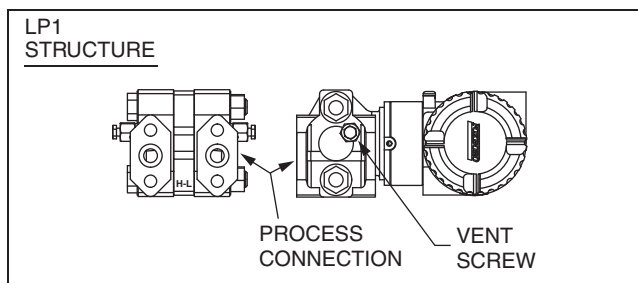


Figure 11. Horizontal Mounting with Vent Screw

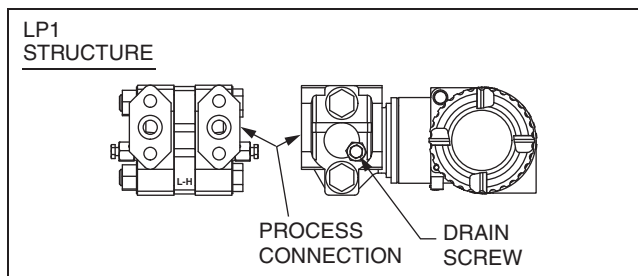


Figure 12. Horizontal Mounting with Drain Screw

*Low Profile Structure LP2 - Bracket or Direct Mount*

Low Profile Structure LP2 is a universal design for either bracket or direct mounting. Drilled and tapped mounting holes facilitate mounting to either new or existing Foxboro brackets (Options -M1, -M2, and -M3), as well as standard brackets supplied with existing Coplanar transmitters. See Figures 13 and 14.

These transmitters can also be directly mounted to manifolds or process piping and are available with the same optional adapter used with low profile structure LP1 to fit existing Coplanar manifolds (Figure 15).

For extra convenience, they use a full-featured vent and drain design, with separate vent and drain screws positioned in each cover for complete venting or draining directly from the sensor cavity. They are normally recommended for upright, vertical installation.

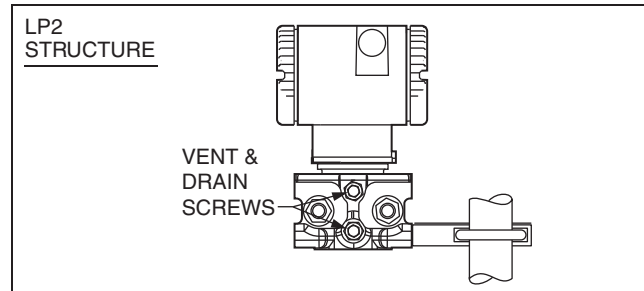


Figure 13. Shown on Foxboro Universal Bracket

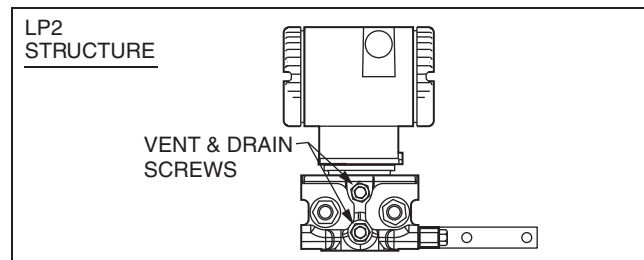


Figure 14. Shown on Coplanar Bracket

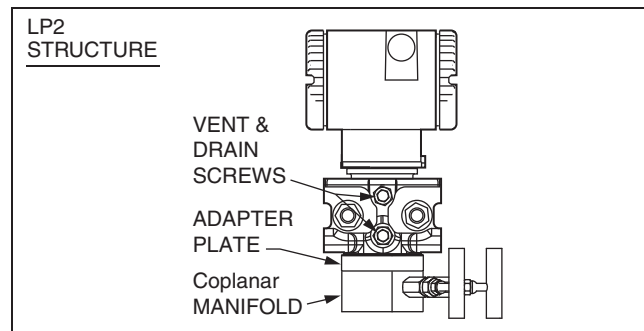


Figure 15. Adapter Mount to Existing Coplanar Manifold

**PRESSURE SEALS**

Pressure seals are used with transmitters having a traditional structure (see Transmitter Structures section above) when it is necessary to keep the transmitter isolated from the process. A sealed system is used for a process fluid that may be corrosive, viscous, subject to temperature extremes, toxic, sanitary, or tend to collect and solidify.

Table 1 lists the various pressure seals that can be used with an IDP10 Transmitter. To order a transmitter with seals, both a Transmitter Model Number and Seal Model Number are required. For a complete listing of pressure seal models and specifications, see PSS 2A-1Z11 A. Also see Figure 16 for typical pressure seal configurations.

Table 1. Pressure Seals Used with IDP10 Transmitters

Direct Connect Pressure Seal Assemblies		
Seal Model	Seal Description	Process Connections
PSFLT	Flanged, Direct Connect (Flanged Level), Flush or Extended Diaphragm	ANSI Class 150/300/600 flanges and BS/DIN PN 10/40, 10/16, 25/40 flanges
PSSCT	Sanitary, Direct Connect (Level Seal), Flush Diaphragm	Process Connection to Sanitary Piping with 2- or 3-inch Tri-Clamp
PSSST	Sanitary, Direct Connect (Level Seal), Extended Diaphragm	Process Connection to 2-in Mini Spud or 4-in Standard Spud; Tri-Clamp
Remote Mount, Capillary-Connected Pressure Seal Assemblies		
Seal Model	Seal Description	Process Connections
PSFPS	Flanged, Remote Mount, Flush Diaphragm	ANSI Class 150/300/600 flanges and BS/DIN PN 10/40 flanges
PSFES	Flanged, Remote Mount, Extended Diaphragm	ANSI Class 150/300/600 flanges and BS/DIN PN 10/40, 10/16, 25/40 flanges
PSFAR	Flanged, Remote Mount, Recessed Diaphragm	ANSI Class 150/300/600/1500 flanges
PSTAR	Threaded, Remote Mount, Recessed Diaphragm	1/4, 1/2, 3/4, 1, or 1 1/2 NPT internal thread
PSISR	In-Line Saddle Weld, Remote Mount, Recessed Diaphragm	Lower housing of seal is in-line saddle welded to nominal 3- or 4-inch (and larger) Pipe
PSSCR	Sanitary, Remote Mount, Flush Diaphragm	Process Connection secured with a Tri-Clamp to a 2- or 3-inch pipe
PSSSR	Sanitary, Remote Mount, Extended Diaphragm	Process Connection to 2-in Mini Spud or 4-in Standard Spud; Tri-Clamp



Figure 16. Typical Pressure Seals used with IDP10 Transmitters

TRANSMITTER FUNCTIONAL BLOCK DIAGRAM - Figure 17

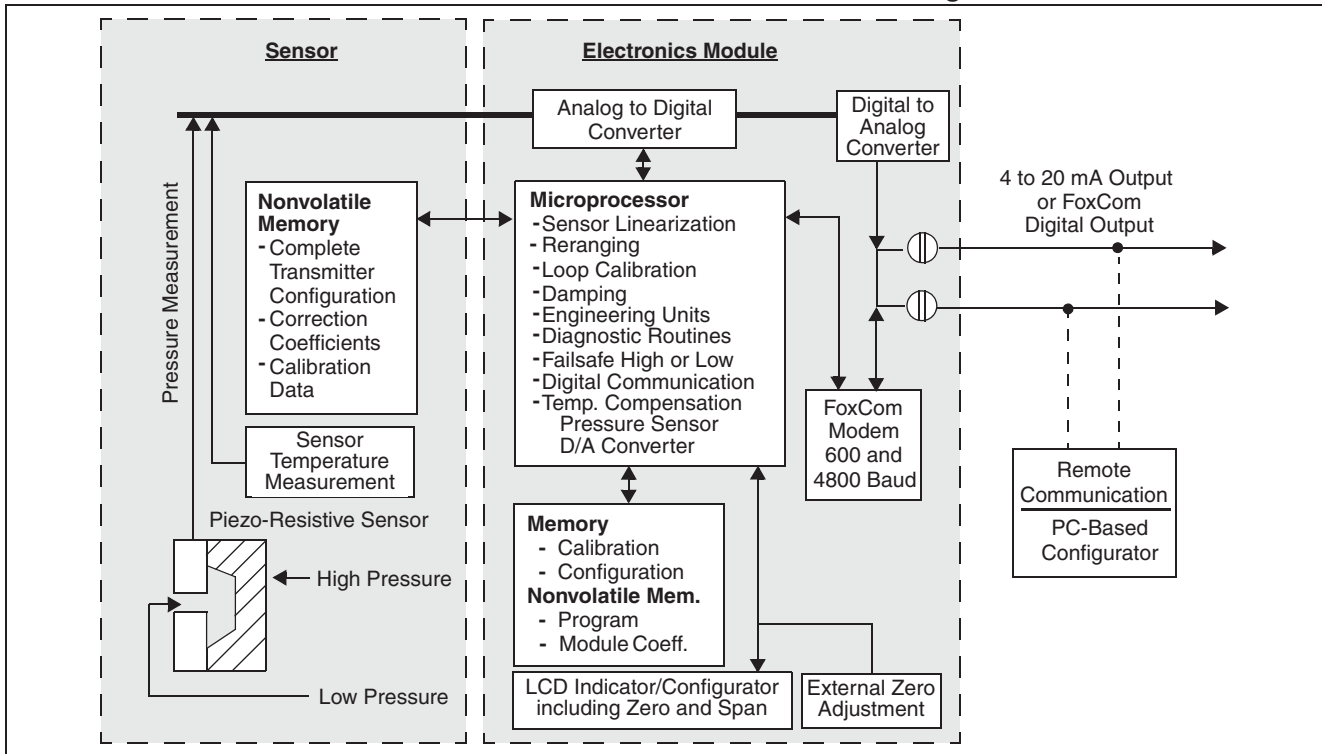


Figure 17. Intelligent Transmitter Functional Block Diagram

## FUNCTIONAL SPECIFICATIONS

### Span Limits for IDP10 d/p Cell Transmitters

Code	kPa	psi	mbar	mmHg	mmH <sub>2</sub> O	inH <sub>2</sub> O
A (a)	0.12 and 7.5	0.018 and 1.1	1.2 and 75	0.93 and 56	12 and 750	0.5 and 30
B	0.87 and 50	0.125 and 7.2	8.7 and 500	6.5 and 375	87 and 5000	3.5 and 200
C	7 and 210	1 and 30	70 and 2100	50 and 1500	700 and 21 000	28 and 840
Code	MPa	psi	bar or kg/cm <sup>2</sup>	mHg	mH <sub>2</sub> O	ftH <sub>2</sub> O
D	0.07 and 2.1	10 and 300	0.7 and 21	0.5 and 15	7 and 210	23 and 690
E (b)	0.7 and 21(b)	100 and 3000 (b)	7 and 210 (b)	5 and 150 (b)	70 and 2100 (b)	230 and 6900 (b)

(a) Span Limit Code "A" not available when pressure seals are selected.

(b) When certain options are specified, the upper span and range limits are reduced as shown in the "Options Impact" table below.

### Range Limits for IDP10 d/p Cell Transmitters (a)

Code	kPa	psi	mbar	mmHg	mmH <sub>2</sub> O	inH <sub>2</sub> O
A (b)	-7.5 and +7.5	-1.1 and +1.1	-75 and +75	-56 and +56	-750 and +750	-30 and +30
B	-50 and +50	-7.2 and +7.2	-500 and +500	-375 and +375	-5000 and +5000	-200 and +200
C	-210 and +210	-30 and +30	-2100 and +2100	-150 and +150	-21 000 and +21 000	-840 and +840
Code	MPa	psi	bar or kg/cm <sup>2</sup>	mHg	mH <sub>2</sub> O	ftH <sub>2</sub> O
D	-0.21 and +2.1	-30 and +300	-2.1 and +21	-1.5 and +15	-21 and +210	-69 and +690
E (c)	-0.21 and 21 (c)	-30 and +3000 (c)	-2.1 and +210 (c)	-1.5 and +150 (c)	-21 and +2100 (c)	-69 and +6900 (c)

(a) Positive values indicate HI side of sensor at the high pressure, and negative values indicate LO side of sensor at the high pressure.

(b) Span Limit Code "A" not available when pressure seals are selected.

(c) When certain options are specified, the upper span and range limits are reduced as shown in the "Options Impact" table below.

### Impact of Certain Options on Span and Range Limits (a)

Option	Description (Also see Model Code)	Span and Range Limits Derated to:
-B3	B7M Bolts and Nuts (NACE)	20 MPa (2900 psi, 200 bar, or kg/cm <sup>2</sup> )
-D1	DIN Construction	16 MPa (2320 psi, 160 bar or kg/cm <sup>2</sup> )
-D5 or -B1	DIN Construction or 316 ss Bolting	15 MPa (2175 psi, 150 bar or kg/cm <sup>2</sup> )
-D2, -D4, -D6, or -D8 (a)	DIN Construction (a)	10 MPa (1500 psi, 100 bar or kg/cm <sup>2</sup> ) (a)

(a) Refer to Model Code section for application and restrictions related to the items listed in the table.

### Maximum Static and Proof Pressure Ratings for IDP10 d/p Cell Transmitters (a)

Transmitter Configuration (See Model Code for Description of Options)	Static Pressure Rating			Proof Pressure Rating (b)		
	MPa	psi	bar or kg/cm <sup>2</sup>	MPa	psi	bar or kg/cm <sup>2</sup>
With Option -D9 or -Y	40	5800	400	100	14500	1000
Standard or with Option -B2, -D3, or -D7	25	3625	250	100	14500	1000
With Option -B3	20	2900	200	70	11150	700
With Option -D1	16	2320	160	64	9280	640
With Option -B1 or -D5	15	2175	150	60	8700	600
With Option -D2, -D4, -D6, or -D8	10	1500	100	40	6000	400
With Structure Codes 78 and 79 (pvd insert)	2.1	300	21	8.4	1200	84

(a) Refer to Model Code section for application and restrictions related to the items listed in the table.

(b) Proof pressure ratings meet ANSI/ISA Standard S82.03-1988. Unit may become nonfunctional after application of proof pressure.

### Output Signal and Configuration

Digital FoxCom and/or 4 to 20 mA. Configurable using I/A Series system (with applicable FBMs), PC-based Configurator, or optional LCD Indicator with on-board pushbuttons.

### Field Wiring Reversal

No transmitter damage.

### Suppressed Zero and Elevated Zero

Suppressed or elevated zero ranges acceptable as long as Span and Range Limits are not exceeded.

### Electronics and Sensor Temperatures

Readable from I/A Series system or PC-based Configurator. Measurement is transmitter temperature, at the sensor and electronics module, not necessarily process temperature.

**Minimum Allowable Absolute Pressure vs. Transmitter Temperature**

WITH SILICONE FILL FLUID

Full vacuum: up to 121 °C (250 °F)

WITH FLUORINERT FILL FLUID

Refer to Figure 18.

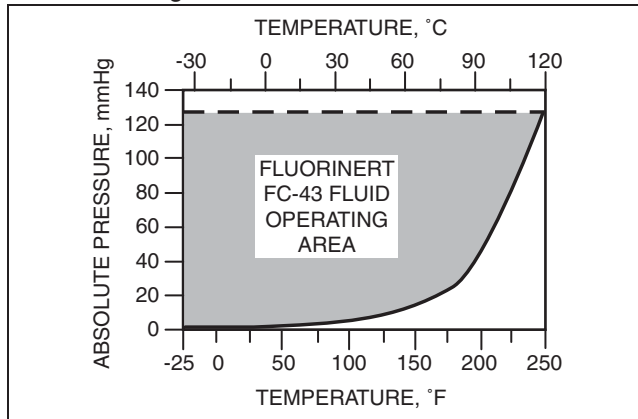


Figure 18. Minimum Allowable Absolute Pressure vs. Transmitter Temperature, Fluorinert FC-43, 2.6 cSt at 25°C (77°F)

**Adjustable Damping**

Response time is normally 0.75 s, or electronically adjustable setting of 0.00 (none), 0.25, 0.50, 1, 2, 4, 8, 16, or 32 seconds, whichever is greater, for 90% recovery from an 80% input step as defined in ANSI/ISA S51.1 (for 63.2% recovery, 0.50 s with sensors B to E, and 0.60 s with sensor A.)

**Zero and Span Adjustments**

Zero and span adjustments can be initiated from the I/A Series Workstation (with applicable FBMs), the PC-based Configurator, or the optional LCD Indicator with on-board pushbuttons.

**Zeroing for Nonzero-Based Ranges**

Dual Function Zeroing allows zeroing with the transmitter open to atmosphere, even when there is a nonzero-based range. This greatly simplifies position effect zeroing on many pressure and level applications. It applies to Optional LCD Indicator and Optional External Zero Adjustment.

**Current Outputs for Overrange, Fail, and Offline Conditions**

OFFLINE:	User Configurable (between 4 and 20 mA)
SENSOR FAILURE:	User Configurable to Fail LO or Fail HI
FAIL LO:	3.60 mA
UNDERRANGE:	3.75 mA
OVERRANGE:	21.00 mA
FAIL HI:	22.00 mA

**Write Protect Jumper**

Can be positioned to lock out all configurators from making transmitter database changes. This makes transmitter suitable for Safety Shutdown System Applications that require this feature.

**Square Root Low Flow Cutoff**

User configurable from I/A Series system, HHT, PC-based Configurator, or optional LCD Indicator with on-board pushbuttons to provide either:

- Cutoff to Zero at flows < 10% of maximum flow (1% of maximum differential pressure).
- Or Active Point-to-Point line between zero and 20% of maximum flow (4% of maximum differential pressure).

**Supply Voltage Requirements and External Loop Load Limitations**

**DIGITAL OUTPUT**

Power supplied through I/A Series system 4 to 20 mA OUTPUT (See Figure 19)

Nominal minimum supply voltage shown in Figure 19 is 11.5 V dc. This value can be reduced to 11 V dc by using a plug-in jumper across the test receptacles in the field wiring compartment terminal block. An optional plug-in shorting bar (Figure 23) is offered for this purpose.

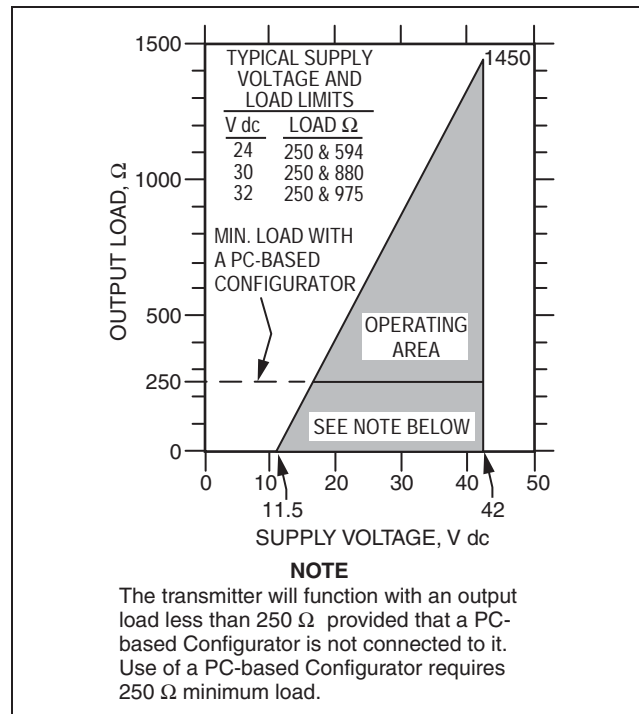


Figure 19. 4 to 20 mA Output, Supply Voltage vs. Output Load



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## FUNCTIONAL SPECIFICATIONS (Cont.)

### Configuration and Calibration Data

All factory characterization data and user configuration and calibration data are stored in the sensor, as shown in the transmitter block diagram, Figure 17. This means that the electronics module can be replaced with one of like type, without the need for reconfiguration or recalibration. Although module replacement can affect accuracy up to 0.20% of span, this error can be removed by an mA trim without application of pressure.

### Electronics Upgradeability

As stated above, all factory characterization data is stored in the sensor and is accessed by each electronics module type. This means that electronics modules can be changed from one type to another, allowing for easy upgrade from an analog output type to a fully intelligent type module. Changing module types may require reconfiguration and recalibration, but all factory characterization data is retained.

### Communications

Configurable for either Analog Mode (4 to 20 mA) or Digital Mode (fixed current). Digital communications is provided in both modes based upon the FSK (Frequency Shift Keying) technique which alternately superimposes one of two different frequencies on the uninterrupted current carried by the two signal/power wires.

#### ANALOG MODE (4 to 20 mA)

The analog 4 to 20 mA output signal is updated 30 times per second, minimum. Digital communications between the transmitter and a PC-based Configurator, or applicable I/A Series system FBM is rated for distances up to 1800 m (6000 ft). The digital communications rate is 600 baud and requires a minimum loop load of 250 ohms. See Figure 20.

#### DIGITAL MODE (FIXED CURRENT)

Digital Mode requires connection to an applicable I/A Series system FBM. The digital output signal is updated 10 times per second (matching the FBM) and carries not only the pressure measurement, but also the sensor and electronics temperatures (internal recalculation rate for temperature is one time per second). Digital communications between the transmitter and the FBM, or between the transmitter and PC-based Configurator is rated for distances up to 600 m (2000 ft). The digital communications rate is 4800 baud and requires a minimum loop load of 250 ohms. See Figure 21.

### Remote Communications

If the transmitter is configured for digital output and is digitally integrated into an I/A Series system, the system has full access to all of the "Display" and "Display and Reconfigure" items listed below.

Also, regardless of whether the transmitter is configured for digital output or analog 4 to 20 mA output, the PC-based Configurator and applicable I/A Series system FBMs have full access to all of the "Display" and "Display and Reconfigure" items listed below.

The PC-based Configurator may be connected anywhere along the communications wiring loop, and does not disturb the communications signals. Plug-in connection points are provided on the transmitter terminal block.

#### "Display" Items

- Process Measurement
- Transmitter Temperature (Electronics and Sensor)
- mA Output (if so configured)
- Transmitter Model and Serial Number

#### "Display and Reconfigure" Items

- Output in mA, %, or Engineering Units (EGU)
- Zero and Span, Including Reranging
- Zero Elevation and Suppression
- Linear or Square Root Output
- 4 to 20 mA or Digital Output
- Pressure and Plant EGU
- Temperature Sensor Failure Strategy
- Electronic Damping
- Failsafe Direction (High or Low)
- Tag Number, Tag Name, and Device Name
- Transmitter Location
- Calibrator's Initials
- Date of Last Calibration

**Communications Functional Block Diagrams - Figure 20 and Figure 21**

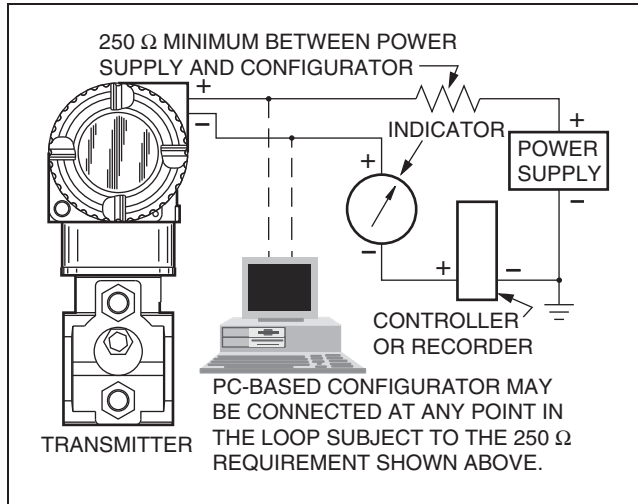


Figure 20.  
4 to 20 mA Output Functional Block Diagram

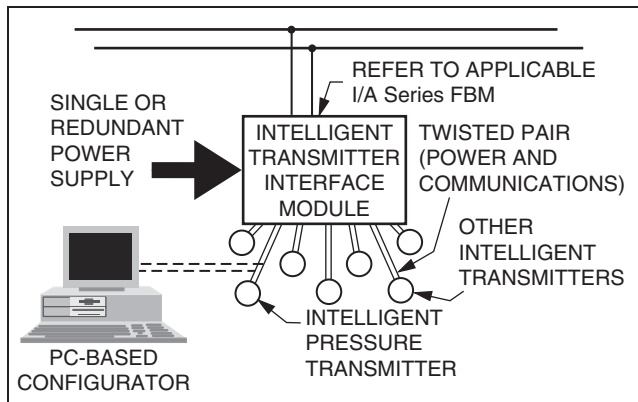


Figure 21.  
Digital Output Functional Block Diagram

**Configuration Capability**

**CALIBRATED RANGE**

- Input range within Span and Range Limits.
- One of pressure units shown in Table 2.

**OUTPUT MEASUREMENT #1 —**

**DIGITAL PRIMARY VARIABLE AND 4 to 20 mA Mode**

Linear or Square Root

*Units for Linear Mode*

As specified for calibrated range, or a custom unit.

*Units for Square Root Mode*

% of flow, or a custom unit.

**OUTPUT MEASUREMENT #2 —**

**DIGITAL SECONDARY VARIABLE**

*Mode*

Linear or Square Root (Independent of Measurement #1)

*Units for Linear Mode*

One of pressure units shown in Table 2, or a custom unit.

*Units for Square Root Mode*

% of flow, or a custom unit.

*Measurements #1 and #2*

These measurements may be swapped.

Table 2. Allowable Pressure Units for Calibrated Range

inH <sub>2</sub> O	inHg	Pa	mbar	psi
ftH <sub>2</sub> O	mmHg	kPa	bar	atm
mmH <sub>2</sub> O	cmHg	MPa	g/cm <sup>2</sup>	
cmH <sub>2</sub> O	dy/cm <sup>2</sup>	torr	kg/cm <sup>2</sup>	

**FUNCTIONAL SPECIFICATIONS (Cont.)**

**Optional Custom Configuration (Option -C2)**

For the transmitter to be custom configured by the factory, the user must fill out a data form. If this option is not selected, a standard default configuration will be provided; for example:

Parameter	Standard (Default) Config.	Example of Custom Configuration Option -C2
<b>Tagging Info.</b>		
Tag Number (12 char. max.)	per S.O.	FT103A
Tag Name (14 char. max.)	Tag Name	Feedwater
Location (14 char. max.)	Location	Building 4
Device Name (6 char. max.)	DevNam	FT103A
<b>Calibrated Range</b>		
Pressure EGU	per S.O. (a)	inH <sub>2</sub> O
LRV	per S.O. (b)	0
URV	per S.O. (b)	100
<b>Measurement #1</b>		
Linear/Sq. Root (Flow) EGU	Linear per S.O. (c)	Sq. Rt gal/m
Range	per S.O. (c)	0 to 500
Output	4 to 20 mA	4 to 20 mA
<b>Measurement #2</b>		
Linear/Sq. Root (Flow) EGU	Linear %	Linear inH <sub>2</sub> O
Range	0 to 100	0 to 100
<b>Other</b>		
Electronic Damping (sec)	None	0.5 s
Failure Strategy	Continue	Failsafe
Failsafe Direction	Upscale	Downscale
Ext. Zero Option	Enabled	Disabled

- (a) Select from Table 2. If not specified, the factory default calibration is zero to maximum span; default units vary by sensor code.
- (b) Within Span and Range Limits for a selected sensor code.
- (c) Same as calibrated range.

Any of the above configurable parameters can easily be changed using the PC-based Configurator or the I/A Series Workstation.

**Optional External Zero Adjustment**

An external pushbutton (Figure 22) mechanism is isolated from the electronics compartment and magnetically activates an internal reed switch through the housing. This eliminates a potential leak path for moisture or contaminants to get into the electronics compartment. This zero adjustment can be disabled by a configuration selection.

**Optional Liquid Crystal Display (LCD) Digital Indicator w/Pushbuttons (Figure 22)**

Indicator Provides:

- Two Lines; five numeric characters on top line (four when a minus sign is needed) and seven alphanumeric characters on bottom line.
- Measurement Readout; Value displayed on top line, and units label displayed on bottom line.
- Configuration and Calibration Prompts.

Pushbuttons (two) Provide the Following Configuration and Calibration Functions:

- Zero and Span settings, non-interactive to automatically set output to either 4 mA or 20 mA using the "NEXT" and "ENTER" pushbuttons.
- 4 and 20 mA Jog Settings, allowing the user to easily increment the mA output signal up or down in fine steps to match a value shown on an external meter.
- Linear or Square Root Output
- Forward or Reverse Output
- Damping Adjustment
- Enable/Disable Optional External Zero
- Failsafe Direction (High or Low)
- Units Label (Bottom Line of Display)
- Settable Lower and Upper Range Values for Transmission and Display (Top Line)
- Reranging
- Secondary Digital Measurement
- mA Output Value during Offline Conditions
- Pushbutton Password Protection; two Levels, to lock out Configuration or to lock out Calibration and Configuration
- Tag

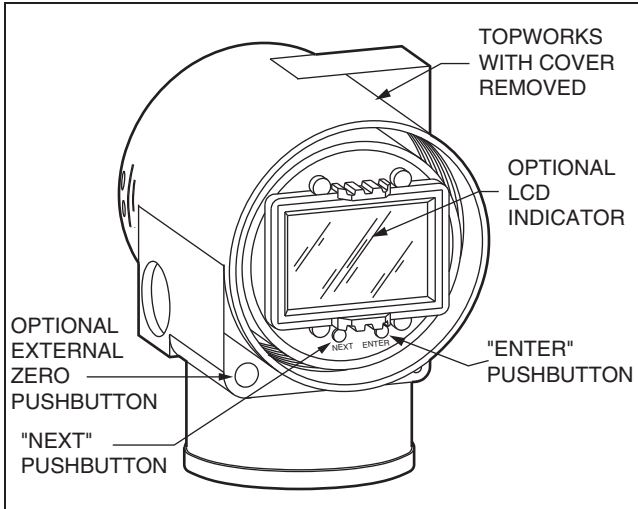


Figure 22. LCD Indicator with Pushbuttons

**OPERATING, STORAGE, AND TRANSPORTATION CONDITIONS**

Influence	Reference Operating Conditions	Normal Operating Conditions (a)	Operative Limits (a)	Storage and Transportation Limits
Process Connection Temp. • with Silicone Fill Fluid  • with Fluorinert Fill Fluid	• 24 ± 2°C (75 ± 3°F) • 24 ± 2°C (75 ± 3°F)	• -29 to + 82°C (-20 to +180°F) • -29 to + 82°C (-20 to +180°F)	• -46 and +121°C (b) (-50 and +250°F) (b) • -29 and +121°C (-20 and +250°F)	• Not Applicable  • Not Applicable
Electronics Temperature  • with LCD Indicator (c)	• 24 ± 2°C (75 ± 3°F) • 24 ± 2°C (75 ± 3°F)	• -29 to + 82 °C(g) (-20 to +180 °F)(g) • -20 to + 82 °C(g) (-4 to +180 °F)(g)	• -40 and +85°C(g) (-40 and +185°F)(g) • -29 and +85°C(g) (-20 and +185°F)(g)	• -54 and +85°C (-65 and +185°F) • -54 and +85°C (-65 and +185°F)
Relative Humidity (d)	50 ±10%	0 to 100%	0 and 100%	0 and 100% Noncondensing
Supply Voltage – mA Output	30 ±0.5 V dc	11.5 to 42 V dc (e)	11.5 and 42 V dc (e)	Not Applicable
Output Load – mA Output	650 Ω	0 to 1450 Ω	0 and 1450 Ω	Not Applicable
Vibration	1 m/s <sup>2</sup> (0.1 “g”)	6.3 mm (0.25 in) Double Amplitude: from 5 to 15 Hz with Aluminum Housing and from 5 to 9 Hz with 316 ss Housing ----- 0 to 30 m/s <sup>2</sup> (0 to 3 “g”) from 15 to 500 Hz with Aluminum Housing; and 0 to 10 m/s <sup>2</sup> (0 to 1 “g”) from 9 to 500 Hz with 316 ss Housing		11 m/s <sup>2</sup> (1.1 “g”) from 2.5 to 5 Hz (in Shipping Package)
Mounting Position	Upright or Horizontal (f)	Upright or Horizontal (f)	No Limit	Not Applicable

- (a) When Structure Codes 78/79 (pvdf inserts in Hi- and Lo-side process covers) are used, maximum overrange is 2.1 MPa (300 psi), and temperature limits are -7 and +82°C (20 and 180°F); when DIN Construction Options D2/D4/D6/D8 are used, temperature limits are 0 and 60°C (32 and 140°F).
- (b) Selection of Option “-J” extends the low temperature operative limit of transmitters with silicone filled sensors down to -50°C (-58°F).
- (c) Although the LCD will not be damaged at any temperature within the “Storage and Transportation Limits”, updates will be slowed and readability decreased at temperatures outside the “Normal Operating Conditions”.
- (d) With topworks cover on and conduit entrances sealed.
- (e) 11.5 V dc can be reduced to 11 V dc by using a plug-in shorting bar; see “Supply Voltage Requirements” section and Figure 23.
- (f) Sensor process wetted diaphragms in a vertical plane.
- (g) Refer to the Electrical Safety Specifications section for a restriction in ambient temperature with certain electrical certifications.

## PERFORMANCE SPECIFICATIONS

Zero-Based Calibrations; Cobalt-Nickel-Chromium or Stainless Steel Sensor w/Silicone Fluid; Under Reference Operating Conditions unless otherwise Specified; URL = Upper Range Limit and Span = Calibrated Span

### Accuracy (Linear Output) - Table 1 (a)

Accuracy, % of Span (b)(c)	
Spans $\geq$ 10% URL	Spans <10% URL
$\pm 0.075\%$	$\pm[0.04 + 0.0035 (\text{URL}/\text{Span})]\%$

(a) Accuracy includes Linearity, Hysteresis, and Repeatability.

(b) Add  $\pm 0.05\%$  for Span Code A, and  $\pm 0.02\%$  for Span Code E.

(c) Subtract  $\pm 0.025\%$  for digital output accuracy.

### Accuracy (Square Root Output) (a)

Operating Point % of Flow Rate Span	Accuracy % of Flow Rate Span
50% and Greater	Accuracy % from Table 1
Less than 50% (to cutoff)	$\frac{(\text{Accuracy \% from Table 1})(50)}{\text{Operating Point in \% of Flow Rate Span}}$

(a) Accuracy includes Linearity, Hysteresis, and Repeatability.

### Stability

Long term drift is less than  $\pm 0.05\%$  of URL per year over a 5-year period.

### Calibration Frequency

The calibration frequency is five years. The five years is derived using the values of allowable error (% span), TPE (% span), performance margin (% span), and stability (% span/month); where:

$$\text{Calibration Frequency} = \frac{\text{Performance Margin}}{\text{Stability}} = \text{Months}$$

### Power-up Time

Less than 5 seconds for output to reach first valid measurement.

### RFI Effect

The output error is less than 0.1% of span for radio frequencies in the range of 27 to 1000 MHz and field intensity of 30 V/m when the transmitter is properly installed with shielded conduit and grounding, and housing covers are in place. (Per IEC Std. 61000-4-3.)

### Supply Voltage Effect

The output changes less than 0.005% of span for each 1 V change within the specified supply voltage requirements. See Figure 19.

### Vibration Effect

Total effect is  $\pm 0.2\%$  of URL per "g" for vibrations in the frequency range of 5 to 500 Hz; with double amplitudes of 6.3 mm (0.25 in) in the range of 5 to 15 Hz, or accelerations of 3 "g" in the range of 15 to 500 Hz, whichever is smaller, for transmitter with aluminum housing; and with double amplitudes of 6.3 mm (0.25 in) in the range of 5 to 9 Hz, or accelerations of 1 "g" in the range of 9 to 500 Hz, whichever is smaller, for transmitter with 316 ss housing.

### Position Effect

Transmitter may be mounted in any position. Any zero effect caused by mounting position can be eliminated by rezeroing. There is no span effect.

### Static Pressure Effect

The zero and span shift for a 7 MPa, 1000 psi, change in static pressure is:

ZERO SHIFT (a)

Span Code	Zero Shift-Static Pressure Effect
A	$\pm 0.30\%$ URL (b)
B and C	$\pm 0.10\%$ URL
D	$\pm 0.50\%$ URL (b)
E	$\pm 0.50\%$ URL

(a) Can be calibrated out by zeroing at nominal line pressure.

(b) Per 3.5 MPa (500 psi) for Span Codes A and D.

SPAN SHIFT

$\pm 0.15\%$  of Reading

### Switching and Indirect Lightning Transients

The transmitter can withstand a transient surge up to 2000 V common mode or 1000 V normal mode without permanent damage. The output shift is less than 1.0%. (Per ANSI/IEEE C62.41-1980 and IEC Std. 61000-4-5.)

### Ambient Temperature Effect

Total effect for a 28°C (50°F) change within Normal Operating Condition limits is:

Span Code	Ambient Temperature Effect
A	$\pm (0.18\% \text{ URL} + 0.025\% \text{ Span})$
B and C	$\pm (0.03\% \text{ URL} + 0.060\% \text{ Span})$
D	$\pm (0.05\% \text{ URL} + 0.045\% \text{ Span})$
E	$\pm (0.08\% \text{ URL} + 0.025\% \text{ Span})$

### NOTE

For additional ambient temperature effect when pressure seals are used, see PSS 2A-1Z11 A.

**PHYSICAL SPECIFICATIONS**

**Process Cover and Connector Material (Process Wetted)**

Carbon Steel, 316 ss, Monel, Hastelloy C, or pvdf (Kynar) inserts in 316 ss covers for transmitter traditional structure; and 316 ss for transmitter low profile structures. For exceptional value and corrosion resistance, 316 ss is the least expensive material.

**Process Cover and Process Connection Gaskets**

Glass filled ptfе, or Viton when Structure Codes 78/79 (pvdf inserts) are used.

**Process Cover Bolts and Nuts**

ASTM A193, Grade B7 high strength alloy steel for bolts, and ASTM A194 Grade 2H high strength alloy steel for nuts are standard. Options include NACE Class B7M bolting, 17-4 ss bolting, and 316 ss bolting.

**Sensor Material (Process Wetted)**

Co-Ni-Cr, 316 L ss, Gold-Plated 316L ss, Monel, Hastelloy C, or Tantalum for transmitter traditional structure; and 316L ss or Hastelloy C for transmitter low profile structures. For exceptional value and corrosion resistance, 316L ss is the least expensive material. Refer to TI 037-078 and TI 37-75b for information regarding the corrosion resistance of Co-Ni-Cr and other sensor materials.

**Sensor Fill Fluids**

Silicone Oil or Fluorinert (FC-43)

**Environmental Protection**

Transmitter is dusttight and weatherproof per IEC IP66 and provides the environmental and corrosion resistant protection of NEMA Type 4X.

**Electronics Housing and Housing Covers**

Housing has two compartments to separate the electronics from the field connections. The housing and covers are made from low copper, die-cast aluminum alloy with an epoxy finish, or from 316 ss. Buna-N O-ring seals are used to seal the threaded housing covers, housing neck, and terminal block.

**Electrical Connections**

Field and RTD sensor wires enter through 1/2 NPT, PG 13.5, or M20 threaded entrances, as specified, on either side of the electronics housing. Wires terminate under screw terminals and washers on terminal block in the field terminal compartment. Unused entrance is plugged to insure moisture and RFI/EMI protection. See Figure 23.

**Electronics Module**

Printed wiring assemblies are conformally coated for moisture and dust protection.

**Mounting Position**

The transmitter may be mounted in any orientation.

**Approximate Mass (with Process Connectors)**

- 4.2 kg (9.2 lb) – with Traditional Structure
- Add 0.1 kg (0.2 lb) – with Low Profile Structure LP1
- Add 0.8 kg (1.8 lb) – with Low Profile Structure LP2
- Add 1.1 kg (2.4 lb) – with 316 ss Housing
- Add 0.2 kg (0.4 lb) – with LCD Indicator Option

**Dimensions**

See “Dimensions - Nominal” section and Dimensional Print DP 020-446.

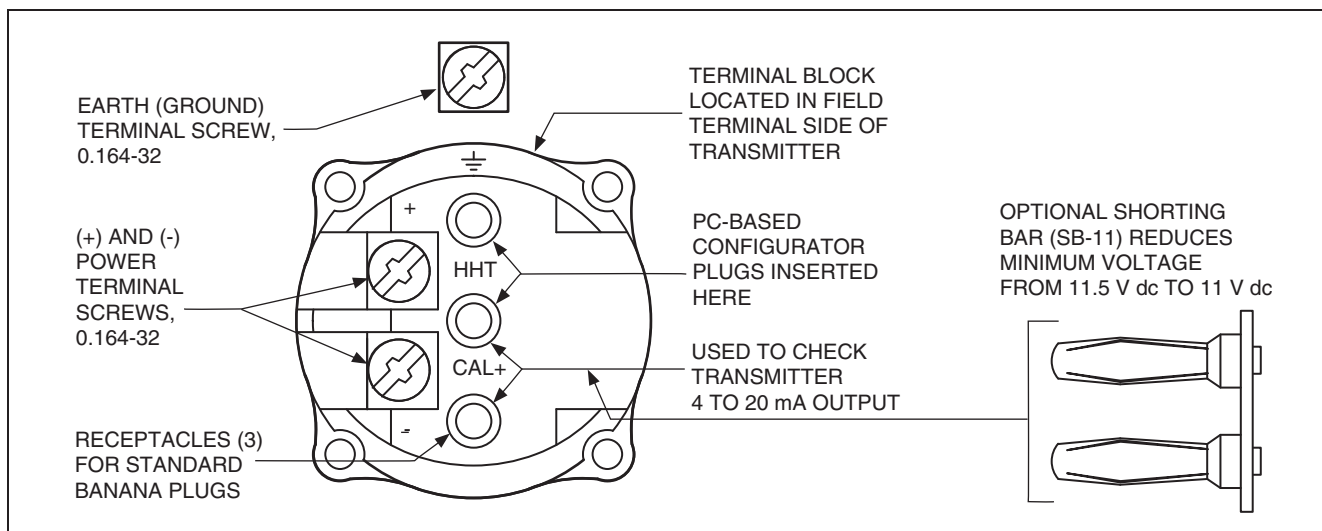


Figure 23. Field Terminal Connections

## ELECTRICAL SAFETY SPECIFICATIONS

Testing Laboratory, Types of Protection, and Area Classification	Application Conditions	Elec. Safety Design Code
<b>ATEX</b> intrinsically safe; II 1 GD, EEx ia IIC, Zone 0; or II 1/2 GD EEx ib IIC, Zone 0/Zone 1.	Temperature Class T4 at 80°C, T5 at 40°C, and T6 at 40°C maximum ambient.	E
<b>ATEX</b> flameproof; II 2 GD, EEx d IIC, Zone 1.	Temperature Class T6, 85°C; Ta = -40°C to +80°C.	D
<b>ATEX</b> protection n; II 3 GD, EEx nL IIC, Zone 2.	Temperature Class T4 at 80°C, T5 at 70°C, and T6 at 40°C maximum ambient.	N
<b>ATEX</b> multiple certifications, ia & ib, d, and n. Refer to Codes D, E, and N for details.	Applies to Codes D, E, and N. (a)	M
<b>CSA</b> intrinsically safe for Class I, Div. 1, Groups A, B, C, and D; Class II, Div. 1, Groups E, F, and G; and Class III, Div. 1.	Connect per MI 020-427. Temperature Class T6 at 40°C, and T4A at 85°C maximum ambient.	C
<b>CSA</b> explosionproof for Class I, Div. 1, Groups B, C, and D; and dust-ignitionproof for Class II, Div. 1, Groups E, F, and G; and Class III, Div. 1.	Maximum Ambient Temperature 85°C.	C
<b>CSA</b> for Class I, Div. 2, Groups A, B, C, and D; Class II, Div. 2, Groups F and G; Class III, Div. 2.	Temperature Class T6 at 40°C and T4A at 85°C maximum ambient.	C
<b>CSA</b> field device zone certified flameproof Ex d IIC. Also, all certifications of Code C above.	Maximum Ambient Temperature 85°C.	B
<b>FM</b> intrinsically safe for Class I, Div. 1, Groups A, B, C, and D; Class II, Div. 1, Groups E, F, and G; and Class III, Div. 1.	Connect per MI 020-427. Temperature Class T4A at 40°C and T4 at 85°C maximum ambient.	F
<b>FM</b> explosionproof for Class I, Div. 1, Groups B, C, and D; and dust-ignitionproof for Class II, Div. 1, Groups E, F, and G; and Class III, Div. 1.	Temperature Class T6 at 80°C and T5 at 85°C maximum ambient.	F
<b>FM</b> nonincendive Class I, Div. 2, Groups A, B, C, and D; Class II, Div. 2, Groups F and G; and Class III, Div. 2.	Temperature Class T4A at 40°C and T4 at 85°C maximum ambient.	F
<b>FM</b> field device zone certified flameproof AEx d IIC. Also, all certifications of Code F above.	Temperature Class T6 at 80°C and T5 at 85°C maximum ambient.	G
<b>IECEx</b> flameproof, Ex d IIC.	Temperature Class T6, Ta = 80°C; T5, Ta = 85°C; Ambient Temperature -20 to +85°C.	V

(a) When selecting ATEX Code M, the user must permanently mark (check off on rectangular box on data plate) one type of protection only (ia and ib, d, or n). This mark cannot be changed once it is applied.

**NOTE**

Transmitter has been designed to meet the Electrical Safety Specifications listed above. Contact Invensys Foxboro for information or status of testing laboratory approvals or certifications.

**MODEL CODE**

<b>Description</b>			<b>Model</b>
I/A Series, Electronic d/p Cell Transmitter for Differential Pressure Measurement			IDP10
<b>Electronics Versions and Output Signal</b>			
Intelligent; Digital, FoxCom or 4 to 20 mA dc, configurable (Version -D)			-D
<b>Structure Code - Select from one of the following six groups:</b>			
<b>1. Transmitter with Traditional Structure</b>			
<b>Covers</b>	<b>Sensor</b>	<b>Fill Fluid</b>	
Steel	Co-Ni-Cr	Silicone	10
Steel	Co-Ni-Cr	Fluorinert	11
Steel	316L ss	Silicone	12
Steel	316L ss	Fluorinert	13
Steel	Hastelloy C	Silicone	16
Steel	Hastelloy C	Fluorinert	17
316 ss	Co-Ni-Cr	Silicone	20
316 ss	Co-Ni-Cr	Fluorinert	21
316 ss	316L ss	Silicone	22
316 ss	316L ss	Fluorinert	23
316 ss	316L ss, Gold Plated	Silicone	2G
316ss	Monel	Silicone	24
316 ss	Monel	Fluorinert	25
316 ss	Hastelloy C	Silicone	26
316 ss	Hastelloy C	Fluorinert	27
Monel	Monel	Silicone	34
Monel	Monel	Fluorinert	35
Hastelloy C	Hastelloy C	Silicone	46
Hastelloy C	Hastelloy C	Fluorinert	47
Hastelloy C	Tantalum	Silicone	48
Hastelloy C	Tantalum	Fluorinert	49
pvdF Insert (Kynar)	Tantalum	Silicone (Used w/Process Connector Type 7)	78 (a)
pvdF Insert (Kynar)	Tantalum	Fluorinert (Used w/Process Connector Type 7)	79 (a)
<b>2. Transmitter with Low Profile Structure LP1 (Not available with Pressure Seals)</b>			
<b>Covers</b>	<b>Sensor</b>	<b>Fill Fluid</b>	
316 ss	316L ss	Silicone	LL
316 ss	316L ss	Fluorinert	LM
316 ss	Hastelloy C	Silicone	LC
316 ss	Hastelloy C	Fluorinert	LD
<b>3. Transmitter with Low Profile Structure LP2 (Not available with Pressure Seals)</b>			
<b>Covers</b>	<b>Sensor</b>	<b>Fill Fluid</b>	
316 ss	316L ss	Silicone	52
316 ss	316L ss	Fluorinert	53
316 ss	Hastelloy C	Silicone	56
316 ss	Hastelloy C	Fluorinert	57
<b>4. Transmitter prepared for Foxboro Model Coded Remote Mount Seals (b)(c)</b>			
Transmitter prepared for Remote Seals on Both HI and LO Sides, Silicone Fill in Sensor			S1
Transmitter prepared for Remote Seals on Both HI and LO Sides, Fluorinert Fill in Sensor			S2
Transmitter prepared for Remote Seal HI Side, 1/2 NPT Connector LO Side, Silicone Fill in Sensor			S3
Transmitter prepared for Remote Seal HI Side, 1/2 NPT Connector LO Side, Fluorinert Fill in Sensor			S4
Transmitter prepared for Remote Seal LO Side, 1/2 NPT Connector HI Side, Silicone Fill in Sensor			S5
Transmitter prepared for Remote Seal LO Side, 1/2 NPT Connector HI Side, Fluorinert Fill in Sensor			S6

Model Code continued on next page



## IDP10 DIFFERENTIAL PRESSURE TRANSMITTERS (Cont.)

## MODEL CODE (Cont.)

<b>5. Transmitter Prepared for Foxboro Model Coded Direct Connect Seals (b)</b>			
PSFLT, PSSCT, or PSSST Direct Connect Seal on HI Side; 1/2 NPT Process Connector LO Side; Silicone Fill			F1
PSFLT, PSSCT, or PSSST Direct Connect Seal on HI Side; 1/2 NPT Process Connector LO Side; Fluorinert Fill			F2
PSFLT, PSSCT, or PSSST Direct Connect Seal on HI Side; Remote Seal with Capillary LO Side; Silicone Fill			F3
PSFLT, PSSCT, or PSSST Direct Connect Seal on HI Side; Remote Seal with Capillary LO Side; Fluorinert Fill			F4
<b>6. Transmitter Prepared for non-Foxboro Seals</b>			
Remote Seals on High and Low Sides; Silicone Fill in Sensor			SA
Remote Seals on High and Low Sides; Inert Fill in Sensor			SB
Remote Seal on High Side and 1/2 NPT Connector on Low Side, Silicone Fill in Sensor			SC
Remote Seal on High Side and 1/2 NPT Connector on Low Side, Inert Fill in Sensor			SD
Remote Seal on Low Side and 1/2 NPT Connector on High Side, Silicone Fill in Sensor			SE
Remote Seal on Low Side and 1/2 NPT Connector on High Side, Inert Fill in Sensor			SF
<b>Span Limits (Differential Pressure Units)</b>			
<b>kPa</b>	<b>inH<sub>2</sub>O</b>	<b>mbar</b>	
0.12 and 7.5	0.5 and 30	1.2 and 75	A (e)
0.87 and 50	3.5 and 200	8.7 and 500	B
7 and 210	28 and 840	70 and 2100	C
<b>MPa</b>	<b>psi</b>	<b>bar or kg/cm<sup>2</sup></b>	
0.07 and 2.1	10 and 300	0.7 and 21	D
0.7 and 21	100 and 3000	7 and 210	E (f)
<b>Process Connector Type (Material Same as Process Cover Material) (g)</b>			
See below:			0
<ul style="list-style-type: none"> <li>For d/p: No connectors; both covers tapped for 1/4 NPT (316 ss only, no side vents)</li> <li>Flange Mount Hi Side: 1/2 NPT, 316 ss Process Connector on Lo Side (F1 and F2 only)</li> <li>Flange Mount Hi Side: No connectors; both sides prepared for seals (F3 and F4 only)</li> <li>Two Remote Seals: No connectors; both covers tapped for capillary connection (S1, S2, SA, SB only)</li> <li>One Remote Seal: 1/2 NPT, 316 ss Process Connector on Side Opposite Seal (S3 to S6, SC to SF only)</li> </ul>			
1/4 NPT, Not with Structure Codes 46 to 49, 78, 79, or pressure seals			1
1/2 NPT, Not with Structure Codes 78 or 79, or pressure seals			2
Rc 1/4, Not with Structure Codes 46 to 49, 78, 79, or pressure seals			3
Rc 1/2, Not with Structure Codes 78 or 79, or pressure seals			4
1/2 Schedule 80 Welding Neck, Not with Structure Codes 46 to 49, 78, 79, or pressure seals			6
None; pvdf Insert tapped for 1/2 NPT/Process Inlet on Side of 316 ss Process Covers (only with 78/79 above)			7
<b>Conduit Connection and Housing Material</b>			
1/2 NPT Conduit Connection, Aluminum Housing			1
PG 13.5 Conduit Connection, Aluminum Housing (With Electrical Safety Codes E, D, M, and N only)			2
1/2 NPT Conduit Connection, 316 ss Housing			3
PG 13.5 Conduit Connection, 316 ss Housing (With Electrical Safety Codes E, D, M, and N only)			4
M20 Conduit Connection, Both Sides, Aluminum Housing (With Electrical Safety Codes E, D, M, and N only)			5
M20 Conduit Connection, Both Sides, 316 ss Housing (With Electrical Safety Codes E, D, M, and N only)			6
<b>Electrical Safety - See Electrical Safety Specifications section for descriptions</b>			
ATEX II 1 GD, EEx ia IIC, Zone 0; or II 1/2 GD, EEx ib IIC, Zone 0/1			E
ATEX II 2 GD, EEx d IIC, Zone 1 (d)			D
ATEX II 3 GD, EEx nL IIC, Zone 2			N
ATEX Multiple Certifications (includes ATEX Codes E, D, and N) (d) (See Electrical Safety Specifications section for <u>user marking</u> )			M
CSA Certified Division 1 intrinsically safe, explosionproof, dust-ignitionproof, and Division 2, Classes I, II, and III			C
CSA Zone Certified Ex d IIC; also all certifications of Code C above (d)			B
FM approved Division 1 intrinsically safe, explosionproof, dust-ignitionproof, and nonincendive			F
FM Zone approved AEx d IIC; also all approvals of Code F above (d)			G
IECEx flameproof, Ex d IIC			V

Model Code continued on next page

IDP10 DIFFERENTIAL PRESSURE TRANSMITTERS (Cont.)

MODEL CODE (Cont.)

<b>Optional Selections</b>	
Refer to Optional Selections below.	
<b>Mounting Bracket Set (h)</b>	
Standard Style Painted Steel Bracket with Plated Steel Bolts	-M1
Standard Style Stainless Steel Bracket with Stainless Steel Bolts	-M2
Universal Style Stainless Steel Bracket w/Stainless Steel Bolts (not w/Structure Codes LL, LM, LC, or LD)	-M3
<b>Digital Indicator with Pushbuttons</b>	
Digital Indicator, Pushbuttons, and Window Cover	-L1
<b>DIN 19213 Construction used with Process Connector Code 0 and 316 ss Covers with no side vents (not available when remote or direct connect seals are specified)</b>	
Single Ended Process Cover with M10, B7 Steel Bolting (j)(v)	-D1
Double Ended Process Cover with M10, B7 Steel Bolting (Blind Kidney Flange on Back) (j)(k)(l)	-D2
Single Ended Process Cover with 7/16 in, B7 Steel Bolting; standard pressure rating 25 MPa (3625 psi) (v)	-D3
Double Ended Process Cover with 7/16 in, B7 Steel Bolting (Blind Kidney Flange on Back) (j)(k)(l)	-D4
Single Ended Process Cover with 7/16 in, 316 ss Bolting (j)(v)	-D5
Double Ended Process Cover with 7/16 in, 316 ss Bolting (Blind Kidney Flange on Back) (j)(k)(l)	-D6
Single Ended Process Cover with 7/16 in, 17-4 ss Bolting; standard pressure rating 25 MPa (3625 psi) (v)	-D7
Double Ended Process Cover with 7/16 in, 17-4 ss Bolting (Blind Kidney Flange on Back) (j)(k)(l)	-D8
Single Ended Process Cover with 7/16 in, 17-4 ss Bolting; pressure rating 40 MPa (5800 psi) (v) Not available with Span Codes A, D, or E; or Option Codes -V, -B1, -B2, -B3, or -Y	-D9
<b>Cleaning and Preparation - Not Available with Gold-Plated Sensor, Structure 2G, or Pressure Seals</b>	
Unit Degreased - for Silicone Filled Sensors Only (Not for Oxygen/Chlorine/Other Fluids that may react with Silicone)	-X1
Cleaned and Prepared for Oxygen Service - for Fluorinert Filled Sensors Only (Not Available with Carbon Steel Covers or with Silicone Filled Sensors)	-X2
Cleaned and Prepared for Chlorine Service - for Fluorinert Filled Sensors Only (m) (Not Available with Carbon Steel Covers or with Silicone Filled Sensors)	-X3
<b>Bolting for Process Covers/Connectors - Not with DIN 19213 Construction or Structure Codes 78 and 79 (n)</b>	
316 ss Bolts and Nuts (Pressure Derated; Not Available with -Y Option) (j)	-B1
17-4 ss Bolts and Nuts (m)	-B2
B7-M Bolts and Nuts (NACE)(Pressure Derated) (j)	-B3
<b>Conduit Thread Adapters (Not available with Conduit Connection Codes 5 and 6)</b>	
Hawke-Type 1/2 NPT Cable Gland for use with Conduit Connection Codes 1 and 3 (p)	-A1
Plastic PG 13.5 Cable Gland for use with Conduit Connection Codes 2 and 4 (q)	-A2
M20 Conduit Thread Adapter for use with Conduit Connection Codes 1 and 3 (p)	-A3
Brass PG 13.5 Cable Gland (Trumpet-Shaped) for use w/Conduit Connection Codes 2 and 4 (q)	-A4
<b>Electronics Housing Features</b>	
External Zero Adjustment	-Z1
Custody Transfer Lock and Seal	-Z2
External Zero Adjustment and Custody Transfer Lock/Seal	-Z3
<b>Custom Factory Configuration</b>	
Digital Output (4 to 20 mA default if not selected)	-C1
Full Factory Configuration (Requires Configuration Form to be Filled Out)	-C2
<b>Tubing Connectors - Not available with Structure Codes 78 and 79; also not available with Seals</b>	
Steel, Connecting 6 mm Tubing to 1/4 NPT Process Connector Only with Structure Codes 10 to 13; and Process Connector Codes 0 and 1	-E1
Steel, Connecting 12 mm Tubing to 1/2 NPT Process Connector Only with Structure Codes 10 to 13; and Process Connector Code 2	-E2
316 ss, Connecting 6 mm Tubing to 1/4 NPT Process Connector Only with Structure Codes 10 to 13 and 20 to 23; and Process Connector Codes 0 and 1	-E3
316 ss, Connecting 12 mm Tubing to 1/2 NPT Process Connector Only with Structure Codes 10 to 13 and 20 to 23; and Process Connector Code 2	-E4

Model Code continued on next page

**MODEL CODE (Cont.)**

<b>Vent Screw in Process Cover</b>	
Supply Vent Screw in Side of Each Process Cover (Available only on Traditional Process Cover Structure Codes 22 to 47)	-V
Omit Vent Screw in Side of Each Process Cover (Available only on Type LP1 Low Profile Process Cover Structures Codes LL, LM, LC, and LD)	-V1
<b>Adapter Plate, Bolts, and Gaskets for Direct Mount to Competitive Manifolds (t)</b>	
See inside pages for manifold compatibility.	
Adapter Set for MC Coplanar Manifolds, B7 Bolts (not with options -B1, -B2, or -B3)	-P1
Adapter Set for MC Coplanar Manifolds, 316 ss Bolts (requires -B1 option)	-P2
Adapter Set for MC Coplanar Manifolds, 17-4 ss Bolts (requires -B2 option)	-P3
Adapter Set for MC Coplanar Manifolds, B7M Bolts (requires -B3 option)	-P4
Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7 Bolts (not with options -B1, -B2, or -B3)	-P5
Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 316 ss Bolts (requires -B1 option)	-P6
Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, 17-4 ss Bolts (requires -B2 option)	-P7
Adapter Set for MT3 Coplanar Manifolds, Traditional Flange, B7M Bolts (requires -B3 option)	-P8
<b>Gaskets</b>	
Metal O-ring for pressure seals in Vacuum Service (s)	-G1
<b>Instruction Books (Common MI, Brochure, and Full Documentation Set on CD-ROM is Standard)</b>	
Without Instruction Book and CD; only "Getting Started" brochure is supplied.	-K1
<b>Miscellaneous Optional Selections</b>	
Low Temperature Operative Limit of Electronics Housing Extended Down to -50°C (-58°F) Not available with sensors and seals with fluorinert fill; Structure Codes 78 and 79; and DIN Options -D2, -D4, -D6, and -D8	-J
Supplemental Customer Tag (Stainless Steel Tag wired onto Transmitter)	-T
Static Pressure Rating to 40 MPa (5800 psi); Only with Span Codes B and C Not available with: – Options -B1, -B2, and -B3 (r) – Options -D1 to -D9 – Structure Codes 34, 35, 78, 79, S1 to S6, SA to SF, F1 to F4	-Y

- (a) Maximum static pressure rating is 2.1 MPa (300 psi); temperature limits are -7 and +82°C (20 and 180°F).
- (b) Both Transmitter and Pressure Seal Model Numbers are required. See PSS 2A-1Z11 A for the various pressure seal Model Codes.
- (c) Remote Seal Models that may be specified are PSFPS, PSFES, PSFAR, PSTAR, PSISR, PSSCR, and PSSSR.
- (d) Cover lock provided as standard with Electrical Safety Codes D, B, G, M, and V.
- (e) Span Limit Code A is not available with pressure seals, except for Sanitary Spud Seals Models PSSSR-4 and PSSST-4.
- (f) Span Limit Code E is not available with Structure Codes 78 and 79 above (pdf insert in HI side cover).
- (g) Select Code "0" if a pressure seal is specified. Otherwise select Code 1 through 7.
- (h) Mounting sets not offered with direct connect (flange mount) seals.
- (i) See Functional Specifications section for pressure deratings when certain DIN 19213 versions and Bolting Options -B1 and -B3 are specified.
- (k) Temperature limits derated to 0 and 60°C (32 and 140°F). Also not available with Structure Codes 52 to 57, and LL, LM, LC, or LD.
- (l) Mounting Bracket Set options are not available.
- (m) When -X3 is specified, the standard bolting is replaced with 17-4 ss bolts and nuts. Therefore, there is no need to specify Option -B2 when selecting the Chlorine Service Option -X3.
- (n) Not available with DIN construction options. For stainless steel bolts with DIN construction, specify -D5 to -D9, as required.
- (p) Available with Electric Safety Codes E, D, M, and N only.
- (q) Available with Electric Safety Code E only.
- (r) -B2 Bolt Option (17-4 ss) is not available with the -Y option because 17-4 ss bolts and nuts are supplied as part of the -Y option.
- (s) -G1 is a required option when pressure seal will be used in vacuum applications. This option substitutes vacuum service metal gasket for standard ptfе process cover gasket.
- (t) Adapter plate options -P1 to -P8 are not available with:  
– Pressure Seal Structure Codes.  
– Process Connector Codes 1-7.  
– DIN Construction Options -D1, -D2, -D4, -D5, -D6, -D7, -D8, -D9.
- (v) Not available with Low Profile Structure Codes 52 to 67.

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**SUGGESTED RFQ SPECIFICATIONS**

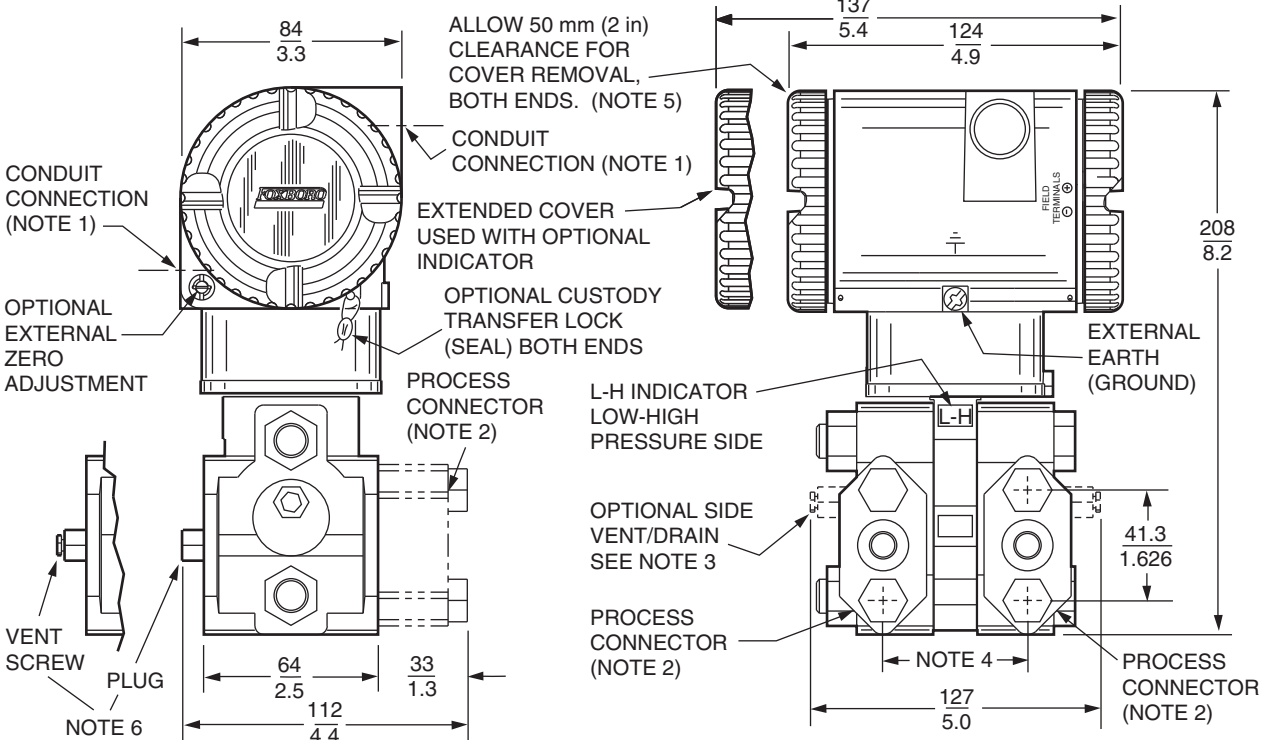
The manufacturer shall provide field-mounted differential pressure transmitter(s) featuring remote digital communications capability for measuring differential pressure and transmitting a 4 to 20 mA dc and/or digital output signal (software selectable) for use in a standard two-wire dc supply voltage system. They are offered with traditional or low profile structures. Transmitters with a traditional structure can also be provided (as required) with direct connect seals, or remote mount, capillary connected seals. The specifications for these transmitters are as follows:

<b>Communication Protocol:</b>	FoxCom, digital or 4 to 20 mA dc output signal, configurable
<b>Remote Communications:</b>	Must not interfere with output
<b>Accuracy:</b>	Digital Output, Linear: $\pm 0.050\%$ of calibrated span 4 to 20 mA Output, Linear: $\pm 0.075\%$ of calibrated span
<b>Damping:</b>	Settable for a range of none to 32 seconds
<b>RFI Protection:</b>	0.1% error between 27 and 1000 MHz at 30 V/m field intensity
<b>Span Limits:</b>	0.5 and 30 inH <sub>2</sub> O, 3.5 and 200 inH <sub>2</sub> O, 1 and 30 psi, 10 and 300 psi, 100 and 3000 psi, as specified; or SI and metric equivalents.
<b>Proof Pressure:</b>	14 500 psi for standard transmitters
<b>Mounting:</b>	On process piping, manifold, or optional mounting bracket
<b>Input Connection:</b>	With process connectors to accept 1/4 NPT, 1/2 NPT, Rc 1/4, Rc 1/2, or 1/2 Schedule 80 welding neck; or 1/2 NPT pvdf inserts installed in 316 ss process covers; or prepared for a direct connect seal; or prepared for a single remote capillary connected seal, or two remote capillary connected seals.
<b>Electronics Housing:</b>	316 ss, or aluminum housing with epoxy finish
<b>Modular Electronics:</b>	Enclosed in a NEMA 4X (IEC IP66) housing sealed with O-rings for protection against moisture or other contaminants. Optional Integral LCD indicator with on-board configuration pushbuttons.
<b>Process Cover:</b>	Traditional Structures Steel, 316 ss, Monel, Hastelloy C, or pvdf insert Low Profile Structures: 316 ss
<b>Sensor Materials:</b>	Traditional Structure: 316L ss, Hastelloy C, Co-Ni-Cr, Monel, Tantalum, or Gold-Plated 316L ss Low Profile Structures: 316L ss or Hastelloy C
<b>Approvals and Certifications:</b>	Must be suitable for Division 1 hazardous locations, and conform to all applicable European Union Directives. Also versions available to meet Agency flameproof and zone requirements.
<b>Approximate Mass: (with Process Connectors)</b>	4.2 kg (9.2 lb), with Traditional Structures; Add 0.1 kg (0.2 lb) with Low Profile Structure LP1; Add 0.8 kg (1.8 lb) with Low Profile Structure LP2; Add 1.1 kg (2.4 lb) with 316 ss housing; Add 0.2 kg (0.4 lb) with optional LCD indicator.
<b>Model Code:</b>	I/A Series Intelligent IDP10 d/p Cell Transmitter with FoxCom Communication Protocol, with or without pressure seals, or equivalent.

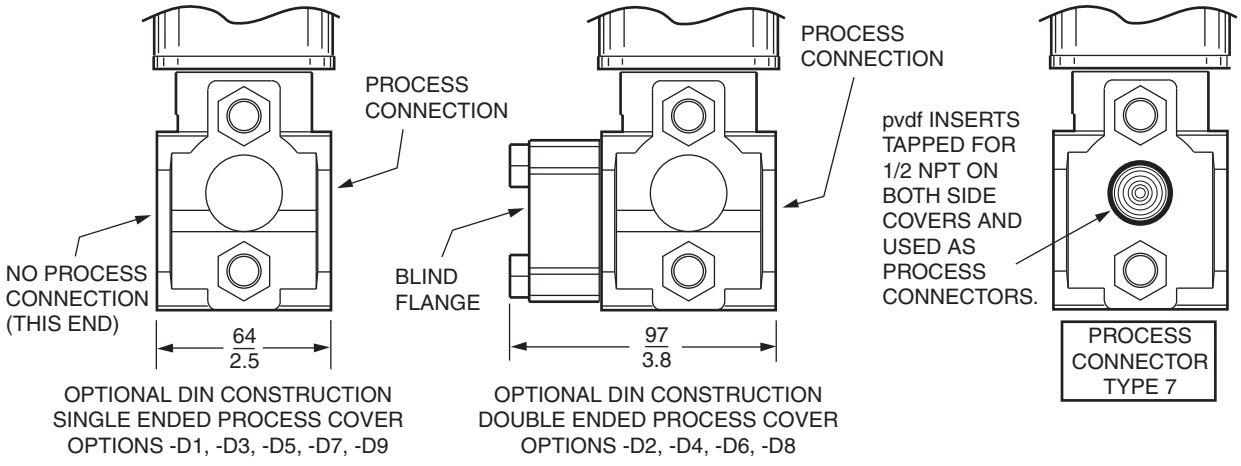
**DIMENSIONS - NOMINAL**

**mm  
in**

**TRANSMITTER WITH TRADITIONAL STRUCTURE**



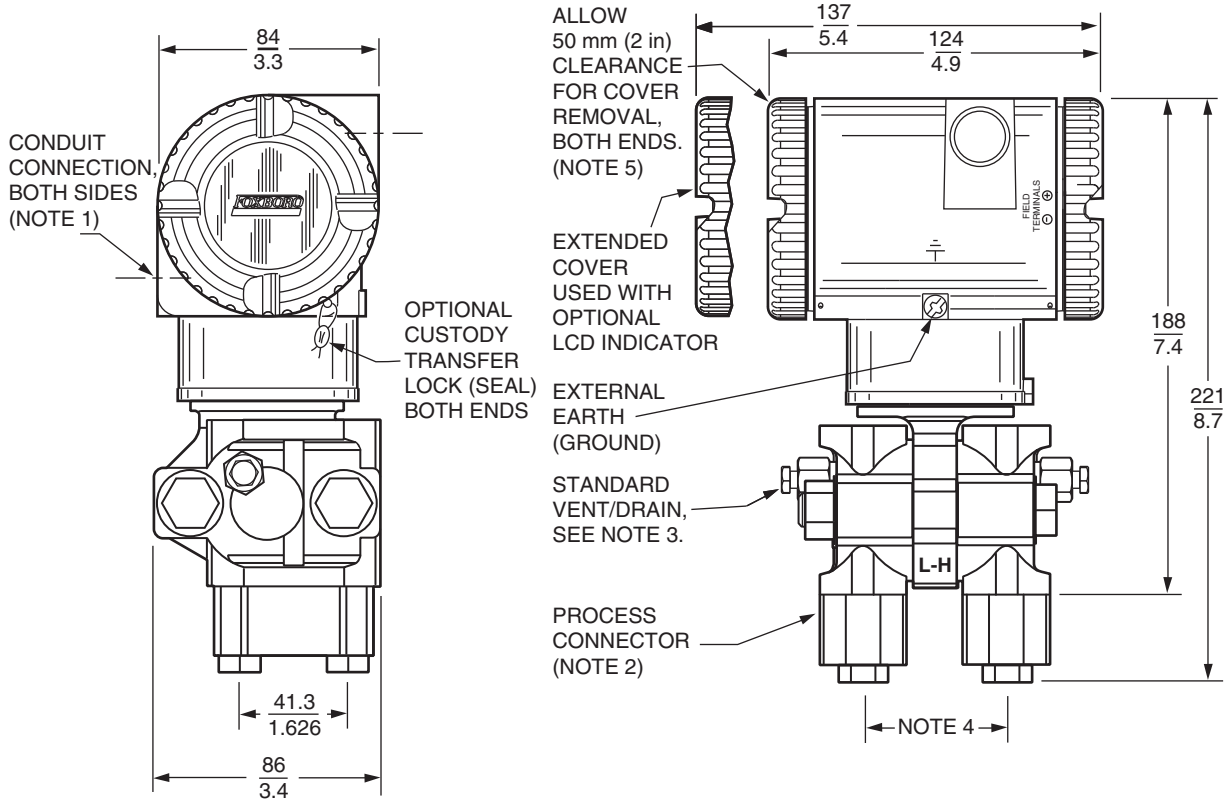
- NOTES:**
1. CONDUIT CONNECTION 1/2 NPT OR PG 13.5, BOTH SIDES: PLUG UNUSED CONNECTION WITH METAL PLUG (SUPPLIED).
  2. PROCESS CONNECTORS MAY BE REMOVED AND TRANSMITTER MOUNTED DIRECTLY ON A MANIFOLD, OR CONNECTIONS MADE DIRECTLY TO PROCESS COVER USING 1/4 NPT INTERNAL THREAD IN PROCESS COVER.
  3. PROCESS COVER CAN BE INVERTED MAKING OPTIONAL SIDE VENTS OR SIDE DRAINS
  4. PROCESS CONNECTORS CAN BE INVERTED TO GIVE EITHER 51, 54, OR 57 mm (2.0, 2.125, OR 2.25 in) CENTER-TO-CENTER DISTANCE BETWEEN HIGH AND LOW PRESSURE CONNECTIONS.
  5. TOPWORKS CAN BE ROTATED TO ANY POSITION WITHIN ONE TURN COUNTERCLOCKWISE OF THE FULLY TIGHTENED POSITION.
  6. PROCESS COVER END PLUGS ARE SUBSTITUTED FOR VENT SCREWS WHEN OPTIONAL SIDE VENTS (NOTE 3) ARE SPECIFIED.



**DIMENSIONS-NOMINAL (Cont.)**

**mm  
in**

**TRANSMITTER WITH LOW PROFILE STRUCTURE LP1**



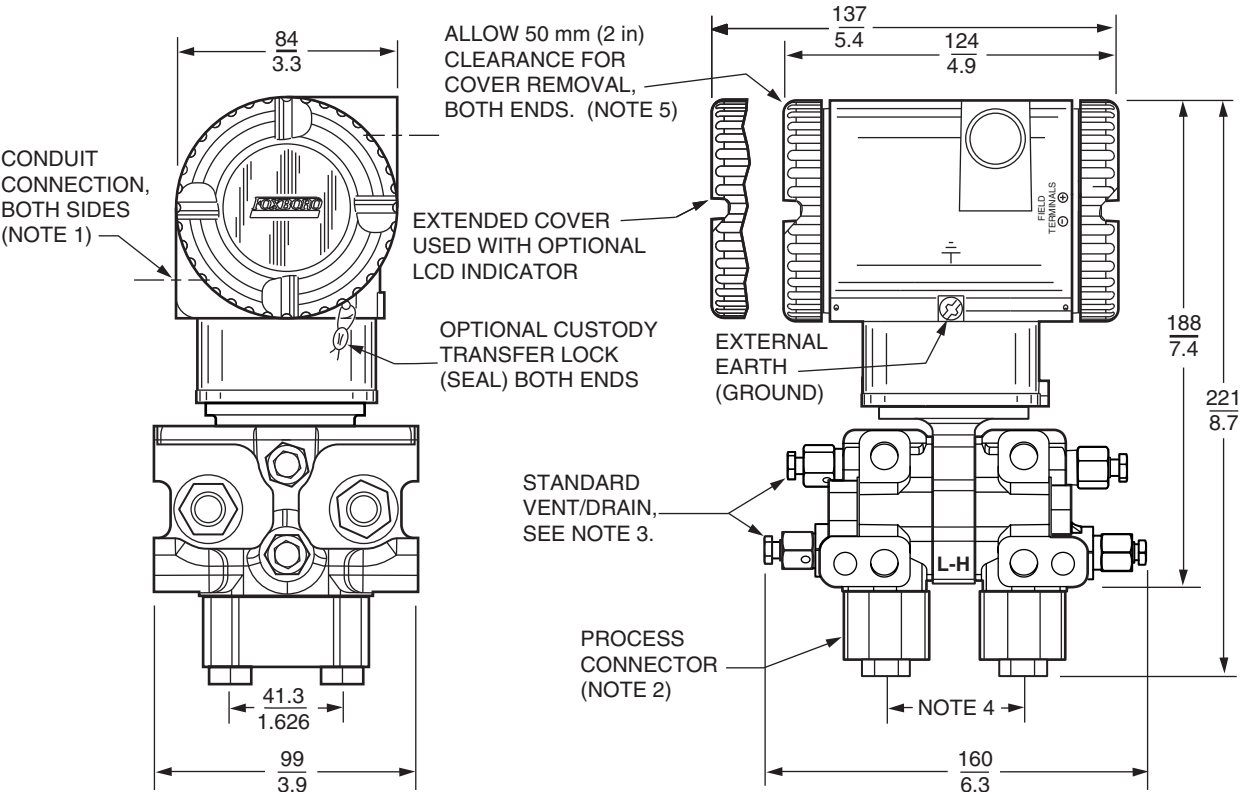
**NOTES:**

1. CONDUIT CONNECTION 1/2 NPT, PG 13.5, OR M20, BOTH SIDES: PLUG UNUSED CONNECTION WITH METAL PLUG (SUPPLIED).
2. PROCESS CONNECTORS MAY BE REMOVED AND TRANSMITTER MOUNTED DIRECTLY ON A MANIFOLD, OR CONNECTIONS MADE DIRECTLY TO PROCESS COVER USING 1/4 NPT INTERNAL THREAD IN PROCESS COVER.
3. THE TRANSMITTER'S LOW PROFILE STRUCTURE LP1 IS SHOWN IN THE VERTICALLY UPRIGHT POSITION. NOTE THE LOCATION OF THE STANDARD VENT/DRAIN SCREW. IN THIS CONFIGURATION THE TRANSMITTER CAN BE VENTED OR IS SELF-DRAINING. ALSO RECOMMENDED IS A HORIZONTAL INSTALLATION WHERE THE INSTALLED ORIENTATION CAN BE SET TO ALLOW FOR VENTING OR DRAINING.
4. PROCESS CONNECTORS CAN BE INVERTED TO GIVE EITHER 51, 54, OR 57 mm (2.0, 2.125, OR 2.25 in) CENTER-TO-CENTER DISTANCE BETWEEN HIGH AND LOW PRESSURE CONNECTIONS.
5. TOPWORKS CAN BE ROTATED TO ANY POSITION WITHIN ONE TURN COUNTERCLOCKWISE OF THE FULLY TIGHTENED POSITION.

DIMENSIONS-NOMINAL (Cont.)

mm  
in

TRANSMITTER WITH LOW PROFILE STRUCTURE LP2

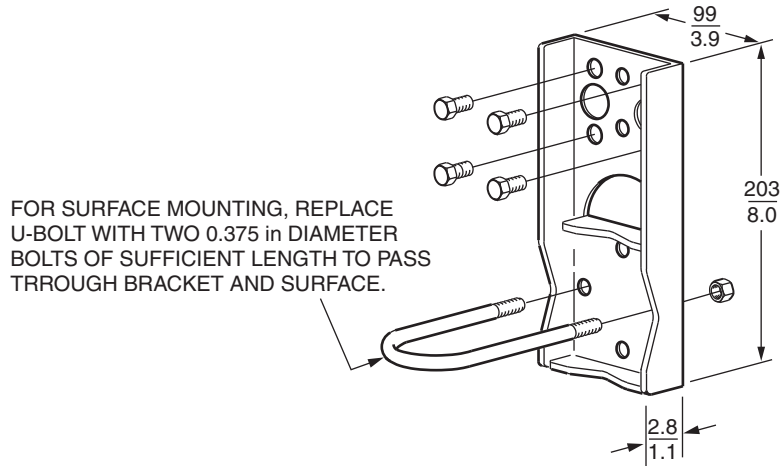


- NOTES:
1. CONDUIT CONNECTION 1/2 NPT, PG 13.5, OR M20, BOTH SIDES: PLUG UNUSED CONNECTION WITH METAL PLUG (SUPPLIED).
  2. PROCESS CONNECTORS MAY BE REMOVED AND TRANSMITTER MOUNTED DIRECTLY ON A MANIFOLD, OR CONNECTIONS MADE DIRECTLY TO PROCESS COVER USING 1/4 NPT INTERNAL THREAD IN PROCESS COVER.
  3. THE TRANSMITTER'S LOW PROFILE STRUCTURE LP2 IS SHOWN IN THE RECOMMENDED VERTICAL UPRIGHT POSITION. NOTE THE STANDARD VENT OR DRAIN SCREWS. HORIZONTAL INSTALLATIONS ARE NOT RECOMMENDED.
  4. PROCESS CONNECTORS CAN BE INVERTED TO GIVE EITHER 51, 54, OR 57 mm (2.0, 2.125, OR 2.25 in) CENTER-TO-CENTER DISTANCE BETWEEN HIGH AND LOW PRESSURE CONNECTIONS.
  5. TOPWORKS CAN BE ROTATED TO ANY POSITION WITHIN ONE TURN COUNTERCLOCKWISE OF THE FULLY TIGHTENED POSITION.

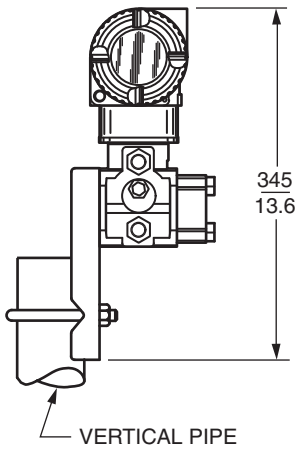
**DIMENSIONS-NOMINAL (Cont.)**

$\frac{\text{mm}}{\text{in}}$

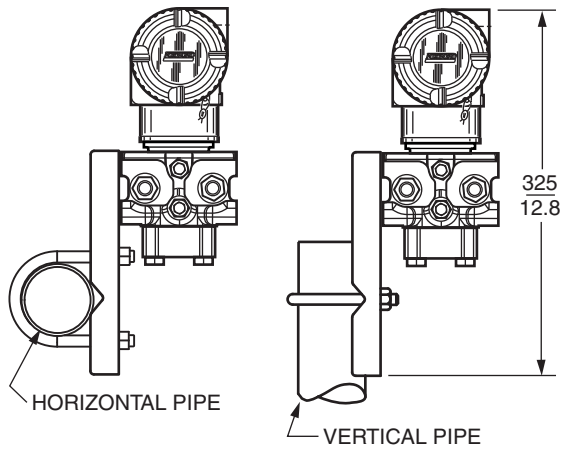
**TRANSMITTER WITH STANDARD STYLE MOUNTING BRACKET KIT (Options -M1 and -M2)**



**TRANSMITTER WITH TRADITIONAL STRUCTURE**



**TRANSMITTER WITH LOW PROFILE STRUCTURE LP2**

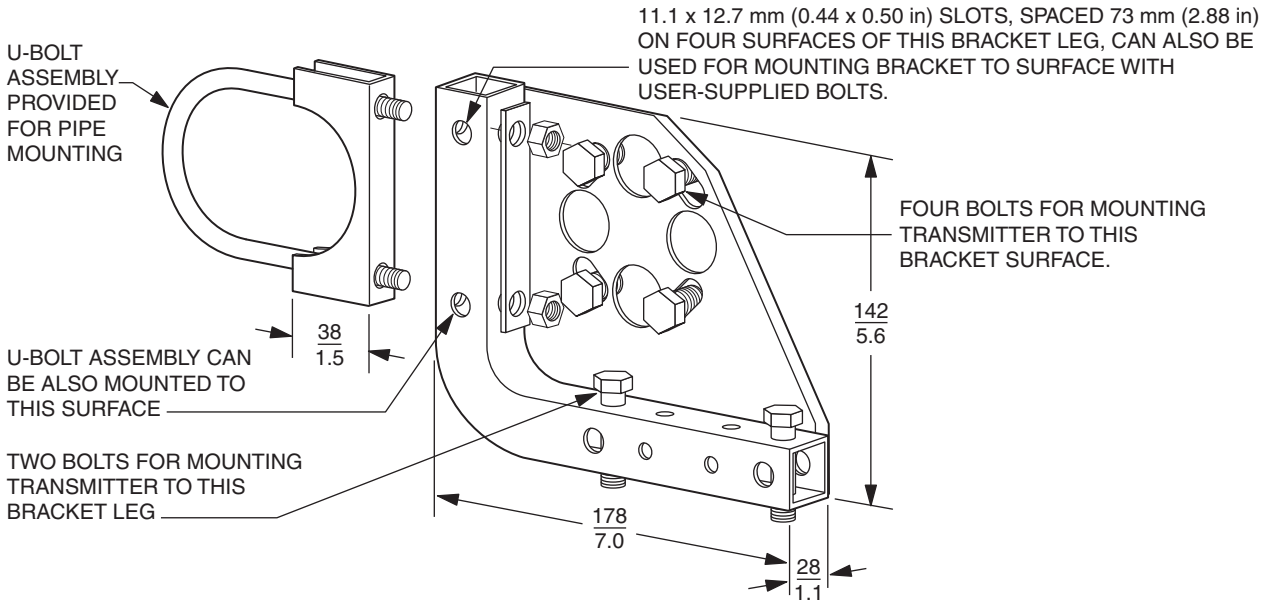




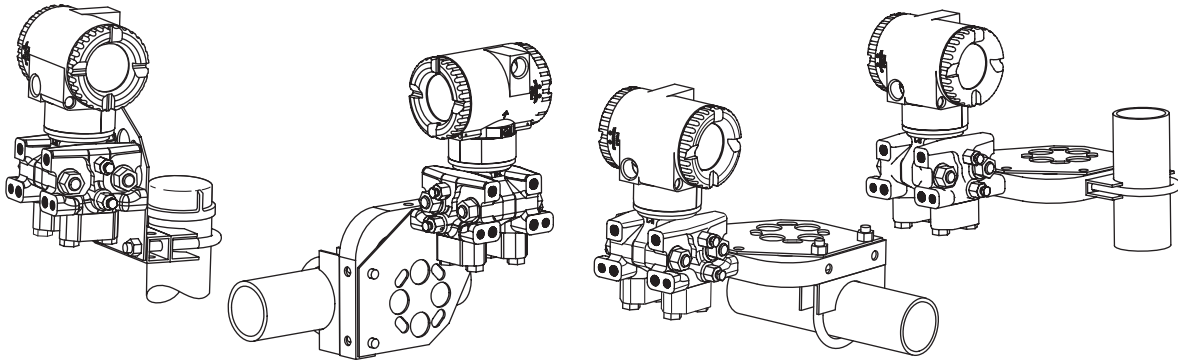
**DIMENSIONS-NOMINAL (Cont.)**

**mm**  
**in**

**TRANSMITTER WITH UNIVERSAL STYLE MOUNTING BRACKET KIT (Option -M3)**

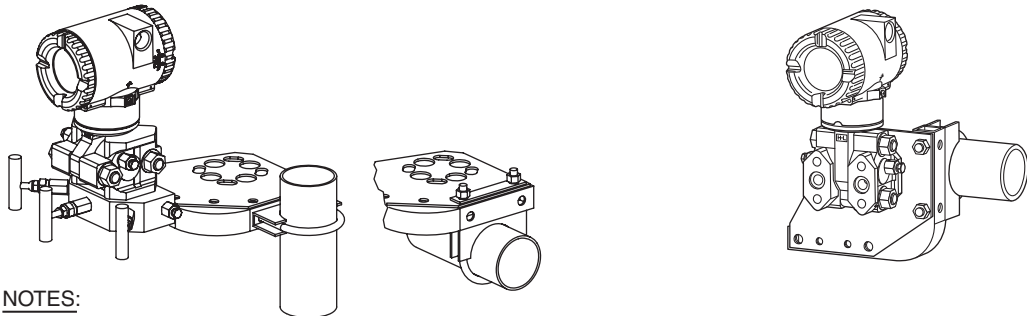


**TYPICAL PIPE MOUNTING WITH LOW PROFILE STRUCTURE LP2**



**TYPICAL PIPE MOUNTING  
LOW PROFILE STRUCTURE LP1**

**TYPICAL PIPE MOUNTING  
WITH TRADITIONAL STRUCTURE**



**NOTES:**

1. FOR SURFACE MOUNTING CONFIGURATIONS, USE THE U-BOLT MOUNTING HOLES FOR ATTACHING THE BRACKET TO A SURFACE RATHER THAN TO THE U-BOLT ASSEMBLY. SURFACE MOUNTING BOLTS FOR ATTACHING THE BRACKET TO A SURFACE ARE USER SUPPLIED.
2. REFER TO DIMENSIONAL PRINT DP 020-446 FOR FURTHER IDP10 MOUNTING CONFIGURATIONS, INCLUDING MOUNTING WITH -P SERIES OPTIONAL MOUNTING PLATES.

**ORDERING INSTRUCTIONS**

1. Model Number(s) as follows:
  - Transmitter only if pressure seals are not selected
  - Both transmitter and pressure seals if pressure seals are selected with traditional structure. See PSS 2A-1Z11 A.
2. Calibrated Pressure Range (using Allowable Pressure Units from the table below).
3. Configuration Data Form when Factory Calibration Option -C2 is specified.
4. Options and Accessories not in Model Code (see PSS 2A-1Z9 E).
5. User Tag Data - Data Plate; 32 characters maximum. For additional tag data, specify Optional Supplemental Tag -T.
6. User Tag Data - Software (Database); 12 characters maximum (user configured).

Allowable Pressure Units for Calibrated Range

inH <sub>2</sub> O	cmH <sub>2</sub> O	cmHg	kPa	mbar	kg/cm <sup>2</sup>
ftH <sub>2</sub> O	inHg	dy/cm <sup>2</sup>	MPa	bar	psia
mmH <sub>2</sub> O	mmHg	Pa	torr	g/cm <sup>2</sup>	atm

**OTHER M&I PRODUCTS**

Invensys Foxboro provides a broad range of measurement and instrument products, including solutions for pressure, flow, analytical, positioners, temperature, controlling and recording. For a listing of these offerings, visit the Invensys Foxboro web site at:

[www.foxboro.com/instrumentation](http://www.foxboro.com/instrumentation)

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BM 010

Printed in U.S.A.

0507

- **High installed base accuracy :  $\pm 0.10\%$**
- **Reliable inductive sensing system coupled with the very latest digital technologies**
  - ensures high performance at all process conditions
- **Specific design for low pressure**
- **Wide selection of materials**
  - meet virtually all process requirements
- **HART 4-20 mA, Profibus PA, FF versions with plug-and-play electronics replacement**
  - provides interchangeability for upgrading transmitter
- **Local snap calibration and full management via hand terminal or PC-running software**
- **HART®, Profibus PA, FF communications**
  - allows integration with standard process bus
- **CoMeter display option**
  - offers HART Configuration capabilities combined with local indication
- **Ecoefficient life cycle**
  - ensures low environmental impact in compliance with LCA assessment to ISO 14040 standard



***The all new 600T Series transmitter  
The first choice pressure transmitter is  
now an even bigger choice***

## 621EM 621PT 621NS

The 621EM is a specific application transmittance sensor for use in a differential configuration for liquid level interface and density measurements. It is typically used for non-invasive measurement upon the other side of a differential specific interface in a tank. The transmittance has a defined structure with two seals. One direct contact face of the glass seal is on the high pressure side.

One remote seal is selected to be of an antiflash diaphragm fitted to a capillary to the low pressure side. The seals should have the same physical characteristics (size, material, etc.) for the two sides. These are suitable to interface to a nozzle of 1/8" in to 1/4" S.O.D. to 1/2" S.O.D.

## Range and span limits

### Range and span limits

Sensor code	Upper Range Limit (URL)	Lower Range Limit (URL) 621EM Liquid level interface, density	Minimum Span	Compatibility allowed seal types Direct mount and one remote seal (max length in m)
621EM	1000 Pa 10000 Pa 1 in H <sub>2</sub> O	1000 Pa 10000 Pa 1 in H <sub>2</sub> O	1000 Pa 10000 Pa 1 in H <sub>2</sub> O	Incompatible antiflash diaphragm seal
621PT	1000 Pa 10000 Pa 1 in H <sub>2</sub> O	1000 Pa 10000 Pa 1 in H <sub>2</sub> O	1000 Pa 10000 Pa 1 in H <sub>2</sub> O	Incompatible antiflash diaphragm seal Compatible antiflash diaphragm seal

The combinations sensor code, seal type, and material of the case according to static pressure effect refer to performance specifications.

### Turndown ratio (TDR)

Up to 100:1

### Span limits

- Maximum span 10000 Pa
- Minimum span 1000 Pa

### Zero suppression and elevation

- Zero and span can be adjusted to an arbitrary point within the range of its range in the tank as long as the calculated span  $\geq$  minimum span

### Damping

Selectable time constant 100ms to 1000ms or 1 sec

### Electromagnetic compatibility (EMC)

- Complies with CE marking for emission and CE marking for immunity tests and test methods

### Turn on time

- Operation within specification in less than 1 sec with minimum gain

### Insulation resistance

- 1000  $\Omega$  / 1000 Vc (relative to earth)

### Temperature limits (°C)

#### Process

The flow in the tube shows characteristics of fluid flow in the seals on the two sides of transmittance one side.

LL LRS PPL TNS	PE TNS NT NS Tma P of	Tmin
Silicone oil (general purpose)	1000 Pa 10000 Pa	1000 Pa
neither a dense	1000 Pa 10000 Pa	1000 Pa

#### Ambient is the operating temperature

Silicone oil and 1000 Pa and 10000 Pa neither a dense 1000 Pa and 10000 Pa pressure coefficient in the flow of 1000 Pa and 10000 Pa

#### Storage

Code: 1000 Pa 10000 Pa 10000 Pa 10000 Pa 10000 Pa 10000 Pa 10000 Pa 10000 Pa 10000 Pa 10000 Pa

### Time response

The time response of a transmittance sensor is a function of some characteristics which define relevant coefficients as follows:

#### Configuration coefficient (1)

- Incompatible seal
- Incompatible seal

is the capillary length of the remote seal if present

**Damping coefficient 2 and 2**

Fill fluid	2	2
Silicone oil	1	1
Inert fluid	1	1

**Operating temperature coefficient**

to be considered on for operation temperature less than 100 °C

0.01 / 0.001 / 0.001

Coefficient should be considered for temperatures above 100 °C

**Sensor L coefficient**

Sensor code	2
1	1
1	1

The sea is constant time is calculate the following information

1 sec 1 sec 1 sec

The total constant time of the transmittance is the combination of relevant response times the following

1 sec 1 sec 1 sec

The following table details the transmittance values in seconds with specific fluid types

Sensor code	Silicone oil 200	Inert fluid
1	1	1
1	1	1

**Overpressure limits**

without reference to the transmittance  
 1000 psi  
 1000 psi  
 1000 psi  
 1000 psi

**Model 621EM**

sensocode 1 1 1 psi

sensocode 1 1 1 psi

**Flanged seals S6**

S 1 1 1 psi

S 1 1 1 psi

S 1 1 1 psi

S 1 1 1 psi

**Static pressure**

transmitters operate within specifications

between the following limits

0.01

atmosphere the two sides are better

0.01

same of overpressure in it

**Proof pressure**

The transmitter meets S 1 requirements and can be exposed without fear to line pressure of up to 1000 psi  
 1000 psi 1000 psi for sensor code 1  
 times the flange fitting rating of the sea

**ELECTRICAL TESTS ON PTNS**

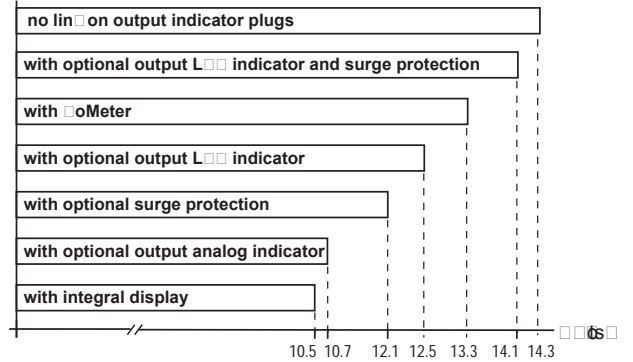
**20 m digital communication and 20 m output**

**Power Supply**

The transmitter operates from 10 to 14.3 with no load and is protected against reverse polarity connection in addition to a

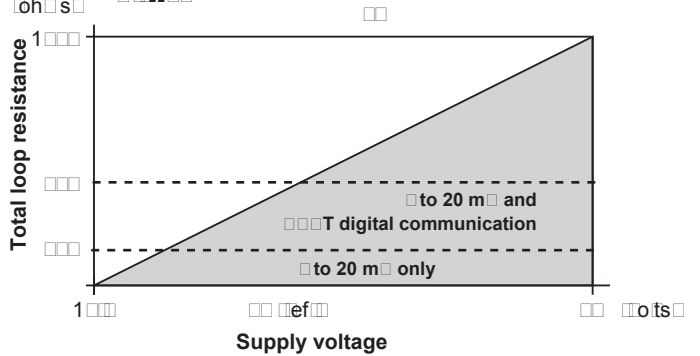
auto operations over 1000 C  
 1000 A and intrinsic safe 1000 S and S 1000 A  
 power supply must not exceed 1000 C

M N M P E T N L T ES



**Load limitations**

and total loop resistance



**Optional indicators**

**Output meter user adjustable**

1000 bit with 1000 in which these ent characters in engineering units are produced output etc a 1000 within the range 1000 to 1000 with a span adjustable between 1000 and 1000 units  
 1000 of decimal point if decimal is switch selected  
 1000 in scale on 1000

**Integral display**

1000 bit with 1000 in which these ent aphan  
 1000 characters  
 1000 refine display over 1000 communication  
 1000 process available in engineering units  
 1000 percent of range  
 1000 process available in engineering units and percent of range  
 1000 a termination error seconds  
 1000 process available in engineering units and digital  
 1000 output to 1000 a termination error seconds  
 1000 auto select the display over 1000 output  
 1000 percent of range  
 1000 percent of range and 1000 output a termination error  
 1000 seconds  
 1000 display also indicates diagnostic messages

**0 Meter**

1000 bit 1000 counts proportional to 1000 in which in  
 1000 ent non-linear characters position and digital point  
 1000 1000 ent graph display 1000 percent ent  
 1000 bit with 1000 in which in 1000 ent aphan  
 1000 1000 characters

### Optional surge protection

- up to 1000 V surge current of 100 µs rise time 1000 µs decay

### Output signal

- can be set to 4-20 mA or 0-10 Vdc
- output type of 0-10 Vdc or 4-20 mA
- point select the process variable
- communication protocol: Modbus RTU
- open line in units: span, zero, or 100%
- with protocol based on IEEE 802.3 standard

### Output current limits to NAMUR standard

- zero condition
- 0.1 mA limit
- 10 mA limit

### Transmitter failure mode to NAMUR standard

- the output signal can be selected to a range of 0-100% on gross transmitter failure condition detected by self-diagnostics
- in case of failure the output is given 100% or 0%

### Profibus PA output

#### Power supply

- the transmitter operates from 12-30 Vdc with no polarity
- 100 mA approx. power supply must not exceed 1 Wdc
- intrinsic safety installation according to IEC 60079

#### Current consumption

- operating (quiescent) 100 mA
- communicating 200 mA
- fault current limiting 16 mA approx.

#### Output signal

- the signal is in compliance to IEC 1158-2/EN 61158-2 with transmission to Manchester II modulation at 31.25 kbit/sec

#### Output interface

- FOUNDATION fieldbus digital communication protocol to standard H1, compliant to specification V. 1.4; FF registration IT011000.

#### Output update time 100 ms

#### Function blocks

- analog input 1 transmitter 1 physical

#### Optional indicator

- integral display
- LCD: 4 digit characters, displaying process variable in engineering units or as percentage value
- display also indicates diagnostic messages

#### Transmitter failure mode

- on gross transmitter failure condition detected by self-diagnostics the output signal can be given to defined conditions selected by the user as safe or last valid or calculate value

### FOUNDATION fieldbus output

#### Device type

- Link Active Scheduler (LAS) capability implemented

#### Power supply

- The transmitter operates from 9 to 32 Vdc with no polarity.
- For EEx ia approval power supply must not exceed 24 Vdc.
- Intrinsic safety installation according to FF application guide.

### Current consumption

- operating (quiescent) : 10.5 mA
- communicating : 20.5 mA
- fault current limiting : 16 mA max.

### Output signal

Physical layer in compliance to IEC 1158-2/EN 61158-2 with transmission to Manchester II modulation, at 31.25 kbit/sec.

### Function blocks/execution period

- 2 standard Analog Input blocks / 25 msec. max (each)
- 1 standard PID block / 70 msec. max.

### Additional blocks

- Transducer block, 1 standard Resource block,
- 1 custom Pressure with calibration block

### Number of link objects : 25

### Number of VCRs : 24

### Output interface

FOUNDATION fieldbus digital communication protocol to standard H1, compliant to specification V. 1.4; FF registration IT011000.

### Optional indicator

- Integral display
- LCD : 4 digit characters, displaying process variable in engineering units or as percentage value.
- Display also indicates diagnostic messages.

### Transmitter failure mode

The output signal is "frozen" to the last valid value on gross transmitter failure condition, detected by self-diagnostics which also indicate a BAD conditions. If electronic failure or short circuit occur the transmitter consumption is electronically limited at a defined value (16 mA approx), for safety of the network.

## PERFORMANCE SPECIFICATIONS

Stated at ambient temperature of 23°C ± 3K (75°F ± 5), relative humidity of 50% ± 20%, atmospheric pressure, mounting position with vertical diaphragm and zero based range for transmitter with seal isolating diaphragms in AISI 316 L ss and silicone oil fill and HART digital trim values equal to 4-20 mA span end points, in linear mode.

Unless otherwise specified, errors are quoted as % of span.

Some performance data are affected by the actual turndown (TD) as ratio between Upper Range Limit (URL) and calibrated span. IT IS RECOMMENDED TO SELECT THE TRANSMITTER SENSOR CODE PROVIDING THE TURNDOWN VALUE AS LOWEST AS POSSIBLE TO OPTIMIZE PERFORMANCE CHARACTERISTICS.

### Accuracy rating

% of calibrated span, including combined effects of terminal based linearity, hysteresis and repeatability.

For fieldbus versions SPAN refer to analog input function block outscale range

- ± 0.10% for TD from 1:1 to 5:1

$$- \pm 0.02 \times \frac{\text{URL}}{\text{span}} \text{ for TD from 5:1 to 10:1}$$

Multiply the values by 2 for sensor/seal combination marked (\*)

### Optional indicators accuracy

- integral display (microprocessor driven) : no error
- analog output meter :  $\pm 2\%$  full scale deflection
- LCD output meter :  $\pm 0.1\%$  of calibrated span  $\pm 1$  unit
- CoMeter
  - digital :  $\pm 0.10\%$  of max span(16 mA)  $\pm 1$  digit
  - analog (bargraph) : 10%

## Operating influences

### Temperature effects

- total effect per 20 K (36°F) ambient temperature change on transmitter sensor between the limits of -20°C to 65°C (-4 to 150°F) and per 20 K (36°F) process temperature change on seals diaphragm between the process operating temperature limits
- sensor A with 3in/DN80 seals : 0.01 kPa, 0.1 mbar, 0.04inH<sub>2</sub>O
  - sensor B with 2in/DN50 seals : 0.03 kPa, 0.3 mbar, 0.12 inH<sub>2</sub>O
  - sensor B with 3in/DN80 seals : 0.02 kPa, 0.2 mbar, 0.08 inH<sub>2</sub>O

### Optional LCD output meter ambient temperature

- per 1 K (1.8°F) change between the limits of -20 and 80°C (-4 and 176°F)
- Total effect :  $\pm (0.0002 \times \text{span units} \times 0.1)$  of reading.

### Optional CoMeter ambient temperature

- Total reading error per 20K (36°F) change between the ambient limits of -20 and 70°C (-4 and 158°F) :
- $\pm 0.15\%$  of max span (16 mA).

### Static pressure (zero errors can be calibrated out at line pressure)

per 1 MPa, 10 bar or 145 psi

#### sensor code A

- zero error :  $\pm 0.15\%$  of URL
- span error :  $\pm 0.15\%$  of reading

#### sensor code B

- zero error :  $\pm 0.08\%$  of URL
- span error :  $\pm 0.08\%$  of reading

Multiply by 1.5 the errors for sensor/seal combinations marked (\*)

### Supply voltage

Within voltage/load specified limits the total effect is less than 0.005% of URL per volt.

### Load

Within load/voltage specified limits the total effect is negligible.

### Radio frequency interference

Total effect : less than 0.10% of span from 20 to 1000 MHz and for field strengths up to 30 V/m when tested with shielded conduit and grounding, with or without meter. Meets IEC 801.

### Common mode interference

No effect from 100 V rms 50 Hz, or 50 Vdc.

### Series mode interference

No effect from 1 V rms 50 Hz.

## MEASUREMENT SPECIFICATIONS

(Refer to ordering information sheets for variant availability related to specific model or versions code)

## Materials

### Process seal isolating diaphragms

AISI 316 L ss, Hastelloy C276  $\diamond$ ;

### Fill fluids

Silicone oil (DC200) or inert fill (perfluorinated polyethers - Galden  $\diamond$ )

### Mounting flanges

Carbon steel ; AISI 316 ss

### Sensor housing AISI 316 L ss

### Bolts and nuts

- Plated carbon steel bolts class 8.8 per UNI 5737 (ISO 4014) and nuts class 6.S per UNI 3740/4 (ISO 898/2).
- AISI 316 ss bolts and nuts Class A4-50 per UNI 7323 (ISO 3506), in compliance with NACE MR0175 Class II.

### Electronic housing and covers

Barrel version

- Low-copper content aluminium alloy with baked epoxy finish;
- AISI 316 L ss.

DIN version

- Low-copper content aluminium alloy with baked epoxy finish

### Covers O-ring Buna N.

### Local zero and span adjustments

Glass filled polycarbonate plastic (removable)

### Tagging

AISI 316 ss data plate attached to the electronics housing.

## Calibration

- Standard: at maximum span, zero based range, ambient temperature and pressure
- Optional: at specified range and ambient conditions; or at operating temperature.

## Optional extras

### Output indicator

plug-in rotatable type, LCD or analog.

Standard LCD output meter scale is 0 to 100% linear; special linear scale to specified range and engineering unit is available. Standard analog output meter scale is 0 to 100% linear; special graduation is available.

### Supplemental customer tag

AISI 316 ss tag screwed/fastened to the transmitter for customer's tag data up to a maximum of 20 characters and spaces on one line for tag number and tag name, and up to a maximum of 3 spaced strings of 10 characters each for calibration details (lower and upper values plus unit). Special typing evaluated on request for charges.

### Surge protection not available with Profibus PA and FF output

### Material traceability

## Environmental protection

### ☐ et and dust laden atmosp☐eres

The transmitter is dust and sand tight and protected against immersion effects as defined by IEC 529 (1989) to IP 67 (IP 68 on request) or by NEMA to 4☐ or by ☐S to C0920

### ☐a☐ardous atmosp☐eres

With or without output meter/integral display

#### INTRINSIC SAFETY/EUROPE:

ATE☐/BASEEFA approval

- EC-Type Examination Certificate no. BAS 99ATE☐ 1180 - (HART)

II 1 GDT 50°C, EEx ia IIC T6/T5 (-40°C ≤ Ta ≤ ☐40°C)  
T95°C, EEx ia IIC T4 (-40°C ≤ Ta ≤ ☐85°C)

- (FOUNDATION Fieldbus)

II 1 GD T70°C, EEx ia IIC T4 (-40°C ≤ Ta ≤ ☐60°C)

- EC-Type Examination Certificate no. BAS 00ATE☐ 1241 - (PROFIBUS-PA)

II 1 GD T70°C, EEx ia IIB T4 (-40°C ≤ Ta ≤ ☐60°C)

#### TYPE "N"/EUROPE:

ATE☐/BASEEFA type examination

- Design compliance by Certificate no. BAS 01ATE☐ 3380☐ - (HART)

II 3 GDT 50°C, EEx nL IIC T5 (-40°C ≤ Ta ≤ ☐40°C)  
T95°C, EEx nL IIC T4 (-40°C ≤ Ta ≤ ☐85°C)

- (FOUNDATION Fieldbus)

II 3 GD T70°C, EEx nL IIC T4 (-40°C ≤ Ta ≤ ☐60°C)

- Design compliance by Certificate no. BAS 01ATE☐ 3384☐ - (PROFIBUS-PA)

II 3 GD T70°C, EEx nL IIB T4 (-40°C ≤ Ta ≤ ☐60°C)

#### FLAMEPROOF/EUROPE:

ATE☐/CESI approval;

- EC-Type Examination Certificate no. CESI 00 ATE☐ 035

II 1/2 GD T80°C, EEx d IIC T6 (-40°C ≤ Ta ≤ ☐70°C)

T95°C, EEx d IIC T5 (-40°C ≤ Ta ≤ ☐85°C)

#### CANADIAN STANDARDS ASSOCIATION

#### and FACTOR☐ MUTUAL:

- Explosionproof: Class I, Div. 1, Groups A, B, C, D
- Dust ignitionproof: Class II, Div. 1, Groups E, F, G
- Suitable for: Class II, Div. 2, Groups F, G; Class III, Div. 1, 2
- Nonincendive: Class I, Div. 2, Groups A, B, C, D
- Intrinsically safe: Class I, II, III, Div. 1, Groups A, B, C, D, E, F, G

#### STANDARDS AUSTRALIA (SAA)

TS/WCA Approval (HART only)

- Conformity Certificate no. AUS Ex 3117☐

Ex d IIC T5 (Tamb ☐85°C)/T6 (Tamb ☐70°C) Class 1 Zone 1;

Ex ia IIC T4 (Tamb ☐85°C)/T5 (Tamb ☐55°C) T6 Class 1 Zone 0

## Process connections

Flush diaphragm flanged seal (☐☐):

2in or 3in ANSI 150 to 300 RF

DN50 or DN80 DIN ND 16-40 Form C

Wafer seal (backup flange not supplied)

2in, 3in to ANSI; DN50, DN80 to DIN.

## Electrical connections

Two 1/2 NPT or M20x1.5 or PG 13.5 or 1/2 GK threaded conduit entries, direct on housing; straight or angle Harting HAN connector and one plug, on request.

### Terminal block

- HART version

Three terminals for signal/external meter wiring up to 2.5 mm<sup>2</sup> (14 AWG) and three connection points for test and communication purposes.

- Fieldbus versions

Two terminals for signal wiring (bus connection) up to 2.5 mm<sup>2</sup> (14 AWG)

### ☐rounding

Internal and external 6 mm<sup>2</sup> (10 AWG) ground termination points are provided.

## Mounting position

Transmitter can be mounted in any position but with a maximum ± 1° from vertical.

Electronics housing may be rotated to any position. A positive stop prevents over travel.

## Mass (without options)

9 to 12 kg approx (20 to 27 lb); add 1.5 kg (3.4 lb) for AISI housing.

Add 650 g (1.5 lb) for packing.

## Packing

Carton

◊ Hastelloy is a Cabot Corporation trademark

◊ Galden is a Montefluos trademark

(☐) Wetted parts of the transmitter.

(☐☐) Bolts and nuts, gasket and mating flange supplied by Customer



## CONFIGURATION

### Transmitter with HART communication and 4 to 20 mA Standard configuration

Transmitters are factory calibrated to customer's specified range. Calibrated range and tag number are stamped on the tag plate. If a calibration range and tag data are not specified, the transmitter will be supplied with the plate left blank and configured as follows:

- Engineering Unit: Specify code option
- 4 mA: Zero
- 20 mA: Upper Range Limit (URL)
- Output : Linear
- Damping: 1 sec.
- Transmitter failure mode: Upscale
- Software tag characters: Blank
- Optional LCD output indicator : 0 to 100.0% linear

Any or all the above configurable parameters, including Lower range-value and Upper range-value which must be the same unit of measure, can be easily changed using the HART hand-held communicator. The transmitter database is customized with specified flange type and material, O-ring and drain/vent materials and meter code option.

#### Custom configuration option

The following data may be specified in addition to the standard configuration parameters:

- Descriptor : 16 alphanumeric characters
- Message: 32 alphanumeric characters
- Date: Day, month, year
- Damping: Seconds

### Transmitter with Profibus PA communication

Transmitters are factory calibrated to customer's specified range. Calibrated range and tag number are stamped on the tag plate. If a calibration range and tag data are not specified, the transmitter will be supplied with the plate left blank and configured as follows:

- Measure Profile: Pressure
- Engineering Unit: kPa
- Output scale 0%: Lower Range Limit (LRL)
- Output scale 100%: Upper Range Limit (URL)
- Output : Linear
- Hi-Hi Limit : Upper Range Limit (URL)
- Hi Limit : Upper Range Limit (URL)
- Low Limit : Lower Range Limit (LRL)
- Low-Low Limit : Lower Range Limit (LRL)
- Limits hysteresis: 0.5% of output scale
- PV filter: 0 sec.
- Address (settable by local key): 126
- Tag : 32 alphanumeric characters

Any or all the above configurable parameters, including Lower range-value and Upper range-value which must be the same unit of measure, can be easily changed by a PC running the configuration software Smart Vision with DTM for 600T or 600T template for Siemens Simatic PDM System. The transmitter database is customized with specified flange type and material, O-ring and drain/vent materials and meter code option.

#### Custom configuration option

The following data may be specified in addition to the standard configuration parameters:

- Descriptor : 32 alphanumeric characters
- Message: 32 alphanumeric characters
- Date: Day, month, year
- Air filter: Seconds

### Transmitter with FOUNDATION fieldbus communication

Transmitters are factory calibrated to customer's specified range. Calibrated range and tag number are stamped on the tag plate. If a calibration range and tag data are not specified, the transmitter will be supplied with the plate left blank and configured as follows:

- Measure Profile: Pressure
- Engineering Unit: kPa
- Output scale 0%: Lower Range Limit (LRL)
- Output scale 100%: Upper Range Limit (URL)
- Output : Linear
- Hi-Hi Limit : Upper Range Limit (URL)
- Hi Limit : Upper Range Limit (URL)
- Low Limit : Lower Range Limit (LRL)
- Low-Low Limit : Lower Range Limit (LRL)
- Limits hysteresis: 0.5% of output scale
- PV filter time: 0 sec.
- Tag : 32 alphanumeric characters

Any or all the above configurable parameters, including the range values, can be changed using any host compliant to FOUNDATION fieldbus. The transmitter database is customized with specified flange type and material, O-ring and drain/vent materials and meter code option.

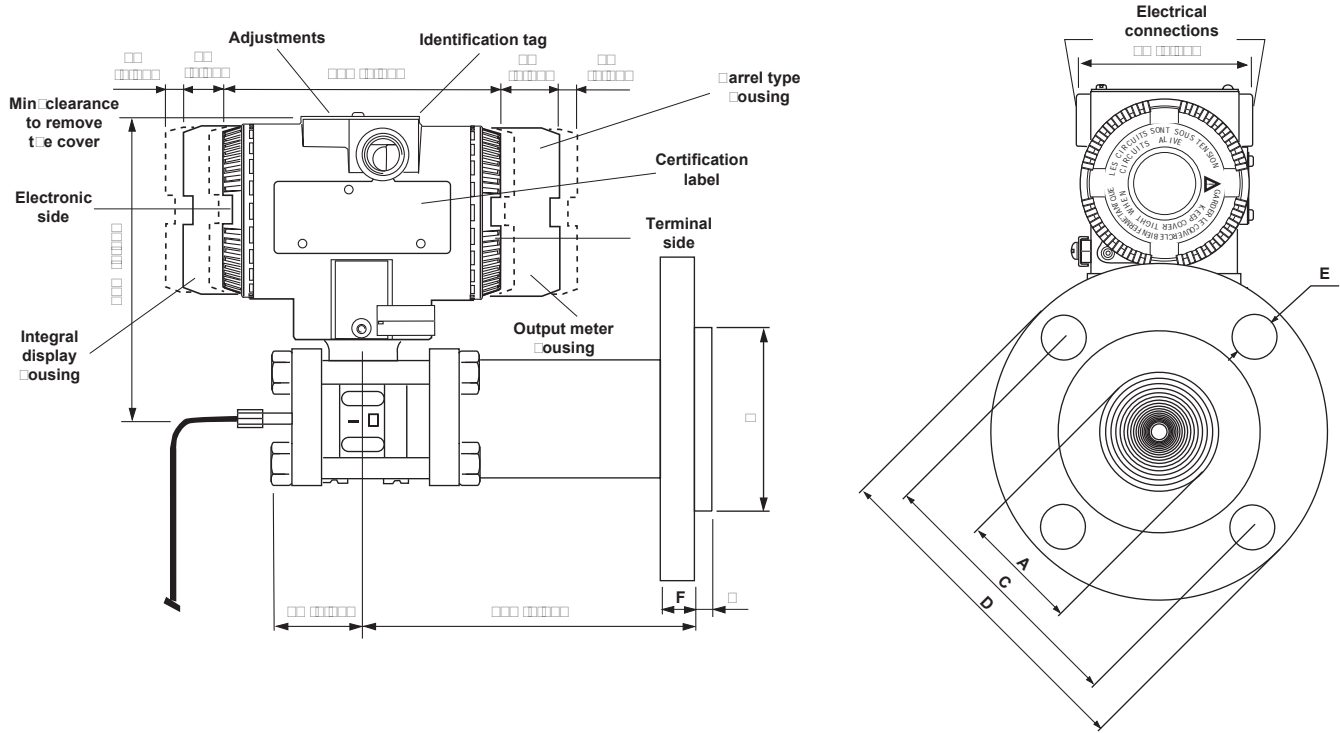
Available engineering units of pressure measure are :

Pa, kPa, MPa  
inH<sub>2</sub>O @ 4°C, mmH<sub>2</sub>O @ 4°C, psi  
inH<sub>2</sub>O @ 20°C, ftH<sub>2</sub>O @ 20°C, mmH<sub>2</sub>O @ 20°C  
inHg, mmHg, Torr  
g/cm<sup>2</sup>, kg/cm<sup>2</sup>, atm  
mbar, bar

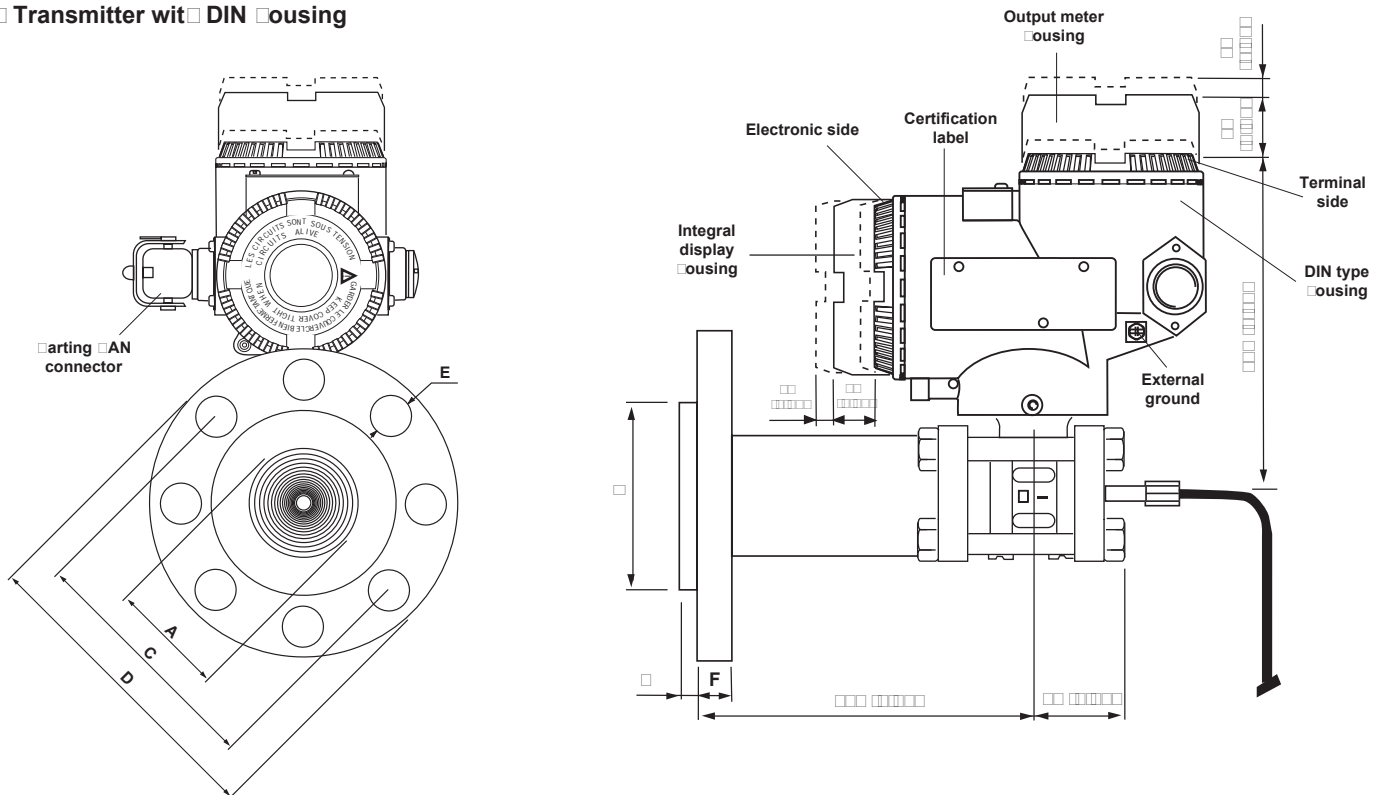
# MO UNTIN DIMENSIONS

not for construction unless certified

## Transmitter with barrel housing

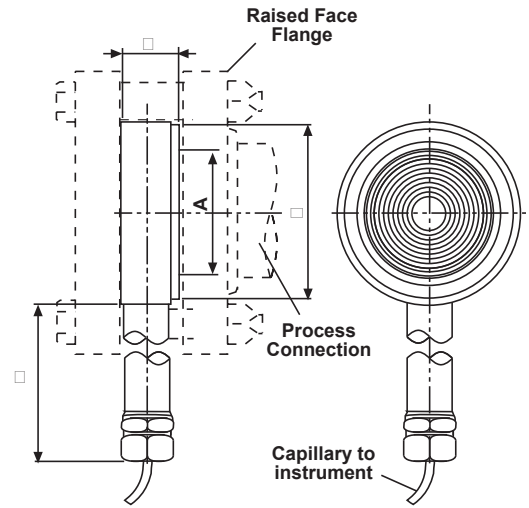


## Transmitter with DIN housing

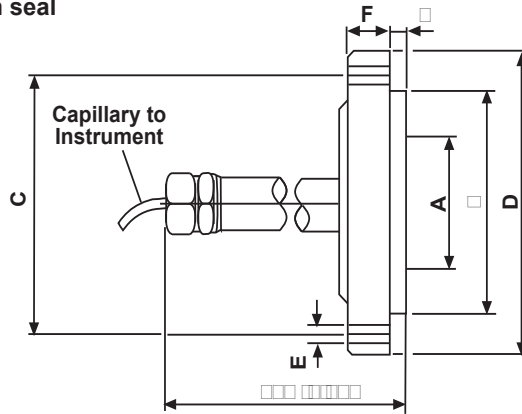


□ □ after type seal

SI □ E	DIMENSIONS mm □ in □			
	A □ dia □	□ □ dia □	□ □	□ □
2 in	60 (2.36)	92.1 (3.62)	23 (0.9)	139.7 (5.5)
3 in	89 (3.5)	127 (5)	23 (0.9)	139.7 (5.5)
DN 50	60 (2.36)	102 (4.02)	23 (0.9)	139.7 (5.5)
DN 80	89 (3.5)	138 (5.43)	23 (0.9)	139.7 (5.5)



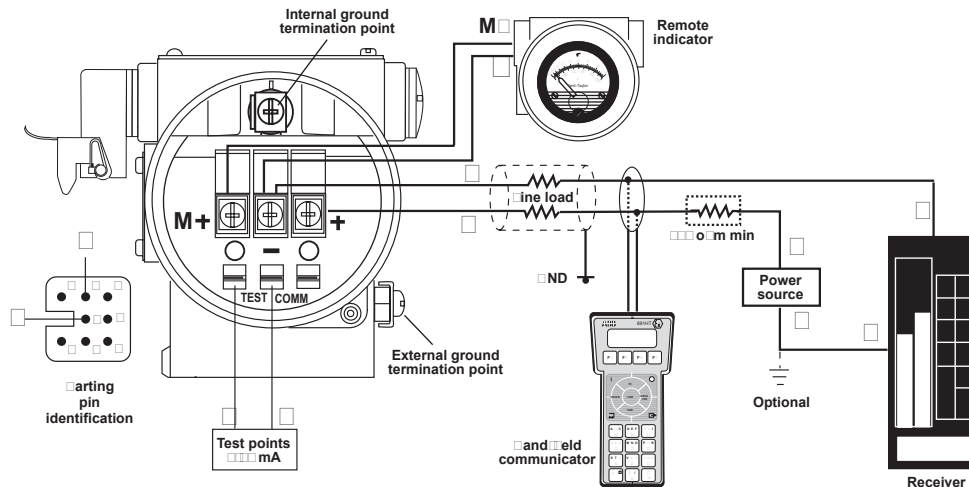
□ Flanged flus □ diap □ ragm seal



SI □ E/RATIN □	DIMENSIONS mm □ in □							N° OF □ O □ ES
	A □ dia □	□ □ dia □	C □ dia □	D □ dia □	E □ dia □	F	□ □	
2in ANSI CL 150	60 (2.36)	92.1 (3.62)	120.5 (4.74)	152.5 (6)	20 (0.79)	19.5 (0.77)	9.5 (0.37)	4
2in ANSI CL 300	60 (2.36)	92.1 (3.62)	127 (5)	165 (6.5)	20 (0.79)	22.5 (0.88)	9.5 (0.37)	8
3in ANSI CL 150	89 (3.5)	127 (5)	152.5 (6)	190.5 (7.5)	20 (0.79)	24 (0.94)	9.5 (0.37)	4
3in ANSI CL 300	89 (3.5)	127 (5)	168.5 (6.63)	210 (8.26)	22 (0.86)	28.5 (1.12)	9.5 (0.37)	8
DN50 DIN ND16	60 (2.36)	102 (4.02)	125 (4.92)	165 (6.5)	18 (0.71)	20 (0.79)	9.5 (0.37)	4
DN50 DIN ND40	60 (2.36)	102 (4.02)	125 (4.92)	165 (6.5)	18 (0.71)	20 (0.79)	9.5 (0.37)	4
DN80 DIN ND16	89 (3.5)	138 (5.43)	160 (6.3)	200 (7.87)	18 (0.71)	20 (0.79)	9.5 (0.37)	8
DN80 DIN ND40	89 (3.5)	138 (5.43)	160 (6.3)	200 (7.87)	18 (0.71)	24 (0.94)	9.5 (0.37)	8

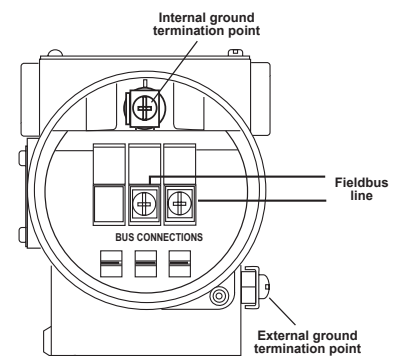
## E □ ECTRICA □ CONNECTIONS

□ □ ART Version



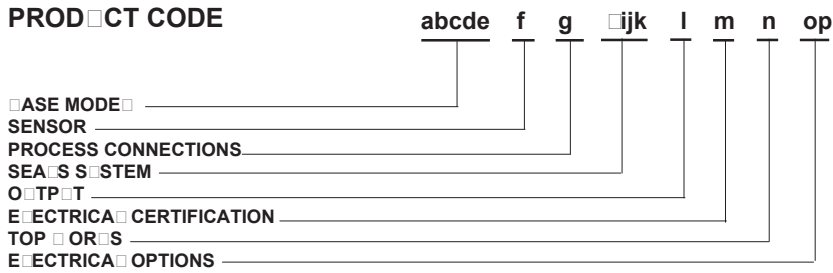
□ □ ART □ □ and □ □ field communicator may be connected at any wiring termination point in the loop providing the minimum resistance is □ □ □ □ m. If it is less than □ □ □ □ m, additional resistance should be added to allow communications.

□ □ FIE □ D □ □ S Versions



# ORDER INFORMATION model EM liquid level interface and density transmitter

Select one character or set of characters from each category and specify complete catalog number.  
Refer to supplementary code and specify another number for each transmitter if additional options are required.



**abcde**  ASE MODE  1st to 5th characters **Code**

Liquid level, interface and density transmitter **EM**

**f** **SENSOR**  Span limits  6th character

0.25 and 2.5 kPa	2.5 and 25 mbar	1 and 10 inH2O (Note)	<b>A</b> <input type="checkbox"/>
1 and 10 kPa	10 and 100 mbar	4 and 40.1 inH2O	

Note : only available with 3in/DN80 seal size

**g** **PROCESS CONNECTIONS**  TYPE OF SEALS  7th character

<input type="checkbox"/> High pressure side	<input type="checkbox"/> Low pressure side	<b>F</b> <input type="checkbox"/>
All-welded direct mount flanged flush diaphragm seal	All-welded remote flanged flush diaphragm seal All-welded remote wafer seal	

**h** **FLANGED CONNECTIONS**  TYPE SEAL SIZE AND RATING  High and Low Pressure Sides  8th character

Material	Rating/size	
Carbon steel	ANSI 150 RF - 2in	<input type="checkbox"/>
	ANSI 150 RF - 3in	<input type="checkbox"/>
	ANSI 300 RF - 2in	<input type="checkbox"/>
	ANSI 300 RF - 3in	<input type="checkbox"/>
	DIN ND 16 Form C-DN 50	<input type="checkbox"/>
	DIN ND 16 Form C-DN 80	<input type="checkbox"/>
	DIN ND 40 Form C-DN 50	<b>A</b>
AISI 316 ss	DIN ND 40 Form C-DN 80	<b>C</b>
	ANSI 150 RF - 2in	<input type="checkbox"/>
	ANSI 150 RF - 3in	<input type="checkbox"/>
	ANSI 300 RF - 2in	<input type="checkbox"/>
	ANSI 300 RF - 3in	<input type="checkbox"/>
	DIN ND 16 Form C-DN 50	<b>M</b>
	DIN ND 16 Form C-DN 80	<input type="checkbox"/>
DIN ND 40 Form C-DN 50	<b>R</b>	
DIN ND 40 Form C-DN 80	<b>S</b>	
		<b>T</b>

FLANGE IS NOT SUPPLIED WHEN WAFER TYPE SEAL IS SELECTED ON LOW PRESSURE SIDE

**i** 9th character

Seal diaphragm material	Fill fluid	
AISI 316 L ss	Silicone oil	<input type="checkbox"/>
Hastelloy C276 ◊	Silicone oil	<input type="checkbox"/>
AISI 316 L ss	Inert fluid	<b>A</b>
Hastelloy C276 ◊	Inert fluid	<input type="checkbox"/>

**j** **CAPIBAR ENT**  Low pressure side  10th character

0.5 m	<b>A</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <b>C</b> <input type="checkbox"/> <b>D</b> <input type="checkbox"/>
1 m	
1.5 m	
2 m	
2.5 m	
3 m	
3.5 m (Note)	
4 m (Note)	

Note : not available with 2in or DN50 seals code 1, 3, 7, A, L, S at position "h"

Compliance to NACE class II bolting, according to specification MR0175, latest revision      ◊ Hastelloy is a Cabot Corporation trademark  
 (i) Process wetted-parts

# ORDERING INFORMATION model EM fluid level interface and density transmitter

11th character

<b>k</b>	<input type="checkbox"/> <b>o</b> lts	<input type="checkbox"/>
	Carbon steel	<input type="checkbox"/>
	AISI 316 ss (NACE)	<b>R</b>

12th character

<b>l</b>	<input type="checkbox"/> <b>O</b> <input type="checkbox"/> <b>TP</b> <input type="checkbox"/> <b>T</b>	<input type="checkbox"/>
	HART digital communication and 4 to 20 mA	<input type="checkbox"/>
	Profibus PA communication	<b>P</b>
	FOUNDATION Fieldbus Communication	<b>F</b>

<b>m</b>	<b>E</b> <input type="checkbox"/> <b>E</b> CTRICA <input type="checkbox"/> <b>C</b> ERTIFICATION <input type="checkbox"/> 13th character	<input type="checkbox"/>
	General Purpose	<input type="checkbox"/>
	ATE <input type="checkbox"/> Group II Category 1/2 GD - Flameproof EEx d CESA approval	<b>F</b>
	ATE <input type="checkbox"/> Group II Category 1 GD - Intrinsic Safety EEx ia BASEEFA approval	<input type="checkbox"/>
	ATE <input type="checkbox"/> Group II Category 3 GD - Type of protection "N" EEx nL design compliance	<b>N</b>
	Factory Mutual (FM) and Canadian Standard Association (CSA) approvals (only with 1/2" NPT and M20 electrical connection)	<input type="checkbox"/>
Intrinsic Safety and Flameproof to Standards Australia SAA approval Ex ia IIC T6/T5/T4 <input type="checkbox"/> Ex d IIC T6/T5 (Note)	<input type="checkbox"/>	

Note : not available with output code P and F at position "l"

**TOP**  **OR**  **S**  14th character

<b>n</b>	<input type="checkbox"/> <b>ousing material</b>	<b>Electrical connection</b>	<input type="checkbox"/>
	Aluminium alloy (Barrel version)		1/2" NPT
M20 x 1.5 (CM 20)			<input type="checkbox"/>
Pg 13.5			<input type="checkbox"/>
1/2" GK			<input type="checkbox"/>
Harting HAN connector - straight entry (Note 1, 2)			<input type="checkbox"/>
Harting HAN connector - angle entry (Note 1, 2)			<input type="checkbox"/>
AISI 316 L ss (Barrel version)		1/2" NPT	<input type="checkbox"/>
		M20 x 1.5 (CM 20)	<b>A</b>
		Pg 13.5	<b>C</b>
		1/2" GK	<b>D</b>
Aluminium alloy (DIN version)		Pg 13.5 (Note 1)	<input type="checkbox"/>
		M20 x 1.5 (CM 20) (Note 1)	<input type="checkbox"/>
		Harting HAN connector - straight entry (Note 1, 2)	<input type="checkbox"/>
			<b>F</b>

Note 1 : requires certification code 1 at position "m"

Note 2 : not available with output code P and F at position "n"

**E**  **E**CTRICA  **O**PTIONS  15th character

<b>o</b>	<b>Internal meter type</b>	<input type="checkbox"/>
	None	<input type="checkbox"/>
	Digital LCD output indicator linear 0-100%, user scalable (Note)	<input type="checkbox"/>
	Digital LCD output indicator linear scale (specify range and engineering units) (Note)	<input type="checkbox"/>
	Analog output indicator linear 0-100% scale (Note)	<input type="checkbox"/>
	Analog output indicator, special graduation (to be specified for linear or square root scale) (Note)	<input type="checkbox"/>
	Digital LCD integral display	<input type="checkbox"/>
	Digital LCD integral display and digital LCD output indicator linear 4-20 mA (Note)	<b>A</b>
	Digital LCD integral display and analog output indicator linear 0-100% scale (Note)	<b>C</b>
	Programmable signal meter and HART configurator (CoMeter) (Note)	<b>E</b>
Programmable signal meter and HART configurator (CoMeter) and digital LCD integral display (Note)	<b>P</b>	
	<b>R</b>	

Note : not available with output code P and F at position "o"

16th character

<b>p</b>	<b>Electrical options</b>	<b>Labels language</b>	<input type="checkbox"/>
		English	<input type="checkbox"/>
		German	<input type="checkbox"/>
	Standard terminal block	Italian	<input type="checkbox"/>
		English	<input type="checkbox"/>
		German	<input type="checkbox"/>
	Surge protector (Note)	Italian	<input type="checkbox"/>
		English	<input type="checkbox"/>
		German	<input type="checkbox"/>
	Terminal block for external meter (Note)	Italian	<input type="checkbox"/>
		English	<input type="checkbox"/>
		German	<input type="checkbox"/>

Note : not available with output code P and F at position "p"

# ORDERING INFORMATION

Select one character or set of characters from each category and specify complete catalog number in addition to each transmitter code, if required.

## PRODUCT CODE

ab c d e f

ASE MODE   
 CONFIGURATION   
 CALIBRATION   
 PROCEDURE   
 INSTRUMENTATION OF ASSOCIATED INSTRUMENTATION

<b>ab</b> <input type="checkbox"/> ASE MODE <input type="checkbox"/> 1st to 2nd characters	<b>Code</b>
Supplementary code	<b>SC</b>

<b>c</b> <input type="checkbox"/> CONFIGURATION <input type="checkbox"/> 3rd character	
Standard - Pressure <input type="checkbox"/> kPa; Temperature <input type="checkbox"/> deg. C	<input type="checkbox"/>
Standard - Pressure <input type="checkbox"/> inH2O/psi ( <input type="checkbox"/> 20°C); Temperature <input type="checkbox"/> deg. F	<input type="checkbox"/>
Standard - Pressure <input type="checkbox"/> inH2O/psi ( <input type="checkbox"/> 4°C); Temperature <input type="checkbox"/> deg. F	<input type="checkbox"/>
Standard - Pressure <input type="checkbox"/> inH2O/psi ( <input type="checkbox"/> 20°C); Temperature <input type="checkbox"/> deg. C	<input type="checkbox"/>
Standard - Pressure <input type="checkbox"/> inH2O/psi ( <input type="checkbox"/> 4°C); Temperature <input type="checkbox"/> deg. C	<input type="checkbox"/>
Custom	<b>C</b>

<b>d</b> <input type="checkbox"/> CALIBRATION <input type="checkbox"/> 4th character			
<b>Calibration range</b>	<b>Calibration</b>	<b>Certificate</b>	
Standard (max span <input type="checkbox"/> 0 to URL)	Reference temperature	None <input type="checkbox"/> es (3 copies)	<input type="checkbox"/>
	Operating temperature	None <input type="checkbox"/> es (3 copies)	<input type="checkbox"/>
At specified range	Reference temperature	None <input type="checkbox"/> es (3 copies)	<input type="checkbox"/>
	Operating temperature	None <input type="checkbox"/> es (3 copies)	<input type="checkbox"/>

<b>e</b> 5th character <input type="checkbox"/> PROCEDURE <input type="checkbox"/>	<b>Material traceability</b>	
None	None	<input type="checkbox"/>
	To EN10204 - 3.1.B (certificates for flanges, adapters, diaphragms)	<b>A</b>
	To EN10204 - 2.1 (declaration for instrument)	<input type="checkbox"/>

<b>f</b> <input type="checkbox"/> INSTRUMENTATION OF ASSOCIATED INSTRUMENTATION <input type="checkbox"/> 6th character	
None	<input type="checkbox"/>



The Company's policy is one of continuous product improvement and the right is reserved to modify the specifications contained herein without notice.

**ABB Instrumentation spa**  
 Via Statale 113  
 22016 Lenno (Como)  
 Italia  
 Tel. 0344 58111  
 Facsimile 0344 56278

**ABB Ltd**  
 Howard Road  
 St. Neots, Cambs.  
 England PE19 3EU  
 Tel. (01480) 475321,  
 Facsimile (01480) 217948

**ABB Inc**  
 125 East County Line Road  
 Warminster, Pa.  
 18974-4995 USA  
 Tel. (215) 674-6693/6320/6777  
 Facsimile (215) 674-7184



**NEPTUNE.**

Neptune Technology Group Inc.

## T-10 Meter

Sizes: 5/8", 3/4", and 1"

*T-10 water meters are warranted for performance, materials, and workmanship.*



Every T-10 water meter meets or exceeds the latest AWWA C700 Standard. Its nutating disc, positive displacement principle is time proven for accuracy and dependability since 1892, ensuring maximum utility revenue.

### Construction

The T-10 water meter consists of three major assemblies: a register, an EnviroBrass™ II maincase, and a nutating disc measuring chamber.

The T-10 meter is available with a variety of register types. For reading convenience, the register can be mounted in one of four positions on the meter.

The corrosion-resistant EnviroBrass II maincase will withstand most service conditions: internal water pressure, rough handling, and in-line piping stress.

The innovative floating chamber design of the nutating disc measuring element protects

the chamber from frost damage while the unique chamber seal extends the low flow accuracy by sealing the chamber outlet port to the maincase outlet port. The nutating disc measuring element utilizes corrosion-resistant materials throughout and a thrust roller to minimize wear.

### Warranty

Neptune provides a limited warranty with respect to its T-10 water meters for performance, materials and workmanship.

When desired, maintenance is easily accomplished either by replacement of major assemblies or individual components.

### Systems Compatibility

Adaptability to all present and future systems for flexibility is available only with Neptune's ARB® Utility Management Systems™.

## Key Features

### ■ Register

- Magnetic drive, low torque registration ensures accuracy
- Impact-resistant register
- High resolution, low flow leak detection
- Bayonet style register mount allows in-line serviceability
- Tamperproof seal pin deters theft
- Date of manufacture, size, and model stamped on dial face

### ■ EnviroBrass II Maincase

- Made from EnviroBrass II
- ANSI/NSF 61 Certified
- Lifetime guarantee
- Resists internal pressure stresses and external damage
- Handles in-line piping variations and stresses
- EnviroBrass II provides residual value vs. plastic
- Electrical grounding continuity

### ■ Nutating Disc Measuring Chamber

- Positive displacement
- Widest effective flow range for maximum revenue
- Proprietary polymer materials maximize long term accuracy
- Floating chamber design is unaffected by meter position or in-line piping stresses

## Operating Characteristics

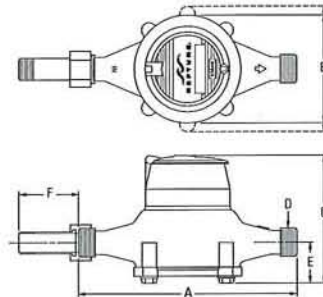
Meter Size	Normal Operating Range @100% Accuracy (±1.5%)	AWWA Standard	Low Flow @ 95% Accuracy
5/8"	1/2 to 20 US gpm 0.11 to 4.55 m <sup>3</sup> /h	1 to 20 US gpm 0.23 to 4.5 m <sup>3</sup> /h	1/8 US gpm 0.03 m <sup>3</sup> /h
3/4"	3/4 to 30 US gpm 0.17 to 6.82 m <sup>3</sup> /h	2 to 30 US gpm 0.45 to 6.8 m <sup>3</sup> /h	1/4 US gpm 0.06 m <sup>3</sup> /h
1"	1 to 50 US gpm 0.23 to 11.36 m <sup>3</sup> /h	3 to 50 US gpm 0.68 to 11.4 m <sup>3</sup> /h	3/8 US gpm 0.09 m <sup>3</sup> /h

## Registration Charts

ProRead Registration (per sweep hand revolution)		5/8"	3/4" & 1"
10	US Gallons	✓	✓
10	Imperial Gallons	✓	✓
1	Cubic Foot	✓	✓
0.1	Cubic Metre	✓	✓
0.01	Cubic Metre	✓	

E-Coder High Resolution (8-digit reading)		5/8"	3/4" & 1"
0.1	US Gallons	✓	✓
0.1	Imperial Gallons	✓	✓
0.01	Cubic Feet	✓	✓
0.001	Cubic Metres	✓	✓

Register Capacity ProRead & E-Coder		5/8"	3/4" & 1"
10,000,000	US Gallons	✓	✓
10,000,000	Imperial Gallons	✓	✓
1,000,000	Cubic Feet	✓	✓
100,000	Cubic Metres	✓	✓
10,000	Cubic Metres	✓	



## Dimensions

Meter Size	A in/mm	B in/mm	C-Std. in/mm	C-ARB in/mm	D-Threads per inch	D-OD in/mm	E in/mm	F in/mm	Weight lbs/kg
5/8"	7 1/2 191	3 5/8 92	4 7/8 124	5 3/8 137	14	1.030 26	1 5/8 41	2 1/2 64	3 3/4 1.7
5/8"x3/4"	7 1/2 191	3 5/8 92	4 7/8 124	5 3/8 137	11 1/2	1.290 33	1 5/8 41	2 5/8 67	4 1.8
3/4"	9 229	4 3/8 111	5 1/2 140	5 13/16 148	11 1/2	1.290 33	1 7/8 48	2 5/8 67	6 2.7
3/4"SL	7 1/2 911	4 3/8 111	5 1/2 140	5 13/16 148	11 1/2	1.290 33	1 7/8 48	2 5/8 67	5 1/2 2.5
3/4"x1"	9 229	4 3/8 111	5 1/2 140	5 13/16 148	11 1/2	1.626 41	1 7/8 48	2 3/4 70	6 1/2 2.9
1"	10 3/4 273	6 1/2 165	6 3/8 162	6 5/8 168	11 1/2	1.626 41	2 1/8 54	2 3/4 70	9 3/4 4.4
1"x1 1/4"	10 3/4 273	6 1/2 165	6 3/8 162	6 5/8 168	11 1/2	1.865 47	2 1/8 54	2 13/16 71	10 1/4 4.6

## Guaranteed Systems Compatibility

All T-10 water meters are guaranteed adaptable to our ARB\*V, ProRead (ARB VI) AutoDetect, E-Coder™ (ARB VII), TRICON\*/S, TRICON/E3\*, and Neptune meter reading systems without removing the meter from service.

## Specifications

- Certification: ANSI/NSF 61
- Application: cold water measurement of flow in one direction
- Maximum operating water pressure: 150 psi (1034 kPa)
- Maximum operating water temperature: 80°F
- Measuring chamber: nutating disc technology design made from proprietary synthetic polymer

## Options

- Sizes:
  - 5/8", 5/8" x 3/4"
  - 3/4", 3/4" SL, 3/4" x 1"
  - 1", 1" x 1 1/4"
- Units of measure: U.S. gallons, imperial gallons, cubic feet, cubic metres
- Register types:
  - Direct reading: Bronze box and cover (standard)
  - Remote reading: ProRead Encoder, E-Coder™, TRICON/S, TRICON/E3
  - Reclaim
- Bottom caps:
  - Synthetic polymer (5/8" only)
  - Cast iron
  - EnviroBrass II, ductile iron
- Connections: EnviroBrass II, straight or bent
- Environmental Conditions:
  - Operating temperature: 33°F to 149°F (0°C to 65°C)
  - Storage temperature: 33°F to 158°F (0°C to 70°C)

Neptune Technology Group Inc. reserves the right to change these specifications without prior notice.



www.neptunetg.com

**Neptune Technology Group Inc.**  
1600 Alabama Highway 229  
Tallahassee, AL 36078, USA  
Tel: (800) 645-1892  
Fax: (334) 283-7299

**Neptune Technology Group (Canada) Ltd.**  
7275 West Credit Avenue  
Mississauga, Ontario  
L5N 5M9  
Canada  
Tel: (905) 858-4211  
Fax: (905) 858-0428

**Neptune Technology Group Inc.**  
Ejército Nacional No. 418  
Piso 12, Desp. 1201-1202  
Col. Chapultepec Morales  
Delegación Miguel Hidalgo  
11570 México, Distrito Federal  
Tel: (525) 55203 5294 / (525) 55203 5708  
Fax: (525) 55203 6503

PS T10SMALL 08.04  
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E-CODER®)R900i™  
INSIDE AND PIT VERSIONS



The E-Coder®)R900i™ combines the field-proven R900® radio frequency meter interface unit (MIU) with our E-Coder® solid state absolute encoder into one integrated package to offer utilities the advantages associated with ease and speed of installation. The E-Coder)R900i does not have any external wires to be installed or require any special programming for operation. The E-Coder)R900i operates within the 902-928 unlicensed RF band.

The E-Coder portion of the integrated unit features a custom integrated circuit design that digitally encodes the rotation of the measuring chamber, providing “absolute” registration with no internal battery requirement. The R900 MIU portion of the integrated unit collects meter-usage data and transmits the data for collection by the meter reader. The R900 MIU is a one-way communication device that transmits data every 14 seconds using frequency-hopping, spread-spectrum technology to ensure data security and improved meter reading accuracy and reliability. Data transmitted by the R900 MIU is received by the Neptune walk-by, mobile, or R900 Gateway fixed network data collection systems and stored for downloading at the utility office.

The E-Coder)R900i provides high resolution, 8-digit remote meter reading and data logging along with value-added features such as leak, tamper, and reverse flow detection. The data logging functionality provides hourly consumption data. Leak flags help identify when the event actually occurs; the same goes for negative consumption that implies a backflow event.

Ninety-six days of historical data can be retrieved directly from the meter and then downloaded directly into N\_SIGHT™ R900® host software. The daily or hourly consumption can then be run as a graph – justifying the amount charged on the bill. Neptune’s data logging is designed to minimize download time as well as the number of service technician visits.

The E-Coder)R900i/PLUS features are also communicated through the E-Coder protocol, allowing host software platforms to interpret the data and pass the information directly to the billing packages, CIS screens, and operations and maintenance reports. The value-added data received through Neptune’s E-Coder)R900i enhances customer service and improves operational efficiencies.

KEY FEATURES

- 8-digit remote meter reading and usage profiling
- Logs 96 days of hourly consumption data
- Leak, tamper, and reverse flow detection
- Ease of installation – no external wiring
- Solid state absolute encoder
- No FCC license required
- No MIU programming required
- Long-life lithium battery with capacitor
- Encoder metrology requires no battery
- Available in both pit and inside versions
- Fully submersible pit version
- LCD leak indicators
- Directional flow indicator
- Rate of flow on LCD display

KEY BENEFITS

- Enhanced “customer care”
  - Leak history/diagnostics
  - Proactive leak notification
  - Provides hourly consumption data
  - Improves meter reading accuracy
  - Eliminates estimated reads
- Enhanced cost savings and ease of installation
  - No external wires
  - Reduces labor cost
  - Reduces potential wire vandalism
- Drought management
  - Reduction of water loss through proactive notification of water leaks
  - Ability to enforce odd/even day water restrictions
- Increased operational efficiencies
  - Reduces costs
  - Minimizes reading time
  - Improves meter reading safety
  - Work order reduction for high water bill inquiries
  - Prioritization of meter maintenance
- Tamper management
  - Identification and prioritization of potential tamper situations

- Replaceable Battery 1
- Antenna 2
- Light Sensor 3
- Flow Indicators 4
- Date of Manufacture 5
- LCD Display 6
- T-10 Meter 7



	<p><b>LIGHT SENSOR</b> Recessed under the small hole near the center of the faceplate of the E-Coder R900i, supplies the power for the LCD panel (light activated) as well as the activation of the data logging extraction.</p>
	<p><b>FLOW INDICATOR</b> Shows the direction of flow through the meter:  <b>ON</b> Water in use.  <b>OFF</b> Water not in use.  <b>Flashing</b> Water is running slowly.          (-) Reverse flow.          (+) Forward flow.</p>
	<p><b>LEAK INDICATOR</b> Displays a possible leak:  <b>OFF</b> No leak indicated.  <b>Flashing</b> Intermittent leak indicates that water has been used for at least 50 of the 96 15-minute intervals during a 24-hour period.  <b>On Continuously</b> Indicates water use for all 96 15-minute intervals during a 24-hour period.</p>
<b>RATE</b>	<p><b>RATE OF FLOW</b> Average flow rate is displayed every six seconds on LCD display.</p>
<b>RF LOG</b>	<p><b>DATA LOGGING</b> displayed on LCD during extraction of data logging consumption data.          **"DL" on dial face denotes data logging</p>
	<p><b>LCD DISPLAY</b> Nine-digit LCD displays the meter reading in billing units of measure: U.S. gallons, cubic feet, Imperial gallons, or cubic metres.</p> <ul style="list-style-type: none"> <li>1 E-Coder basic reading/customary 6-digit remote reading</li> <li>2 Customary sweep hand digits</li> <li>3 E-CoderPLUS reading (8-digit remote reading)</li> <li>4 Testing units used for diagnostics</li> <li>5 Extended reading units</li> <li>6 Customary billing units</li> </ul>

**TECHNICAL SPECIFICATIONS**

- Electrical Specifications:
  - MIU Power: Lithium battery with capacitor
- Transmitter Specifications:
  - Transmit period: Every 14 seconds
  - Transmitter channels: 50
  - Channel frequency: 910 to 920 MHz spread spectrum
  - Output Power: Meets FCC Part 15.247
  - FCC Verification: Part 15.247
- Environmental Conditions: MIU and E-Coder
  - Operating temperature: -22°F to 149°F (-30°C to 65°C)
  - Storage temperature: -40°F to 158°F (-40°C to 70°C)
  - Operating humidity:
    - Inside Set – 0 to 95%, condensing
    - Pit Set – 100% submersible
- Materials
  - Register housing:
    - Inside Set: Plastic Polycarbonate
    - Pit Set: Roll-sealed copper shell
- Lens:
  - Inside Set: Plastic
  - Pit Set: Glass
- Antennas
  - Inside Set: Fixed antenna
  - Pit Set: Standard whip type  
Optional through-the-lid
    - 18" Coax
    - 6' Coax
    - 20' Coax

**OPTIONS**

- Compatibility
  - Available for all sizes and makes of current Neptune meters
  - Handhelds – Walk-by RF
  - MRX920™ – Mobile RF
  - R900® Gateways
- Units of Measure: U.S. Gallons, Cubic Feet, Imperial Gallons, Cubic Metres

**WARRANTY**

- Register: 20 years (10/10)
- R900 MIU: 20 years (10/10)
- R900 Battery: 20 years (10/10)

Neptune Technology Group Inc.  
 1600 Alabama Highway 229  
 Tallahassee, AL 36078  
 USA  
 Tel: (800) 633-8754  
 Fax: (334) 283-7293

Neptune Technology Group (Canada) Ltd.  
 7275 West Credit Avenue  
 Mississauga, Ontario  
 L5N 5M9  
 Canada  
 Tel: (905) 858-4211  
 Fax: (905) 858-0428

Neptune Technology Group Inc.  
 Ejército Nacional No. 418  
 Piso 12, Desp. 1201-1202  
 Col. Chapultepec Morales  
 Delegación Miguel Hidalgo  
 11570 México, Distrito Federal  
 Tel: (525) 55203 5294 / (525) 55203 5708  
 Fax: (525) 55203 6503



# APPENDIX 4

# Town of Charlestown

## Water and Sewer Rate Sheet

### Connection Fees

Water:	\$750.00	Per Connection plus cost of meter and parts
Sewer:	\$750.00	Per Connection plus meter if applicable

### All Charges Billed Semi-Annually

<b>Water:</b>	Base Rate	\$ 55.00	Semi-Annual
	Metered Rate	\$ 0.0185	Per cubic foot
	Muti-Service	\$ 15.00	Per unit over two
	Turn-Off	\$ 30.00	During working hours
	Turn-On	\$ 30.00	During working hours
Unrecorded	Water Neglect	\$ 1,000.00	Per incident
	Meter Cost	Market price paid	
	After Hour Turn Off	\$ 60.00	
	After Hours Turn On	\$ 60.00	

Frozen meter or neglect and broken meter customer is responsible for the cost of the meter and parts plus labor.

<b>Sewer:</b>	Base Rate	\$ 50.00	Semi-Annual
	Metered Rate	\$ 0.026	Per cubic foot of water
	Multi-Service	\$ 15.00	Per unit over two
	Flat Rate	\$ 130.00	Plus \$20.00 per dwelling unit over 1
	Septage Rate	\$ 0.08	Per gallon accepted
Labor cost	Base Rate	\$ 30.00	Per hour Monday-Friday 6am-2:30pm
	After Hours Rate	\$ 60.00	Per hour



## Water Use Facts

Charlestown charges for water using cubic feet because the meters are longer lasting and more accurate.

Charlestown has 1072 water customers and all water meters were replaced in 2003.

Charlestown is 100% metered all customers pay the same rate for service.

Charlestown charges 0.0185 cents per cubic foot of water.

Charlestown charges 0.026 cents per cubic foot of water for sewer users.

### Residential Water Meter Head



1 cubic foot = 7.48 Gallons

100 cubic feet = 748 gallons

1/8 inch leak or one toilet = 78,800cuft of water per billing cycle or \$1,457.80 per bill or \$ 2,915.60 per year just for the water.

Same leak with sewer is \$ 2048.80 per bill or \$4,097.60 per year

Total cost per bill \$ 3,506.60 per billing cycle for one 1/8" 60 psi leak.

It is our experience in the past that if a meter is faulty it usually stops or slows down. We have never had one speed up or read faster than the water passing thou it.

There is no electric power to these meters the only thing that makes them turn is water.

The average use is 50 – 75 gallons of water per person per day.

### **Water costs money... don't waste it!**

A dripping faucet or fixture can waste 3 gallons a day...a total of 1095 gallons a year.

	U.S. Equivalent	Metric Equivalent
Fluid oz.	8 fl. drams (1.804 cu. inches)	29.573 milliliters
Pint	16 fl. oz. (28.875 cu. inches)	0.473 liter
Quart	2 pints (57.75 cu. inches)	0.946 liter
Gallon	4 quarts (231 cu. inches)	3.785 liters

#### Waste per quarter at 60 psi water pressure

Diameter of stream	Gallons	Cubic Feet	Cubic Meters
¼"	1,181,500	158,000	4,475
⅜"	666,000	89,031	2,521
½"	296,000	39,400	1,115
⅝"	74,000	9,850	280



A continuous leak from a hole this size would, over a three month period, waste water in the amounts shown above.

# ENVIRONMENTAL Fact Sheet



29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • [www.des.nh.gov](http://www.des.nh.gov)

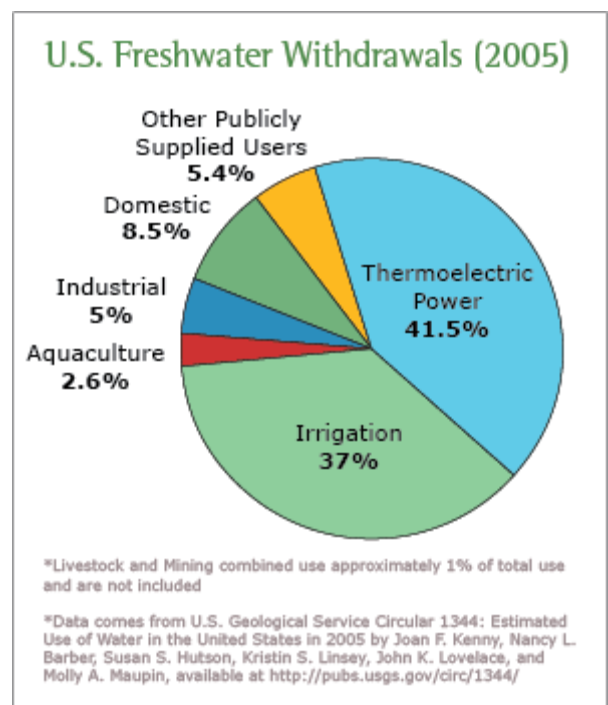
WD-DWGB-26-1

2013

## An Introduction to Water Use Management and Water Efficiency Practices

Water is essential to all life on our planet. Surface and ground waters support a variety of human uses including drinking, irrigation of crops and landscape, industrial processes, domestic applications, and recreation.

Residents have historically thought of New Hampshire as water rich and that conservation was something only people in arid states needed to practice. However, that perception is changing. As Ben Franklin said, “When the well’s dry, you know the worth of water,” later paraphrased by Rowland Howard as “You never miss the water ‘til the well runs dry.” In some parts of the state, wells have indeed gone dry. Water levels in some New Hampshire lakes, ponds, aquifers, and streams have dropped, largely due to over-mining of groundwater supplies. When private and public water wells withdraw more water than the aquifer that supplies them can provide, surface waters may recharge the groundwater. This condition can have serious impacts on both public health and the economy.



Source: EPA WaterSense

Federal regulations applicable to public drinking water quality have become progressively more stringent. Untreated water that once met federal drinking water quality standards is no longer considered potable, and public water suppliers are faced with the increasing chemical, energy, and waste disposal costs of treating raw water. This increase is passed along to their customers in the form of higher rates.

Groundwater supplies are more frequently experiencing quantity deficits. Many private and community wells in New Hampshire have been deepened, replaced, or abandoned due to dwindling production. This decline can be attributed to the stress of escalating housing and industrial development and periodic near-drought conditions. Drilling more or deeper wells, however, will not solve long-term water availability problems. This does not mean New Hampshire residents have to do without adequate water. It simply means that we need to adopt more efficient ways of using water.

States that are less water-rich than New Hampshire have practiced water efficiency methods for decades. Hundreds of water efficient products are now available. Water efficiency management techniques have also been developed including water use and conservation audits, water fixture retrofitting, irrigation scheduling, xeriscape, and water supply maintenance programs.

Water efficiency practices are proven to save valuable water resources and protect the environment. One of the great side benefits of these practices is the simple fact that they save money. Even though the initial cost of replacements or retrofits might be high, most water users find the water-related savings result in a surprisingly short payback period.

### **Water Efficiency Success Stories**

During 2008-2009, DES retrofitted 22 bathrooms in its Concord office with water-efficient toilets, urinals, and faucets. In all, 76 toilets, 30 urinals, and 86 faucet sets were replaced with more efficient models. DES anticipates saving 1.8 million gallons per year resulting in an annual reduction of \$13,000 in water and sewer bills.

Even homeowners can realize astounding savings. One New Hampshire household reported replacing a dripping kitchen faucet and reaping a \$30 drop in the monthly electricity bill. The payback period on the new faucet was less than two months.

One of the most water-intensive uses is lawn and landscape irrigation. A single lawn sprinkler operating at five gallons per minute for half an hour uses as much water as 83 low-flow toilet flushes. That's about a week's worth of bathroom visits for an average family.

These are just a few examples of how practicing water efficiency can benefit you substantially. To help you save money and protect the environment and New Hampshire's valuable drinking water supplies, DES has created a series of fact sheets on water efficiency practices and conservation techniques.

Water efficiency fact sheets may be found at

<http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm#efficiency>.

### **For Additional Information**

Please contact the Drinking Water and Groundwater Bureau at (603) 271-2513 or

[dwgbinfo@des.nh.gov](mailto:dwgbinfo@des.nh.gov) or visit our website at

<http://des.nh.gov/organization/divisions/water/dwgb/index.htm>. The bureau's fact sheets are online at

<http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm>. More information about

the DES Water Conservation Program can be found at

[http://des.nh.gov/organization/divisions/water/dwgb/water\\_conservation/index.htm](http://des.nh.gov/organization/divisions/water/dwgb/water_conservation/index.htm)

### **References:**

New England Interstate Water Pollution Control Commission (NEIWPC), *MRI Water Conservation Technical Bulletin #1, Water Conservation Best Management Practices General Practices and References*; NEIWPC, Lowell, MA; 1996.

Vickers, Amy; *Handbook of Water Use and Conservation*; WaterPlow Press, Amherst, MA; 2001; pp 2-9, 276.

Note: This fact sheet is accurate as of January 2013. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.



## SECTION 9

### TOWN OF CHARLESTOWN, NEW HAMPSHIRE DRINKING WATER PROTECTION DISTRICT ORDINANCE

#### 9.1 AUTHORITY AND PURPOSE

Pursuant to RSA 674:16-21, the Town of Charlestown hereby adopts a Drinking Water Protection District Ordinance and accompanying regulations, in order to protect, preserve and maintain existing municipal groundwater supplies of drinking water within the Town.

#### 9.2 DEFINITIONS

Definitions shall be as contained in section 2 of the Town of Charlestown Book of Ordinances.

#### 9.3 DISTRICT BOUNDARIES

##### A. Location

The Drinking Water Protection District is defined as the area shown on the map entitled "Drinking Water Protection District", and is hereby adopted as part of the Town's Official Zoning Map. The Drinking Water Protection District is a portion of the areas delineated by the groundwater mapping studies entitled Geohydrology and Water Quality of Stratified-Drift Aquifers in the Lower Connecticut River Basin, Southwestern New Hampshire, by Moore, Johnson and Douglas, 1994 (USGS WRIR 92-4013, 68 page report, two sheets (plates) 1:48,000, also available at 1:24,000). The wellhead protection areas were further delineated by the New Hampshire Department of Environmental Services; Wagner, Heindel and Noyes; and the United States Environmental Protection Agency. The Drinking Water Protection District is an overlay district which imposes additional requirements and restrictions to those of the underlying district. In all cases, the more restrictive requirement(s) shall apply.

##### B. Appeals

Where the bounds of a Drinking Water Protection District, as delineated, are in doubt or in dispute, any landowner aggrieved by such delineation may appeal the boundary location to the Planning Board. Upon receipt of a written appeal, the Planning Board shall suspend further action on development plans related to the area under

appeal and shall engage, at the landowner's expense, a qualified hydrologist to prepare a report determining the proper location and extent of the Drinking Water Protection District relative to the property in question.

#### **9.4 USE REGULATIONS**

##### **A. Minimum Lot Size**

The minimum lot size shall be the same as allowed in the underlying zoning district.

##### **B. Water Quality/Quantity Requirements**

Within the Drinking Water Protection District, to the extent feasible, all runoff from impervious surfaces shall not degrade water quality and shall be recharged to the aquifer. Recharge impoundments shall have vegetative cover for surface treatment and infiltration, utilizing methods to include, but not limited to, detention ponds, dry wells and vegetated swales, provided that the following performance standards are met and the plans are approved by the Planning Board.

The developer shall submit a storm-water drainage plan, designed by a licensed civil engineer. Such a plan shall provide for the retention and percolation, within the aquifer, of all development generated storm-water runoff from a ten (10) year storm event, such that the post-development discharge volume to the aquifer is, at a minimum, equal to the pre-development discharge to the aquifer. Furthermore, the storm-water drainage plan shall provide for the removal of oil and gasoline from parking lot runoff by the use of treatment swales, oil/gas separators or other devices, prior to retention and percolation of the runoff.

##### **C. Prohibited Uses**

The following uses are prohibited within the Drinking Water Protection District:

- 1) On-site production, disposal, bulk storage, processing, discharge or recycling of toxic or hazardous materials or wastes;
- 2) Single-walled, underground fuel storage tanks;
- 3) Dumping of snow carried from off-site;
- 4) Automotive uses including: car washes, service and repair shops, junk and salvage yards;

- 5) Laundry and dry cleaning establishments;
- 6) Industrial uses which discharge contact type wastes on site, such as photo-chemicals, radio-active wastes, etc.;
- 7) Road salt storage; or
- 8) Landfills and open dumps.

**D. Conditional Uses**

1) The following uses, if allowed in the underlying zoning district, are permitted only after approval is granted by the Planning Board:

- a) Industrial and commercial land uses not otherwise prohibited by Section 9.4.C, of this Ordinance;
- b) Multi-family residential development;
- c) Sand and gravel excavation and other mining provided that such excavation or mining is not carried out within six vertical feet of the seasonal high water table;
- d) Animal feedlots and manure storage facilities, provided that the applicant has agreed to adopt the Best Management Practices and operational guidelines of the Sullivan County Conservation District (SCCD) before such uses are established;
- e) Storage of chemicals for private or municipal water treatment

2) The Planning Board shall grant approval for those uses listed above only after it is determined that all of the following conditions have been met.

- a) The use will not detrimentally affect groundwater quality, nor cause a significant long-term reduction in the volume of water contained in the aquifer or in the storage capacity of the aquifer.

For uses described in Section 9.4.D.1(a) and (b) the Planning Board shall make this determination by applying the performance standard outlined in Section 9.4.D, item 2 (a);  
b) the use will discharge no waste-water on-site other than to State approved waste-water disposal systems;

c) the proposed use complies with all other applicable provisions of this section.

3) All conditional uses shall be subject to inspections by the Water Department or other agent designated by the Selectmen. The purpose of these inspections is to ensure continued compliance with the conditions under which approvals were granted.

#### **E. Permitted Uses**

The following activities may be permitted provided they are conducted in accordance within the intent of this Ordinance:

- 1) Any use permitted by the underlying district of the Zoning Ordinance, with the following exceptions:
  - a) that the provisions of Section 8.4.4 of the Zoning Ordinance, which relate to the so-called '100' rule', do not apply; and
  - b) those uses prohibited in Section 9.4.C or regulated by Section 9.4.D of this article.
- 2) Maintenance, repair of any existing structure, provided that the use complies with Section 9.4.B of this article.
- 3) Agricultural and forestry uses, provided that fertilizers, pesticides, manure and other leachables are applied and stored according to best management practices, as prescribed by the Sullivan County Conservation District, if applicable. All said leachables must be stored under shelter.
- 4) An applicant for any use requiring a sub-surface disposal system, in excess of the capacity required for single-family residential occupancy, must submit a professional engineering study offering conclusive evidence that the wastes will not adversely impact upon surface or groundwater water quality.
- 5) An applicant for any use which may reasonably be expected to cause a permanent increase in the volume of water drawn from within a delineated Drinking Water Protection District, must submit a professional civil engineering study offering conclusive evidence that the proposed use will not substantially impact upon the quantity of water in the wellhead.

**F. Non-Conforming Uses**

Any non-conforming use within the Drinking Water Protection District shall comply with the provisions of Sections 8.4.1 and 8.4.2 of the Zoning Ordinance (Non-Conforming Uses).

**9.5 MISCELLANEOUS PROVISIONS**

Where the premises are partially outside of the Drinking Water Protection District, potential pollution sources such as, but not limited to, on-site waste disposal systems, shall be located outside and down gradient of the Zone to the extent feasible.

**9.6 ADMINISTRATION**

**A. Application and Interpretation**

The provisions of the Drinking Water Protection District shall be applied and interpreted by The Planning Board

**B. Enforcement**

The Board of Selectmen (or their duly designated agent) shall be responsible for the enforcement of the provisions and conditions of the Drinking Water Protection District.

**9.7 CERTIFICATION**

I hereby certify that the foregoing is a true copy of the Town of Charlestown, New Hampshire Drinking Water Protection District Ordinance, as amended by the Planning Board at a Public Hearing duly warned and held on January 6, 1998, with a second hearing on January 20, 1998. The Ordinance was thereafter approved by the Charlestown Annual Town Meeting, held on Tuesday, March 10, 1998.

Signed Marianne S. Marsha  
Marianne S. Marsha, Planning Administrator

Received this 18<sup>th</sup> day of March, 1998

Debra J. Clark Seal  
Debra J. Clark, Charlestown Town Clerk

drwprot 3/18/98

**TOWN OF CHARLESTOWN  
NEW HAMPSHIRE  
WATER SYSTEM ORDINANCE**

**Adopted May 3, 2006**

**As Amended Through  
June 5, 2013**

**Charlestown Selectboard**

  
Brenda L. Ferland, Chair

  
Arthur Grenier

  
Steven A. Neill

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**RULES AND REGULATIONS**  
(Subject to change without notice)

**1. DEFINITIONS**

The word "Department" as used herein is the Charlestown Water Department.

"Commissioners" means the Charlestown Selectboard acting in their capacity as the Town's Water & Wastewater Commissioners.

"Customer" means any person, firm, corporation, company, association, governmental unit or owner of property as guarantor, furnished water service by the Charlestown Water Department.

"Premises" shall include but is not restricted to the following:

- (a) A building or combination of buildings owned or leased by one customer, in one common enclosure, occupied by one family as a residence or one corporation or firm as a place of business, or
- (b) Each unit of a multiple house or building separated by a solid vertical partition wall occupied by one family as a residence or one firm as a place of business, or
- (c) Each unit in a building owned or leased by one customer and having a number of apartments, offices or lofts which are rented to tenants using in common one hall and one or more means of entrance, or
- (d) Each unit in a building two or more stories high under one roof owned or leased by one customer and having an individual entrance for the ground floor occupants and one for the occupants of the upper floors, or
- (e) A combination of buildings owned by one customer in one common enclosure, none of the individual buildings of which is adapted to separate ownership, or
- (f) A public building, or
- (g) A single plot, used as a park or recreational area.

"Common Enclosure" means property under common ownership which is bounded by property lines, public streets or highways.

"Service Pipe" means the pipe that runs between the main and the customer's meter.

"Service connection" means the service pipe including corporation cock from the main to and including the curb stop adjacent to the street line or the customer's property line, and such other valves and fittings as the Department may require between the main and the curb stop.



## **2. GENERAL**

The following rules and regulations, and all subsequent changes, amendments and additions thereto shall constitute a part of the contract with every water customer.

Every water customer served by the Department shall be the property owner, and said owner shall be considered to have agreed to be bound by these rules and regulations.

A copy of these rules and regulations is available to any water consumer and can be obtained by contacting the main office of the Water Department. All persons are requested to read same carefully. Failure to know the rules and regulations will not excuse any water customer from the consequences of violating such rules and regulations.

## **3. APPLICATIONS**

- (a) All applications for service connections and use of water shall be made at the Office of the Department on the form prescribed, and signed by the owner of the premises to be supplied, or by his duly authorized agent, stating fully and truly the various uses to which the water is to be applied. The approval of the application by the Department shall constitute a contract between the Department and the applicant, obligating the applicant to pay the rates and charges established by the Department and comply with its rules and regulations.
- (b) Owners of property will be held responsible for all payments of all just charges for services furnished them or their property during ownership, until such time as the department receives notice in writing of the transfer of the property. All bills will be rendered to the owner of the property.

## **4. SERVICE PIPE CONNECTIONS**

- a. For ordinary residential service the Department will furnish and install between the main line to the inside of the curb line within public ways and streets, a three quarter inch (3/4) tap and a service pipe of not larger than three quarter inch (3/4) internal diameter at a cost as established by the Department.
- b. In all cases the Department reserves the right to specify the size of the service and meter to be installed, and such sizes will be dependent upon the particular requirements and operating conditions and the applicant shall pay the excess cost thereof, within street limits over and above the cost of the normal residential service.
- c. No new service or service lines, or extensions will be installed during the period from December 1<sup>st</sup> to March 31<sup>st</sup> except at the discretion of the Department. To cover additional cost of laying service when ground is frozen or because of unusual climatic conditions, an extra charge may be made varying with the pipe and length of the service required.

- d. Only one service line will be supplied to a property under each application, unless otherwise specified by the Department.
- e. All service pipes 2 inches and smaller shall be copper type K. Larger sizes shall be subject to approval of the Department.

## **5. WORK INSIDE OF THE CURB LINE**

- a. All work inside the curb line, or in the absence of curbing in the street, 3 feet into highway beyond the property line, shall be done by and at the expense of the customer. The Department reserves the right to decline to connect with plumbing which has not been examined and approved by the Department or its duly authorized representative.
- b. All pipes laid between the curb-stop and the customer's stopcock must have at least 4 feet of earth cover and shall be tested for water tightness by the Department before being covered. Any exceptions shall have approval of the Department.
- c. No service pipes shall be laid within 10 feet of gas pipe, sewer pipe or any other facility of a public service company, nor within three feet of any open excavation or vault, or within 20 feet of a sewage disposal system.
- d. An approved stop and waste cock shall be installed in the service pipe inside the wall line of the building so located as to drain the meter. An approved shut-off valve shall be placed on both sides of the meter assembly.
- e. The Department will furnish the necessary coupling and spacer to be placed in the line to accept a meter Note: section 5B
- f. All repairs to and cost of maintenance of water service pipe from curb-stop to meter shall be at the expense of the customer. If such pipes are not repaired promptly following written notice of need thereof the Department reserves the right to discontinue the service without further notice. The Department shall not be responsible for maintenance or for damage done by water escaping from the service pipe between the Curb Stop and the foundation nor the interior of the foundation.
- g. Prior to the implementation of these regulations, where two or more customers are supplied with water from one service pipe under the control of one curb-stop, if any of the parties so supplied shall violate its rules and regulations, the Department reserves the right to shut off the joint service line as specified in paragraph (f) above. However, such action shall not be taken until the non-violating customer(s) has been given reasonable opportunity to obtain independent service. Reasonable opportunity is defined as sixty days.

## 6. WATER DISTRIBUTION MAINS

- a. The installation or extension of water mains in any public street or way, or in any duly approved private street or way, may be made only as authorized by the Commissioners and in accordance with and subject to such conditions and requirements as the Department may prescribe. All main will be Ductile Iron class 52 cement lined or approved equal. Failure to comply is subject to refusal of service.
- b. All private water lines or main extensions must be pressure tested and chlorinated, Coliform test must be negative before service is supplied and specified by the Department. The entire cost of the test, chlorination and lab work shall be borne by the applicant.

## 7. METERS

- a. All domestic, commercial and industrial water service, including fire protection, will be rendered through meters.
- b. Meters up to and including  $\frac{3}{4}$  inch in size will be provided by the Department. They may be installed by the Department or a licensed plumber. Such meters will require a deposit as established in the Department's schedule of rates and charges. Larger meters will be available from the Department and are charged at a rate established by the Department. All Meters must be approved by the Department.
- c. The installation, repair and disconnection of the Department's meters will to be performed by the employees of the Department or a licensed plumber. If a licensed plumber does work it must be inspected and approved by the Department.
- d. The normal maintenance cost for meters up to and including  $\frac{3}{4}$  inch size will be borne by the Department. The cost for larger meters and unusual repairs necessitated by freezing, hot water, or attributable to any carelessness or neglect on the part of the occupant or owner of the premises, shall be charged to the owner of the premises. This includes wires and outside readers.
- e. A suitable location for installing all water meters shall be provided so that they will be readily accessible for inspection, reading and repair. The Department shall have access to the premises supplied at all reasonable hours for the purpose of reading meters or to examine piping and fixtures connected with the water service.
- f. Whenever an outside location is approved by the Department the meter shall be in an approved pit located where it is easily accessible for meter reading and repairs. The outside vault shall be located inside the property line at the expense of the customer and responsibility for damage or theft that be that of the owner.

- g. All meters shall be connected using couplings furnished by the Department. Meters shall not be moved or disturbed without permission of the Department. The customer shall bear the cost of all pipe changes on his premises made necessary to receive the meter.
- h. All water passing through and recorded by a meter shall be charged for, whether used or wasted as a result of leaks or neglect and the property owner shall be liable and charged for the amount of all water recorded by the meter in conformity with the current schedule of water rates.
- i. Meters up to and including  $\frac{3}{4}$  inch can be tested upon request of the customer. If the meter is found to be accurate within 4%, a test charge in accordance with the Department's rates shall be made to the customer for the test. If the meter error is greater than 4%, the cost of the test will be borne by the Department, and an adjustment of the customer's water bill may be made based upon average daily consumption. Meters larger than  $\frac{3}{4}$  inch in size will be tested at the request and expense of the customer. The charge for the test will be in accordance with prevailing costs.
- j. The Department reserves the right to remove and test all meters within the system without cost to the customer whenever doubt exists on the part of the Department as to the accuracy of the meter. Should the meter fail to register within 4%, the charge for water will be based on the average daily consumption either prior to or subsequent to the failure of the meter.

## 8. HYDRANTS

- a. All public fire hydrants and their connections are installed and maintained by the Department and remain a part of the system.
- b. No person shall obstruct the access to any fire hydrant by placing or permitting snow, debris, building material or other obstructions to remain at or about hydrants so as to interfere with their immediate use.
- c. Public fire hydrants are installed for the sole purpose of fire protection; and, with the exception of the members of Fire Departments operating them for the legitimate purpose of said Departments, no use of hydrants shall be made without written consent of the Department or its duly authorized representative.
- d. The Department may install a hydrant or hydrants in private water lines at the request and expense of the applicant. Installation and assessment charges for these hydrants will be in accordance with the Department's schedule of rates. These hydrants will be subject to the provisions of these regulations.
- e. The customer agrees that the Department will not be considered in any manner an insurer of property or persons, or to have undertaken to extinguish fire or to protect any

persons or property against loss or damage by fire or otherwise, and that it shall be free and exempt from any and all claims of damages on account of any loss of or damage to property or injury to persons by reason of fire, water, failure to supply water or pressure, or for any other cause whatsoever.

## 9. CROSS CONNECTIONS

### a. PURPOSE

Cross connections between water supplies and non-potable sources of contamination represent one of the most significant threats to health in the water supply industry. This program is designed to maintain the safety and potability of the water in the Charlestown Water Department's system by establishing rules and procedures to control cross connection situations and to prevent the contamination of public drinking waters by the backflow of water or other liquids, gases, mixtures or substances into the distribution system from a source or sources other than its intended source. This Ordinance is intended to supplement the regulations promulgated by the Water Division of the NH Department of Environmental Services as listed in section (b) below. The attention of all concerned parties is directed to those regulations.

### b. AUTHORITY

1. New Hampshire Code of Administrative Rules, Part WS 314, Cross Connections.
2. Town of Charlestown (Water Department)

### c. DEFINITIONS

#### 1. Backflow

The flow of water or other foreign liquids, gases or other substances into the distribution system of a public water supply from any source other than the intended source.

#### 2. Backflow Preventer

A device to prevent backflow.

##### a) Air Gap

A physical separation sufficient to prevent backflow between the free-flowing discharge end of the potable water system and any other system.

##### b) Atmospheric Vacuum Breaker

A device which prevents back-siphonage by creating an atmospheric vent where there is either a negative pressure or sub atmospheric pressure in a water system.

c) Backflow Preventer with Intermediate Atmospheric Vent

A device having two check valves separated by an atmospheric vent.

d) Double Check Valve

A device having two spring loaded, bronze faced with rubber disc, check valves with shutoff valves and test cocks for periodic testing.

e) Hose Bibb Vacuum Breaker

A device which is permanently attached to a hose bibb and which acts as an atmospheric vacuum breaker.

f) Pressure Vacuum Breaker

A device containing a spring loaded check valve and a spring-loaded atmospheric vent which opens when pressure approaches atmospheric pressure. It contains valves and fittings which allow the device to be tested.

g) Reduced Pressure Principle Backflow Preventer

An assembly of check valves and a reduced pressure zone which spills water to the atmosphere in event of the failure of the valves. It has valves and fittings which allow the device to be tested.

### 3. Back-siphonage

Backflow resulting from negative or less than atmospheric pressure in the water system.

### 4. Back-pressure

A condition in which the owner's system pressure is greater than the supplier's system pressure.

### 5. Containment

A method of backflow prevention which requires a backflow preventer at the water service entrance.

### 6. Cross-connection

Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other water or other substances of unknown or questionable safety, whereby water or other substances may flow from one system to the other, the direction of flow depending on the pressure differential between the two systems.

7. Department

Town of Charlestown Water Department.

8. Division

Water Division of the New Hampshire Department of Environmental Services.

9. Fixture Isolation

A method of backflow prevention in which a backflow preventer is located to correct a cross-connection at an in-plant unit rather than at the water service entrance.

10. Owner

Any person who has legal title to, or license to operate or habituate in, a property upon which a cross-connection inspection is to be made or upon which a cross-connection is present.

11. Permit

A document issued by the Department which allows the use of a backflow preventer.

12. Person

Any individual, partnership, company, public or private corporation, political subdivision or agency of the State, department, agency or instrumentality of the United States or any other legal entity.

13. Water Service Entrance

That point in the owner's water system beyond the sanitary control of the Department. This will ordinarily be the outlet end of the meter and will always be before any unprotected branch.

d. ADMINISTRATION

1. The Department will operate a cross-connection control program, including keeping necessary records, which fulfills the requirements of the Division's Cross connection Regulations and is approved by the Division.

2. The Owner shall allow his property to be inspected for possible cross-connections and shall follow the provisions of the Department's program and the Division's Regulations if a cross-connection is permitted.
3. If the Department requires that the public supply be protected by containment at a property, the Owner shall be responsible for water quality beyond the outlet end of the containment device, and can utilize fixture isolation for that purpose.
4. Both the Department and the Owner shall attempt to eliminate all cross-connections.

e. RESPONSIBILITY

1. Code enforcement

- a) The Building Inspector shall provide to the Department a list of currently installed devices to the degree such information is available.
- b) On new or renewal plumbing applications, the Department shall provide cross-connection permit applications to the Owner.
- c) The Department shall approve occupancy only after a backflow preventer is installed, if required by the Department.
- d) The Building Inspector will notify the Department of any unprotected cross-connection observed at premises during other plumbing or building inspections.

2. Department

- a) On new or renewal plumbing work, the Department shall inspect and/or review plans to determine backflow preventer requirements, notify Owner of requirements, issue backflow preventer permit, arrange and/or perform installation inspection and testing. All costs shall be borne by the owner.
- b) For premises existing prior to the start of this program, the Department will perform evaluations and inspections of plans or premises and inform the Owner by letter of any correction deemed necessary, the method of making the correction, and the time allowed for correction to be made.
- c) The Department will not allow any cross-connection to remain unless it is protected by an approved backflow preventer, for which a permit has been issued and which is regularly tested and proven to operate satisfactorily.
- d) The Department shall inform the Owner by letter of any failure to comply by the time of the first re-inspection. The Department will allow an additional fifteen (15) days for the correction. If there is a failure to comply with the needed correction by the time of the second re-inspection, the Department



shall inform the Owner by letter that the water service to the Owner's premises will be terminated within period not to exceed five days. If the Owner informs the Department of extenuating circumstances as to why the correction has not been made, extensions to these time periods may be granted by the Department but in no case shall exceed an additional thirty days.

- e) If the Department determines at any time that a serious threat to the public health exists, service shall be terminated immediately.
- f) The Department shall begin initial premise inspections to determine the nature of existing hazards and corrections to be made, following approval of this program by the Commissioners on behalf of the town and the Division on behalf of the State, during calendar year 2006. Initial focus shall be concentrated on industrial and high hazard premises. The Department shall eventually inspect each industrial, commercial, governmental or large residential premise. The Department shall re-inspect each premise at the time of Permit renewal or every five years.

### 3. Owner

- i. The Owner shall be responsible for the elimination or protection of all cross-connections on his premises. The Owner shall have the responsibilities as contained in Section WS 314.04 of (b), 1 (above).
- ii. The Owner, after being informed by a letter from the Department of the need there for, shall at his expense install, maintain and test, or have tested, any backflow preventer on his premises.
- iii. The Owner shall correct any malfunction of the backflow preventer which is revealed by periodic testing. This shall include the replacement of parts or the replacement of the backflow preventer if deemed necessary by the Department.
- iv. The Owner shall inform the Department of any new, proposed or modified cross-connections and any existing cross-connections of which the Owner is aware but which have not been recorded by the Department.
- v. Any Owner having a private well or other private water source shall have a permit if the well or source is cross connected to the Department's system. Approval to cross-connect may be denied by the Department. The Owner shall be required to have a backflow preventer at the service entrance if a private water source is permitted.
- vi. The Owner shall not install a bypass around any backflow preventer unless there is a backflow preventer on the by pass. Owners who cannot shut down operation for testing must supply the additional devices necessary to allow testing to take place.

- vii. Only backflow preventers listed or approved by the Department and the Division shall be installed.
- viii. Backflow preventers shall only be installed in a manner approved by the Department.
- ix. If plumbing is installed to provide potable water for domestic purposes which is on the Department's side of the backflow preventer, such plumbing must have its own backflow preventer or individual fixture isolation.
- x. The Owner shall be responsible for the payment of all fees for Permit (s), annual or semi-annual device testing, retesting in the case a device fails to operate correctly, and second re-inspection for non-compliance with Department or Division rules and regulations.

f. DEGREE OF HAZARD

The Department recognizes the difference in the threat to the public water system arising from different types of cross-connection. These are classified as follows:

1. Low Degree of Hazard

If backflow were to occur, the resulting effect on the water supply would be a change in its aesthetic qualities. The foreign substance must be non-toxic to humans.

2. High Degree of Hazard

If backflow were to occur, the resulting effect on the water supply could cause illness or death if consumed by humans. The foreign substance may be toxic to humans either from a chemical, bacteriological or radiological standpoint. The effects of the contaminants may result from short or long-term exposure.

g. PERMITS

- 1. The Department shall not permit a cross-connection within the public water supply system unless it is deemed necessary and cannot be eliminated.
- 2. Plumbing permits are required for the installation of backflow prevention devices and are secured from the Code Enforcement Department.
- 3. Cross-connection Permits are required for each backflow prevention device and are secured from the Department. There is no fee for the initial permit.
- 4. The Permit shall contain the information required in WS 314.05, (b), 3.
- 5. Permits shall be renewed every five years and are non-transferable. Permits are subject to revocation for cause by the Department and shall be immediately revoked

if the Owner should so change the type of cress-connection or degree of hazard associated with the service.

6. A Permit is not required when fixture isolation is achieved with the utilization of a non-testable backflow preventer. Any existing backflow preventer shall be allowed by the Department to continue in service unless the degree of hazard is such as to supersede the effectiveness of the present backflow preventer, or result in an unreasonable risk to the public health.

#### h. PERIODIC TESTING

1. Backflow prevention devices shall be inspected and tested at least semi-annually in high hazard situations and annually in low hazard situations. This is the responsibility of the owner. Failure to comply will result in notice to shut off service.
2. The Department's or Owners certified inspector shall perform periodic testing.
3. The testing shall be accomplished during the Department's regular business hours. Exceptions to this, when at the request of the Owner, may require additional charges to cover increased costs to the Department.
4. Any backflow preventer which fails during a periodic test will be repaired or replaced. Certain high hazard situations will not be allowed to continue unprotected if the backflow preventer fails the test and cannot be repaired immediately. In other situations, a compliance date of not more than seven days after the test date will be established. The Owner is responsible for the provision of spare parts, repair tools or replacement devices. Parallel installation of two devices is an effective means of insuring uninterrupted water service during testing or repair of devices and is strongly recommended when the Owner desires such continuity.

#### i. RECORDS AND REPORTS

##### 1. Records

- i. Master files on customer inspections.
- ii. Master files on cross-connection permits
- iii. Copies of permits and permit applications.
- iv. Copies of lists and summaries supplied to the Commission.

##### 2. Reports

- a) Initial lists to Division (Forms X-1 (H) & X-1 (L) by February 1, 2006.

- b) Owners must have inspection sheets to the department by January 1 each year
- c) Annual update lists thereafter to Division by April 1 of the following year.
- d) Annual summary of inspections to Division by April 1 of the following year utilizing Form X-2.

## 10. WATER BILLS

Water bills are prepared by the Commissioners' office.

1. Meters are read semi-annually. All seasonal customers shall notify the Department before closing the premises for the season, so that a meter readings can be taken.
2. The Department may require a deposit from a customer whose water has been shut off for any violation of these regulations, for non-payment, or where adequate credit has not been established. The amount of the deposit shall be at the discretion of the Department.
3. When transfers of property are to be made, those interested shall arrange to have the meter read for the proper water charge adjustment between buyer and seller. The seller shall promptly notify the office of the Department of the sale and meter reading as of the date of sale and give the name and address of the purchaser. The new owner must promptly sign a new application.
4. Whenever a customer sells or transfers property, the customer shall promptly notify the Department in writing, giving the name and address of the new owner.
5. Each customer shall be liable for payment of all charges including bills for water furnished to lessees during their ownership and until such time as the Department receives notice in writing of the transfer of his property.
6. Water rates will be charged on the basis of semi-annual meter readings in accordance with latest rate schedule. All bills are due and payable 30 days after the date of mailing.
7. All charges for water supplied by the Department shall constitute and remain a lien upon the buildings and land in connection with which said water shall have been used by the owner or occupant thereof until such rates, interest, shut-off charges and lien fees as specified in the latest rate schedule have been paid. The Commissioners shall have the authority and responsibility to foreclose such liens.
8. Such liens shall be discharged by the Commissioners upon payment of such unpaid water rates, interest, shut-off fee and lien fee as specified in the Water Department's schedule of rates.

## 11. FEES

- a. Service to any customer may be discontinued for violation of any of these rules and regulations. However, before service may be discontinued for such violations, the Department will give written notice to the customer, stating the rule violated, the manner of violation and specifying a period of 15 days after which service will be discontinued. After service is discontinued for violation of rules and regulations, service will not be restored until reasonable assurance is given that the customer has and will continue to comply with the rules and regulations and the fee specified in the Department's schedule of rates has been paid to the Department to cover the cost of service restoration.
- b. All bills and charges for labor and materials or other services are due and payable when rendered. If not paid within 30 days from the date of the bill, the Department may shut off the water and discontinue the service or place liens after having given 15 days written notice. The water will not be turned on until satisfactory arrangements have been made for the payment in full of all amounts due, including any bills for repairs and other services, plus a charge for restoring the service as specified in the Department's schedule of rates.

For seasonal customers closing their premises, the water will be shut off, the meter stored during the absence and replaced upon re-occupancy. Such work will be done by the by the Department and will be subject to charges specified in the Department's schedule of rates. The Owner or authorized agent must be on premises when water is turned on or off.

10. In the event that water service is temporarily discontinued to any premises for any reason, including the destruction, demolition or razing of the structure, the customer shall continue to be subject to and billed for the then prevailing minimum service charge. Failure to pay such minimum service charge shall constitute the permanent discontinuance of service and the subsequent restoration of service to the premises shall require the payment of the then prevailing connection fees.

## 12. GENERAL RULES

- a. All damages to water mains or service pipes, hydrants or other parts of the water system caused by any agency in putting in sewers, drains, pipes or in any other manner, shall be chargeable to the owner of the premises for whom such work is done.
- b. No person shall be entitled to damages, nor to have any portion of a payment refunded, for any stoppage of supply occasioned by accident to any portion of the work, nor for stoppage for purpose of additions or repairs; nor for non-use occasioned by absence or any other reason, and the Department shall have the right at all times to shut off the water temporarily without notice (although it is intended that prior notice will be given whenever possible) for repairs, extensions or other necessary work connected with the

distribution system, or for causes beyond its control. No Customer or other persons or corporation will be entitled to recover any abatement or compensation for damages, on account of shutting off or the limitation of the use of water for damages, on account of shutting off or the limitation of the use of water for non-payment of bills or for neglect or refusal to comply with the rules and regulations of the department. The Department restricts or regulates the quality of water used by consumers in case of scarcity, or wherever the public welfare may require it.

- c. All Customers having boilers on their premises which depend on the pressure in the pipes to keep them supplied are hereby cautioned against danger of collapse; the Department does not recommend the installation of boilers on direct pressure and will not be responsible for damages or leaks arising there from. Neither the Department nor its agents shall be held liable for damages, costs or expenses for personal or property damages caused by bursting, collapse or leakage of pressure boilers of hot water tanks, nor any leakage from pipes, fixtures or other appliances on the premises.
- d. Water used by private contractors under contracts with the Town of Charlestown for work other than for the Department will be charged at the regular schedule rates and payment for same must be made by said contractors.
- e. All water furnished the Town of Charlestown for whatever purpose shall be charged for and collected at the regular schedule rates.
- f. The authorized agents of the Department shall have the right of access at all reasonable hours, to the premises supplied with water for the purpose of reading meters, examining pipes and fixtures, observing manner of water usage, and for any other purpose which is proper and necessary in the conduct of the Department business, and will carry with them the proper credentials denoting their employment by the Department.
- g. No unauthorized person shall open or close any stopcock or valve in any public or private line.
- h. The Department reserves the right to change or amend from time to time terms, conditions, and rates for the uses of water in accordance with the Statutes of the State of New Hampshire.
- i. The Owner shall be responsible for maintaining the water system, which is under the control of the Owner, in good working order including but not limited to: meters, pipes, conduits or any other apparatus which constitutes the Owner's water system. If the Owner neglects, fails or refuses to properly maintain the water system resulting in a failure of the water system which culminates in unrecorded water use then, the Owner shall be responsible for the fee associated with such water use as described in the water rates schedule. **(Amendment approved after duly noticed public hearing 5/19/2010)**

## 13. EMERGENCY WATER USE RESTRICTIONS

### I. Purpose

The purpose of this ordinance is to ensure the use of water is regulated in a manner the Town of Charlestown deems to be in the interest of The Town of Charlestown.

The Town of Charlestown may use reasonable means to protect, preserve and maintain the public health, safety and welfare when a water supply shortage exists.

### II. Authority

The Town of Charlestown adopts this Ordinance under its authority to regulate public water systems under RSA 38:26.

### III. Definitions

- A. Person: Any individual, corporation, trust, partnership, joint stock company, association, state, municipality, commission, United States government or any agency thereof, political subdivision of the State or any interstate body, or other entity.
- B. Water supply shortage: A situation when insufficient water is available to meet the present or anticipated needs of the municipality. A water supply shortage usually occurs due to drought or a major infrastructure failure.

### IV. Requirements

Upon declaration of a water supply shortage or other water emergency The Town of Charlestown shall be authorized to determine and implement a certain restriction necessary to conserve and maintain adequate reserves of the public water supply. Provided there is a declaration as noted above, the following levels of restriction will apply immediately after the public notification period specified in Section VI.

#### A. If The Town of Charlestown issues a Level 1 restriction, then

- i. The public is requested to refrain voluntarily from landscape watering and to limit the amount of water used outdoors for other purposes.
- ii. Landscape watering shall not occur between hours of 8AM and 7PM

#### B. If The Town of Charlestown issues a Level 2 restriction, then

- i. Landscape watering by odd numbered addresses is allowed on odd numbered days.
- ii. Landscape watering by even numbered addresses is allowed on even numbered days.
- iii. Landscape watering shall not occur between hours of 8AM and 7PM

#### C. If The Town of Charlestown issues a Level 3 restriction, then

- i. Landscape watering by odd numbered addresses is allowed on Mondays and  
Thursdays.
- ii. Landscape watering by even numbered addresses is allowed on Tuesdays and  
Fridays

- iii Landscape watering shall not occur between hours of 8AM and 7PM
- iv Use of automated landscape sprinklers systems is prohibited.

**D. If The Town of Charlestown issues a Level 4 restriction, then**

- i Landscape watering is prohibited
- ii The filling of swimming pools is prohibited
- iii Washing of streets, driveways, sidewalks or other impervious areas is prohibited.
- iv Washing of cars or boats shall be prohibited

**VI. Public Notification of a Water Supply Shortage**

Notification of intent to implement water use restrictions by The Town of Charlestown due to a water supply shortage shall be posted in two public locations and published in a newspaper of general circulation within the Town of Charlestown or by such other means reasonably determined to notify all affected water users.

**VII. Termination of a notice of a Water Supply Shortage**

The governing body of the Town of Charlestown upon a determination that the water supply shortage no longer exists may terminate a State of Water Supply Shortage. Public notification of the termination of the State of Water Supply Shortage shall be given in accordance with section VI.

**VIII. Exceptions to Restrictions**

- A. Hand irrigation of crops used for food by residents at a residential property shall not be restricted.
- B. Water to sustain animal life shall not be restricted.
- C. Despite the authority granted by section II. Of this Ordinance, orders imposing water use restrictions shall not apply to uses that obtain water from sources other than the public water supply, unless it can be clearly demonstrated that the use of such water directly affects the public water supply.

Note: The Town of Charlestown has the authority to implement lawn watering restrictions in accordance with RSA 41:11-d applicable to all water users (including those using private wells) under state declared drought conditions. See DES guidance in Restricting Residential Lawn Watering During State and Federal Declared Droughts.

**IX. Penalties**

Any person failing to comply with the restrictions imposed pursuant to this Ordinance shall be subject to a fine and/or be subject to imposition of civil penalties pursuant to RSA 38:26,II not to exceed \$10,000 per day of such violation. Recovered penalties shall be used as the Town of Charlestown may direct. In addition to the forgoing penalties, the Town of Charlestown is authorized to discontinue the furnishing of water where orders and restrictions have been violated. Such discontinuance shall be made pursuant to RSA 38:31 and may be continued so long as there is evidence that the violations will continue.



Penalties for any Level 2, 3 or 4 Violation:

First Violation: Written Warning

Second Violation: \$100 Fine

Third Violation: Fine not to exceed \$1,000 and discontinuance of water service. A reactivation fee of \$100.00 will be charged before water service is restored.

**(Section 13 – Emergency Water Use Restrictions**

**Adopted June 5, 2013 after duly noticed public hearing held May 1, 2013)**

Town of Charlestown

Public Water System

**Emergency Action Plan and Guide**

EPA # 0411010

2009

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**Section 1. System Identification:**

EPA Number #:	0411010
System Name:	Town of Charlestown
System Address:	PO. Box 385
Town:	Charlestown
Source ID/Type Description/Well Yield:	502/GRW/Claybrook 400 gpm
Source ID/Type Description/Well Yield:	504/GRW Bull Run 200 gpm
Population Served/# Service Connections:	2,600 persons & 1,000 Connections
Name, Title, Phone of person responsible for maintaining this emergency plan:	David P. Duquette Superintendent 1-603-826-5387 (Office) 1-603-371-7185 (Cell)

**Section 2. Chain of Command:**

Selectboard Chair

Brenda Ferland  
1-603-826-5034 Home  
1-603-826-4400 Town Office

Water Department Superintendent

David P. Duquette  
1-802-875-6280 Home  
1-603-371-7185 Cell  
1-603-248-8864 Pager  
[dduquette@charlestown-nh.gov](mailto:dduquette@charlestown-nh.gov)

Water Department Operator

Rodney Rumrill  
1-603-826-5635 Home  
1-603-371-7186 Cell  
1-603-248-8863 Pager

Water Department Operator

Ernest Chambers  
1-603-826-5896 Home  
1-603-371-7187 Cell  
1-603-824-8865 Pager

**Section 2 A. Responsibilities:**

**Selectboard:**

1. Overall responsibility for managing a Town Emergency.
2. Instruct the Superintendent or others to implement Emergency Action Plan.
3. Implement a boil water or contamination notice.

**Superintendent:**

1. Overall responsibility for managing the implementation of the emergency plan.
2. Implement and oversee system user notification procedure.
3. Implement unique system user notification procedure.
4. Implement notification of abutting water system.
5. If necessary, oversee and implement boil order, alternate water procedures and water use restrictions.
6. Update and maintain the Town Emergency Action Plan.
7. Be available as contact person for local and State agencies.
8. Be available for hands-on knowledge of system components.
9. Coordinate repair of system.
10. Coordinate return to normal operation
11. Implement a boil water or contamination notice

**Water Operator:**

1. Be available for hands-on knowledge of system components.
2. Make available and coordinate use of system equipment such as keys, maps, tools, spare parts, vehicles, backhoe etc.
3. Be available as necessary to provide specialized repair of system components such as pumps, water treatment devices, hydrants and valves.
4. Be available as necessary to take water samples and transport to lab.
5. Coordinate return to normal operation.
6. Organize and control notification process according to this plan.

**Section 3. Emergency Notification Procedures:**

Notification will be accomplished by the supervisor in charge of the emergency at the time. The Superintendent may contact the main Town Office and/or Police Department and have the personnel there handle all the phone and or personal contacts if possible otherwise it will be delegated to assisting personnel.

**Section 3 A. Boil Water and Chemical Notification:**

Only the Town Selectboard has the authority to authorize a boil water notice, in the rare event none can be reached then the Superintendent is in charge.

Notification will be accomplished by phone, newspaper, newsletter posting at all stores and bulletin boards, Town web site, door to door delivery, radio stations, and local TV. Forms to be used are part of this document.

Responsibility to see that the posting and notification are carried out correctly and efficiently is that of the Selectboard and Superintendent.

Notice shall be given to all consumers within 24 hours of acknowledgment of contamination.

Proof of notification to the state will be done according to state regulations by the Superintendent.

The Superintendent or his appointed agent is responsible for implementing notification to local and state agencies. This list will be kept up to date by the Superintendent.

**Notification Numbers:**

Town of Charlestown:	1-603-826-4400
Fire Department:	911 or 1-603-352-1100
Police Department:	911 or 1-603-826-5747
Ambulance Department:	911 or 1-603-352-1100
Highway Department:	1-603-826-4421 or 1-603-371-7190 or 1-603-675-5555
Health Office:	1-603-826-4400
Eagle Times Newspaper:	1-603-543-3100
Radio Station:	1-603-542-7735

**State Numbers:**

State Police:	1-800-525-5555
Water Supply Eng. Bureau:	1-603-271-3139 or 1-603-271-3503
Emergency Management:	1-603-271-2231 or 1-800-852-3792

Public Health Services: 1-603-271-4496

The Superintendent or his appointed agent is responsible for implementing notification of service contractors and personnel. This list will be kept up to date by the Superintendent.

Service & Repair Numbers:

Electrician: Paul Nickerson	1-603-826-7726 or 1-603-398-2860
Electric Utility: National Grid	1-800-322-3223
Plumber: Rick's Electric	1-603-826-3221
H&B Plumbing	1-802-885-2300
Pump Specialist: Farrar	1-603-352-4316
Northeast Mechanical Corp.	1-800-883-7661
Soil Excavator: Cornerstone	1-603-826-4976 or 1-603-343-3858
Soil Excavator: Pine Hill	1-603-542-4730 or 1-603-504-4348
Equipment Rental: Upper Valley	1-603-298-8744
Ferguson Pipe:	1-603-298-5275
SCADA Telemetry: EOS	1-603-332-2099
Instrumentation: A&D	1-603-382-4667 or 1-603-548-8187

The Superintendent or his appointed agent is responsible for implementing notification of special needs customers.

Priority will be given to this list for notifications and water assistance. This list will be kept up to date by the Superintendent.

**Section 3 B. Special Needs Customers:**

Holiday Inn Express:	1-802-885-4516
Charlestown Senior Center OSR:	1-603-826-5987
Charlestown Laundromat:	1-603-826-5208
Whelen Eng.	1-603-826-4005
Optimum Manufacturing:	1-603-826-3597
Dr. George Grabe: Dentist	1-603-826-5766
Clinic Dr. Office Main St:	1-603-826-5711
Valley Family Ph.	1-603-826-7722
East St Ext.. School:	1-603-826-3694
Main St. Middle School:	1-603-826-7711
OCR Elderly Housing:	1- 603-352-7512 or 1-800-529-0005
Pompanette Corp.:	1-603-826-5791
Design Standards Corp:	1-603-826-7744
Wee Haven Daycare:	1-603-826-5437
Charlestown Daycare Sullivan St.	1-603-826-3066
Charlestown Group Home OSR:	1-603-826-5724
VASE School Woodrise Rd.	1-603-826-4348

**Section 3 C. Mutual Aid:**

**Abutting Water Systems:**

We do not have written agreements with any departments or agencies but we do have excellent working relationships with the following.

North Charlestown Water Department	
Claremont Water Department	1-603-542-7020
Claremont Highway Department	1-603-542-7020
Springfield Water Department	1-802-886-2208
Springfield Highway Department	1-802-886-2208



#### Section 4 A. System Components:

##### System Equipment:

Clay Brook Well # 502:	Rated for 400gpm, 20hp turbine pump, back-up generator, (Sodium Hypochlorite injection, Sodium Hydroxide injection) Storage 300 gallons of Hypo and 4000 gallons hydroxide
Bull Run Well # 504:	Rated for 200gpm, 25 hp deep submersible (Sodium Hypochlorite injection) no storage
Water Tank:	1 million gallon atmospheric tank with locked hatch
Michael Ave Tank:	5000 gallon buried tank with fixed hatch
Stevens St. Tank:	5000 gallon buried tank with fixed hatch
Summit Hill Pump:	Three booster pumps two 3hp and one 5hp, 24 services
Stevens St. Pump:	Two 3hp booster pumps, 14 services
Michael Ave. Pump:	Two 5hp booster pumps, 46 services

##### Repair Equipment:

Back-hoe	1983 two wheel drive
Service Truck	2001 ¾ ton Ford panel truck (repair tool truck)
Repair Trailer	Fully equipped utility trailer for rapid response
Dump Truck	2006 1 ton dump truck
Superintendent Truck	2001 Ford explorer fully equipped for most calls

Town of Charlestown Water department has generators, trash pumps, cutoff saws, compactors, welders and other pipe related hand equipment.

Town of Charlestown Highway department has four nine ton dump trucks, three one ton dump trucks, one loader, one back-hoe, compactor roller, grader, and support staff to man all equipment upon request.

##### Repair Parts and Supplies:

Two or more Six, Eight, Ten and Twelve inch ductile iron pipe in stock  
Various size and lengths of PVC pipe  
Two six inch valves  
Repair Clamps and Maxi repair fittings for all sizes from 1" to 12"  
Assorted brass parts meters and common repair parts.  
Pipe, fittings and tools necessary for such repairs.

**Section 4 B. System Plan:**

The Town of Charlestown has retained the services of Cartographic Associates Inc. A project is currently underway to map the entire water, sewer and drainage systems. This will be plotted on our tax maps and be available in hard copy as well as digital form.

**Section 4 C. System Demand:**

The Town of Charlestown has telemetry and SCADA systems with battery and generator backup to run our pump houses, treatment system and storage tank. We have valves to isolate sections of Town and spare valves to isolate leaks or damaged sections in an emergency. Each pump house contains manual operation controls and instructions.

Capacity of Clay Brook = 570,000 Gallons per day  
Capacity of Bull Run = 288,000 Gallons per day  
Total System Production Capacity = 858,000 Gallons per day

Total Storage at Clay brook reservoir = 1,000,000 Gallons  
Average daily usage in 2008 = 340,000 Gallons per day  
Maximum daily demand = 480,000 Gallons per day  
Divide total storage capacity by average daily demand = 2.9 days

**Section 5. Alternate Water Source:**

Bull Run and Clay Brook well systems are two miles apart with different aquifers different power sources and back up power and controls. Charlestown also operates the North Charlestown water system with a capacity of 180,000 gallons per day and a usage of 29,500 per day so some water could be trucked from this permitted source to Charlestown via a sanitized milk truck. Another possibility is our neighbor the Claremont Water System.

**Section 5 A. Bulk and /or Bottled water:**

The following are companies the Town of Charlestown has contacted and can utilize in an emergency situation for alternate water.

1. Fortin Pool Water:  
Londonderry NH. - 622-6566 or 860-7992 Bulk hauler 6,000 gallons per load
2. L&C Spring Water Suppliers Inc:  
Altón NH. - 293-2225 Bulk hauler 8,100 gallons per load
3. Buxton Oil Co:  
Exeter NH. – 679-5998 Bulk hauler 6,000 gallons per load
4. Wal-Mart Corp:  
Claremont NH. 542-2703 Bottled water at the ready

### **Section 5 B. Interconnection with Adjacent Water Systems:**

This has been looked at many times and is still a very expensive and a massive undertaking. A temporary situation would involve trucking and could be done.

### **Section 5 C. New Source / Reactivation:**

The Town of Charlestown has no plans to develop a new source at this time we have adequate quantities and quality of water at this time. The Town does not have any old wells to reactivate.

### **Section 6 Alternate Power Supply:**

The Town of Charlestown has one Portable Trailer Mounted Caterpillar Olympian 40 KW 3 phase 4 wire 120/208 volt Diesel Generator. Tested on a monthly schedule on load at well site Diesel capacity is 77 gallons enough for at least 30 hours running time. Refueling is easy and quick with the Town's supply and refueling truck.

### **Section 7 Water Use Restrictions:**

The Town of Charlestown will implement the following water conservation measures in the event of a water system emergency.

1. Watering gardens, lawns and other landscape areas will be restricted at a minimum or banned entirely.
2. Washing cars, trucks, boats, RVs, etc., will be restricted at a minimum or banned entirely.
3. Using water from a hose to rinse or clean sidewalks, driveways, decks, etc., will be restricted at a minimum or banned entirely.
4. Filling swimming pools will be restricted at a minimum or banned entirely.
5. Residents will be required to follow indoor water use restrictions adopted from DES Fact Sheet WD-DWGB-26-2 that list water efficiency practices for indoor domestic water use.

If an Emergency necessitates shutting down one of our wells, the excess capacity in the remaining well will be used to supply our system. Similarly, with both wells operational our excess capacity allows us to meet average daily demand while absorbing significant reduction in pumping volumes. The Town of Charlestown will implement at its discretion water conservation measures during an emergency. For most emergencies it will be adequate to implement conservation measures 1 thru 4 as a restriction. At a heightened emergency measures 1 thru 4 may be implemented as a ban.

System demand is greatest during the summer months with an average daily summer demand of approximately 350,000 gallons. Consequently, we estimate that if an emergency occurs in the summer, by implementing measures 1 thru 4 as a ban, average

daily demand would immediately be reduced approximately 25 to 30 percent, This would reduce our average daily summer demand by 87,500 to 105,000 gallons, below the capacity of our smallest well and much below the capacity of the system. Additional demand reductions would be achieved by implementing measure 5. Water conservation measures are more limited during a winter emergency although this is balanced by the lower overall daily demand.

In the event of a severe emergency necessitating the use of bulk truck delivery of water measures 1 thru 4 will be instituted as a ban, and measure 5 will be put into effect.

The Town Administrator in conjunction with the Water Department Superintendent will implement water conservation notification via the same telephone / email tree and notice posting system described earlier to implement and cancel water conservation measures.

### **Section 8. Return to Normal Operation:**

The decision to return to normal operation will be made by the Water Department Superintendent. This decision will be made with input from the DES if contamination is the cause of the emergency event. A water department certified operator will have the responsibility of overseeing the return to normal operation of the system components. The certified operator will do any additional water sampling that may be necessary to assess system conditions before returning to normal operation. All water system users will be notified using the same telephone / email tree and notice posting system described earlier when the system has returned to normal operation.

### **Section 9. Vulnerability Assessment**

This section is not required in Charlestown however it will be looked at and addressed as time permits.

State assessment available

### **Section 10. Plan Readiness and Training**

Each person listed on our Chain of Command will be provided a copy of the plan.

The Superintendent will update the plan as necessary but at minimum yearly

A copy of the most recent plan will be kept at the Water Department Office.

A copy of the most recent plan will be kept at the Selectboard Office.

A copy of the most recent plan will be kept at the Administrator's Office.

The Cover of our Plan is brightly colored to make it easy to find.

An article about our plan will be placed in our local Town paper.

In all cases, earlier plans will be discarded after receipt of newer plan.

Any and all Water Department staff will be trained on all aspects of our emergency plan

The Department will rehearse the plan annually.

Signature Page

The following persons have been supplied with and understand the Emergency Action Plan for the Town of Charlestown Water Department.

Date of Signatures: 3/5/2009

Signatures:

Brenda L Ferland: Brenda L Ferland Chairman  
Steven A Neill: Steven A Neill Select board  
Jon B. Le Clair: Jon B. Le Clair Select board  
Dave M. Edkins: Dave M. Edkins Administrative Assistant  
David P. Duquette: David P. Duquette Superintendent  
Rodney G. Rumrill: Rodney G. Rumrill Operator  
Ernest Chambers: Ernest Chambers Operator

## Clay Brook Power Outage Procedure:

1. Turn Both Bull Run and Clay Brook wells into the off position:
2. Start the generator ( Perform Generator checks)
3. Switch over main power to generator power on generator panel in building.
4. Confirm power on with building lights, VFD, Pro-Control, chlorine analyzer, pH analyzer, and chem. pumps.

Only if all equipment is operational (on) do you proceed.

If VFD not on check generator output and connections, Go to VFD Fail Sheet.

5. Turn Clay Brook Well on in auto.
6. Verify flow at 380+ gpm on Foxboro readout and pro-control and charts.
7. Verify proper chemical feed rates and PID's

Clay Brook Settings: (all settings are approximate) adjusting may be necessary:

### Run Amps:

38.5 – 39.9

### Caustic Chemical Pumps:

Auto Mode PID 70 – 80 @ 380 gpm Chem. speed 55% - 60% pH 6.90 – 7.10 su

### Chlorine Chemical Pumps:

Auto Mode PID 50 – 60 @ 380 gpm Chem. speed 40% - 45% Residual 0.20 - 0.30 mg/l

### Main Turbine Water Pump:

Manual Mode 100% 380 gpm

### Level Out Control Tank Level:

Auto Mode PID 250 (This number is constant but value will vary with psi)

Reservoir low pump on: 35.5 feet (this is set on Clylvl and bullvl alarms screen)

Reservoir full pump off: 38.7 feet (this is set on Clylvl and bullvl alarms screen)

Bull Run Settings: (all settings are approximate) adjusting may be necessary:

### Run Amps:

84-85

### Chlorine Chemical Pump:

Auto Mode PID 580 @ 200 gpm Chem. speed 38% - 40% Residual 0.08-0.18 mg/l

### Well Pump Flow:

200 gpm

## Clay Brook VFD Failure Procedure

1. Verify power to building and pro-control panels.
2. Turn wells to off position on pro-control panel and (on Cutler Hammer Panel)
3. With power restored to building with generator or line, pull knife switches near VFD to direct feed. (this is a manual mode with no auto anything)
4. Open fire hydrant outside.
5. Turn well on in hand on Cutler Hammer Panel.
6. Close hydrant slowly.
7. If Pro-control is Down then all chem. pumps must be put in hand. (follow pump speeds and analysis on Power Outage Sheet.)

This should only be done in the event of power failure with damage to controls and reservoir is low.

Check Bull Run and run it in hand at the site if possible:  
Chlorine Chem. Pump: 580 PID or 40% manual

North Charlestown

Public Water System

**Emergency Action Plan and Guide**

EPA # 0411020

2009



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**Section 1. System Identification:**

EPA Number #: 0411020  
System Name: Town of Charlestown  
System Address: PO. Box 385  
Town: Charlestown  
Source ID/Type Description/Well Yield: 501/GRW/1/001 125 gpm  
Source ID/Type Description/Well Yield: 502/GRW/2/002 125 gpm  
Arsenic Treatment System 511,512 FM/DEP Tap/after AS TRTMT  
Population Served/# Service Connections: 350 persons & 108 Connections  
Name, Title, Phone, of person responsible for maintaining this emergency plan: David P. Duquette Superintendent  
1-603-826-5387 (Office)  
1-603-371-7185 (Cell)

**Section 2. Chain of Command:**

Selectboard Chair

Brenda Ferland  
1-603-826-5034 Home  
1-603-826-4400 Town Office

Water Department Superintendent

David P. Duquette  
1-802-875-6280 Home  
1-603-371-7185 Cell  
1-603-248-8864 Pager  
[dduquette@charlestown-nh.gov](mailto:dduquette@charlestown-nh.gov)

Water Department Operator

Rodney Rumrill  
1-603-826-5635 Home  
1-603-371-7186 Cell  
1-603-248-8863 Pager

Water Department Operator

Ernest Chambers  
1-603-826-5896 Home  
1-603-371-7187 Cell  
1-603-824-8865 Pager

## **Section 2 A. Responsibilities:**

### **Selectboard:**

1. Overall responsibility for managing a Town Emergency.
2. Instruct the Superintendent or others to implement Emergency Action Plan.
3. Implement a boil water or contamination notice.

### **Superintendent:**

1. Overall responsibility for managing the implementation of the emergency plan.
2. Implement and oversee system user notification procedure.
3. Implement unique system user notification procedure.
4. Implement notification of abutting water system.
5. If necessary, oversee and implement boil order, alternate water procedures and water use restrictions.
6. Update and maintain the Town Emergency Action Plan.
7. Be available as contact person for local and State agencies.
8. Be available for hands-on knowledge of system components.
9. Coordinate repair of system.
10. Coordinate return to normal operation
11. Implement a boil water or contamination notice

### **Water Operator:**

1. Be available for hands-on knowledge of system components.
2. Make available and coordinate use of system equipment such as keys, maps, tools, spare parts, vehicles, backhoe etc.
3. Be available as necessary to provide specialized repair of system components such as pumps, water treatment devices, hydrants and valves.
4. Be available as necessary to take water samples and transport to lab.
5. Coordinate return to normal operation.
6. Organize and control notification process according to this plan.

**Section 3. Emergency Notification Procedures:**

Notification will be accomplished by the supervisor in charge of the emergency at the time. The Superintendent may contact the main Town Office and/or Police Department and have the personnel there handle all the phone and or personal contacts if possible otherwise it will be delegated to assisting personnel.

**Section 3 A. Boil Water and Chemical Notification:**

Only the Town Selectboard has the authority to authorize a boil water notice, in the rare event none can be reached then the Superintendent is in charge.

Notification will be accomplished by phone, newspaper, newsletter posting at all stores and bulletin boards, Town web site, door to door delivery, radio stations, and TV.

Forms to be used are part of this document.

Responsibility to see that the posting and notification are carried out correctly and efficiently is that of the Selectboard and Superintendent.

Notice shall be given to all consumers within 24 hours of acknowledgment of contamination.

Proof of notification to the state will be done according to state regulations by the Superintendent.

The Superintendent or his appointed agent is responsible for implementing notification to local and state agencies. This list will be kept up to date by the Superintendent.

**Notification Numbers:**

Town of Charlestown:	1-603-826-4400
Fire Department:	911 or 1-603-352-1100
Police Department:	911 or 1-603-826-5747
Ambulance Department:	911 or 1-603-352-1100
Highway Department:	1-603-826-4421 or 1-603-371-7190 or 1-603-675-5555
Health Office:	1-603-826-4400
Eagle Times Newspaper:	1-603-543-3100
Radio Station:	1-603-542-7735

**State Numbers:**

State Police:	1-800-525-5555
Water Supply Eng. Bureau:	1-603-271-3139 or 1-603-271-3503
Emergency Management:	1-603-271-2231 or 1-800-852-3792
Public Health Services:	1-603-271-4496

The Superintendent or his appointed agent is responsible for implementing notification of service contractors and personal. This list will be kept up to date by the Superintendent.

Service & Repair Numbers:

Electrician: Paul Nickerson	1-603-826-7726 or 1-603-398-2860
Public Service of NH.	1-800-468-0034
Plumber: Rick's Electric	1-603-826-3221
H&B Plumbing	1-802-885-2300
Pump Specialist: Farrar	1-603-352-4316
Northeast Mechanical Corp.	1-800-883-7661
Soil Excavator: Cornerstone	1-603-826-4976 or 1-603-343-3858
Soil Excavator: Pine Hill	1-603-542-4730 or 1-603-504-4348
Equipment Rental: Upper Valley	1-603-298-8744
Ferguson Pipe:	1-603-298-5275
SCADA Telemetry: EOS	1-603-332-2099
Instrumentation: A&D	1-603-382-4667 or 1-603-548-8187

The Superintendent or his appointed agent is responsible for implementing notification of special needs customers.

Priority will be given to this list for notifications and water assistance. This list will be kept up to date by the superintendent.

**Section 3 B. Special Needs Customers:**

North Charlestown Farwell School	1-603-826-3986
Air Gas	1-603-542-5261

**Section 3 C. Mutual Aid:**

Abutting Water Systems:

We do not have written agreements with any departments or agencies but we do have excellent working relationships with the following.

Charlestown Water Department	
Claremont Water Department	1-603-542-7020
Claremont Highway Department	1-603-542-7020
Springfield Water Department	1-802-886-2208
Springfield Highway Department	1-802-886-2208

## Section 4 A. System Components:

### System Equipment:

Well # 501/001:	Rated for 125gpm, 20hp turbine pump, back-up generator, (Sodium Hypochlorite injection) no storage
Well # 502/002:	Rated for 125gpm, 20 hp deep submersible (Sodium Hypochlorite injection) no storage
Arsenic Treatment:	Cartridge Pressurized Vessel Treatment System
Water Tank:	250,000 gallon atmospheric tank with locked hatch
Salt Shed Road Pump:	Two 2hp booster pumps, 2 services

### Repair Equipment:

Back-hoe	1983 two wheel drive
Service Truck	2001 ¾ ton ford panel truck (repair tool truck)
Repair Trailer	Fully equipped utility trailer for rapid response
Dump Truck	2006 1 ton dump truck
Superintendent Truck	2001 Ford explorer fully equipped for most calls

Town of Charlestown Water department has generators, trash pumps, cutoff saws, compactors, welders and other pipe related hand equipment.

Town of Charlestown Highway Department has four nine ton dump trucks, three one ton dump trucks, one loader one back-hoe, compactor roller, grader, and support staff to man all equipment upon request.

### Repair Parts and Supplies:

Two or more Six, Eight, Ten and Twelve inch ductile iron pipe in stock  
Various size and lengths of PVC pipe  
Two six inch valves  
Repair Clamps and Maxi repair fittings for all sizes from 1" to 12"  
Assorted brass parts meters and common repair parts.  
Pipe fittings tools necessary for such repairs.

#### **Section 4 B. System Plan:**

The Town of Charlestown has retained the services of Cartographic Associates Inc. A project is currently underway to map our entire water, sewer and drainage systems. This will be plotted on our tax maps and be available in hard copy as well as digital form.

#### **Section 4 C. System Demand:**

The Town of Charlestown and North Charlestown has telemetry and SCADA systems with battery and generator backup to run our pump house and treatment system. We have valves to isolate sections of Town and spare valves to isolate leaks or damaged sections in an emergency. Each pump house contains manual operation controls and instructions.

Capacity of Well #1	= 180,000 Gallons per day
Capacity of Well #2	= 180,000 Gallons per day
Total System Production Capacity	= 180,000 Gallons per day
Total Storage at reservoir	= 250,000 Gallons
Average daily usage in 2008	= 29,500 Gallons per day
Maximum daily demand	= 38,000 Gallons per day
Divide total storage capacity by average daily demand	= 8.5 days

#### **Section 5. Alternate Water Source:**

North Charlestown is operated by the Charlestown water system with a capacity of 858,000 gallons per day and a usage of 340,000 per day so some water could be trucked from this permitted source to North Charlestown via a sanitized milk truck. Another possibility is our neighbor the Claremont Water System.

#### **Section 5 A. Bulk and /or Bottled water:**

The following are companies the Town of Charlestown has contacted and can utilize in an emergency situation for alternate water.

1. Fortin Pool Water:  
Londonderry NH. - 622-6566 or 860-7992 Bulk hauler 6,000 gallons per load
2. L&C Spring Water Suppliers Inc:  
Alton NH. - 293-2225 Bulk hauler 8,100 gallons per load
3. Buxton Oil Co:  
Exeter NH. - 679-5998 Bulk hauler 6,000 gallons per load
4. Wal-Mart Corp:  
Claremont NH. 542-2703 Bottled water at the ready

### **Section 5 B. Interconnection with Adjacent Water Systems:**

This has been looked at many times and is still a very expensive and a massive undertaking. A temporary situation would involve trucking and could be done.

### **Section 5 C. New Source / Reactivation:**

The Town of Charlestown has no plans to develop a new source in North Charlestown at this time we have adequate quantities and quality of water at this time. The Town does not have any old wells to reactivate.

### **Section 6 Alternate Power Supply:**

The North Charlestown Water System has one portable, trailer mounted Caterpillar Olympian 40 KW 3 phase 4 wire 120/208 volt diesel generator. Diesel capacity is 77 gallons enough for at least 30 hour running time. Refueling is easy and quick with the Town,s supply and refueling truck. And one mounted Caterpillar Olympian Model CG065 65KW 120/240 volt, propane fueled. Tested on a monthly schedule on load at well site Propane is stored on site 1,000 gallon tank runs seven days Deliveries are weekly.

### **Section 7 Water Use Restrictions:**

The North Charlestown Water System will implement the following water conservation measures in the event of a water system emergency.

1. Watering gardens, lawns, and other landscape areas will be restricted at a minimum or banned entirely.
2. Washing cars, trucks, boats, RVs, etc., will be restricted at a minimum or banned entirely.
3. Using water from a hose to rinse or clean sidewalks, driveways, decks, etc., will be restricted at a minimum or banned entirely.
4. Filling swimming pools will be restricted at a minimum or banned entirely.
5. Residents will be required to follow indoor water use restrictions adopted from DES Fact Sheet WD-DWGB-26-2 that lists water efficiency practices for indoor domestic water use.

If an emergency necessitates shutting down one of our wells, the excess capacity in the remaining well will be used to supply our system. Similarly, with both wells operational our excess capacity allows us to meet average daily demand while absorbing significant reduction in pumping volumes. The Town of Charlestown will implement at its discretion water conservation measures during an emergency. For most emergencies it will be adequate to implement conservation measures 1 through 4 as a restriction. At a heightened emergency measures 1 through 4 may be implemented as a ban.



System demand is greatest during the summer months with an average summer demand of approximately 30,000 gallons. Consequently, we estimate that if an emergency occurs in the summer, by implementing measures 1 thru 4 as a ban, average daily demand would immediately be reduced approximately 25 to 30 percent, This would reduce our average daily summer demand by 7,500 to 9,000 gallons, Below the capacity of our smallest well and much below the capacity of the system. Additional demand reductions would be achieved by implementing measure 5. Water conservation measures are more limited during a winter emergency although this is balanced by the lower overall daily demand.

In the event of a severe emergency necessitating the use of bulk truck delivery of water measures 1 through 4 will be instituted as a ban, and measure 5 will be put into effect.

The Town Administrator in conjunction with the Water Department Superintendent will implement water conservation notification via the same telephone / email tree and notice posting system described earlier to implement and cancel water conservation measures.

#### **Section 8. Return to Normal Operation:**

The decision to return to normal operation will be made by the Water Department Superintendent. This decision will be made with input from the DES if contamination is the cause of the emergency event. A water department certified operator will have the responsibility of overseeing the return to normal operation of the system components. The certified operator will do any additional water sampling that may be necessary to assess system conditions before returning to normal operation. All water system users will be notified using the same telephone / email tree and notice posting system described earlier when the system has returned to normal operation.

#### **Section 9. Vulnerability Assessment**

This section is not required in North Charlestown however it will be looked at and addressed as time permits.

State Assessment available

#### **Section 10. Plan Readiness and Training**

Each person listed on our Chain of Command will be provided a copy of the plan.

The Superintendent will update the plan as necessary but at minimum yearly

A copy of the most recent plan will be kept at the Water Department Office.

A copy of the most recent plan will be kept at the Selectboard Office.

A copy of the most recent plan will be kept at the Administrator's Office.

The cover of our Plan is brightly colored to make it easy to find.

An article about our plan will be placed in our local Town paper.

In all cases, earlier plans will be discarded after receipt of newer plan.

Any and all Water Department staff will be trained on all aspects of our emergency plan

The Department will rehearse the plan annually.

Signature Page

The following persons have been supplied with and understand the Emergency Action Plan for the Town of Charlestown Water Department.

Date of Signatures: 3/5/2009

Signatures:

Brenda L Ferland: Brenda L. Ferland Chairman  
Steven A Neill: Steve Neill Select board  
Jon B. Le Clair: Jon B. Le Clair Select board  
Dave M. Edkins: Dave M. Edkins Administrative Assistant  
David P. Duquette: David P. Duquette Superintendent  
Rodney G. Rumrill: Rodney G. Rumrill Operator  
Ernest Chambers: Ernest Chambers Operator

## North Charlestown Power Outage Procedure

1. Turn well pumps into off position on master panel.
2. Verify good generator operation.

### Arsenic Control Panel:

3. Arsenic system pro-control plug moved from battery to surge protection outlet.
4. Reset bypass valve to appropriate setting 65%-75% listen for movement in valve.
5. Visually inspect for open position. ( on top of valve)

### Master well panel:

6. Move telephone stick plug from surge protection to outside wall outlet.
7. Master pro-control plug moved from battery to surge protection outlet.
8. Reset wells one and two speed control on master pro-control.(Manual Mode on speed control) #1 - 96% #2 - 91%
9. Check status of radio communication with reservoir. Red, Orange flickering and Green solid lights must be seen on radio controller.
10. Well cannot be run in auto without the lights, Manual mode will be only option.
11. Put only the one well that you want to run into Auto or Manual Mode.

If well starts: flow should be about 80-90 gallons per min.

12. Check for verification of flow on the arsenic system flow meters they should be 20 filter 60 by pass approximately.
13. Check propane tank and record % volume.
14. Reset chlorine pump to a (PID) setting of 100 – 130 this is approximate @ 80gpm 40% -50% chemical pump speed
- 15.

When Power is interrupted in these control panels the items below MUST be reset and verified.

1. Well speed control. Well #1 95% - 96% Well #2 91% - 94%  
Objective is 80 – 85 gpm

2. Bypass Valve Settings. 65% - 75%  
Objective is 20 gpm filter 60 gpm By pass

3. Chlorine PID speed controls. 100 -150 PID  
Objective 40% - 50% Chemical pump speed  
Previous pump speed can be obtained by data logging analog outputs.

## North Charlestown Reservoir Power Outage Procedure

1. Establish that the battery back- up is functioning:  
Pro-control, Radio communication, Pressure Transducer should be operating

Back-up batteries and Uninterruptible Power Supplies are stored at the Wastewater Treatment Facility

2. Establish Radio Communication with solid green light, flashing orange light, flashing red light must be acknowledged at well house.

Communication must be active to operate in auto if none, system can be operated in manual.

3. Monitor system throughout power outage and replace back-up units as needed, recharge spent units at Wastewater Treatment Facility.