

F-4600 FLOW METER Installation and Operation Guide



SAFETY INFORMATION

This meter was calibrated at the factory prior to shipment. To ensure correct use of the meter, please read this manual thoroughly.

Regarding this Manual:

- This manual should be passed on to the end user.
- Before use, read this manual thoroughly to comprehend its contents.
- The contents of this manual may be changed without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without ONICON's written permission.
- ONICON makes no warranty of any kind with regard to this material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors are found, please inform ONICON.
- ONICON assumes no responsibilities for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, ONICON assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

Safety Precautions:

The following general safety precautions must be observed during all phases of installation, operation, service, and repair of this product. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. ONICON Incorporated assumes no liability for the customer's failure to comply with these requirements. If this product is used in a manner not specified in this manual, the protection provided by this product may be impaired.

The following symbols are used in this manual:



CAUTION

Messages identified as "Caution" contain information regarding potential damage to the product or other ancillary products.



IMPORTANT NOTE

Messages identified as "Important Note" contain information critical to the proper operation of the product.

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SECTION 1.0: INTRODUCTION

1.1 PURPOSE OF THIS GUIDE

The purpose of this guide is to provide installation and commissioning procedures, and basic operating and servicing instructions for the blind version of the ONICON F-4600 Flow Meter.

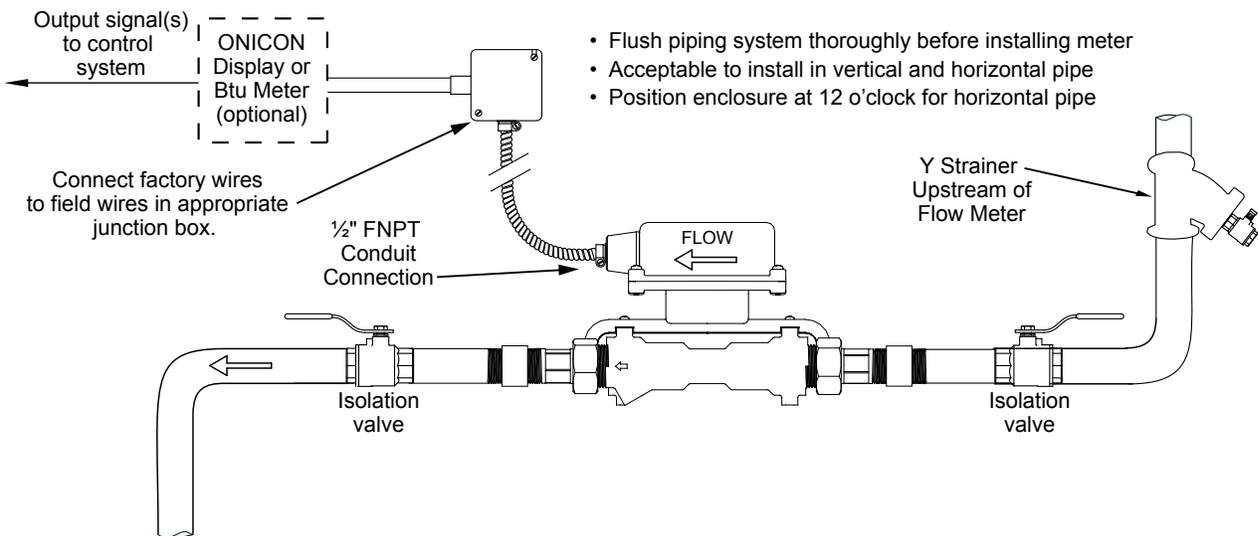


CAUTION

Only qualified service personnel should attempt to install or service this meter. The improper installation or use of this product may result in a loss of integrity in the piping system.

1.2 TYPICAL F-4600 FLOW METER

The F-4600 Inline Flow Meter utilizes direct path wetted ultrasonic transducers for measuring the volumetric flow of liquids in a wide variety of applications.



1.3 STANDARD FEATURES AND SPECIFICATIONS

- 4-20 mA output for flow rate
- Scaled pulse output for totalization
- All weather NEMA4 enclosure
- ANSI/NSF 61 & 372 compliant (pending)

GENERAL SPECIFICATIONS*

ACCURACY

FLOW

- ± 1% of reading over 25:1 turndown
- ± 2% of reading over 100:1 turndown
- Repeatability: $\leq \pm 0.2\%$

OVERALL FLOW RANGE

500:1 turndown

SENSING METHOD

Direct beam path wetted ultrasonic sensors utilizing differential transit time velocity measurement

METER SIZES (Nominal diameter in inches)

½, ¾, 1, 1¼, 1½, 2 and 2½

PIPING SYSTEM CONNECTIONS

- Male NPT threads
- 2½" meter provided with ANSI Class 150 raised face flanges
- Optional PN16 or ANSI Class 300

FLUID TEMPERATURE RANGE

32° F to 250° F

AMBIENT TEMPERATURE RANGE

-13° F to 131° F

MAXIMUM OPERATING PRESSURE

400 PSI

PRESSURE DROP

Less than 1 PSI at 4 ft/sec, decreasing at lower velocities

POWER SUPPLY REQUIREMENTS

- Non-display version
- 20-26.5V ac/dc, 50/60 Hz, 5 VA or 60 mA DC

PULSE OUTPUT and ANALOG OUTPUT

Analog output: 4-20 mA (non-isolated)

Scalable pulse output:

- Isolated solid state dry contact
- Contact rating: 50 mA, 30V dc
- Contact duration: 1000ms

APPROVALS

- FCC: Part 15, Subpart B
- CE
- Conforms to ANSI/NSF 61 & 372 (certification pending)

*Specifications subject to change without notice

Meter Size	Process Connection Type	Typical Design Flow	1% of Rate Flow Range	2% of Rate Flow Range	Minimum Flow	C _v
(Nominal)	(Nominal)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
½"	Male NPT	6.6	0.6 – 15	0.15 – 15	0.03	6.08
¾"	Male NPT	6.6	0.6 – 15	0.15 – 15	0.03	6.08
¾" (high flow)	Male NPT	11	1 – 25	0.25 – 25	0.05	8.81
1"	Male NPT	11	1 – 25	0.25 – 25	0.05	8.81
1" (high flow)	Male NPT	15.4	1.4 – 35	0.35 – 35	0.07	12.17
1¼"	Male NPT	26.4	3 – 60	0.6 – 60	0.12	36.95
1½"	Male NPT	44	5 – 100	1 – 100	0.2	51.20
2"	Male NPT	66	8 – 150	1.5 – 150	0.3	101.2
2½"	Class 150 Flange	110	12 - 225	2.5 - 250	0.5	156.2

1.4 WORKING ENVIRONMENT

The blind version of the F-4600 was designed for indoor or outdoor installation and use in residential, commercial and light industrial environments that are free of corrosive liquids and fumes, temperature extremes and excess vibration. Avoid installing the meter in direct sunlight.

The operating ambient air temperature range is -13° F to 131° F. Electrical power should be relatively clean, free of excess high frequency noise and large voltage transients.

1.5 WARRANTY & SERIAL NUMBER

Warranty

ONICON's 2-year "No-fault" warranty reduces start-up costs by extending coverage for incidental damage during installation. Certain exclusions apply. Please refer to ONICON's Conditions of Sale (Appendix page A-2) for details.

Serial Number

The serial number of your F-4600 is located on the side of the enclosure. The serial number is a unique identifier for the product. Please have this number available when contacting ONICON for assistance.

SECTION 2.0: UNPACKING

The F-4600 is generally shipped in one package unless optional hardware or equipment is ordered. Notify the freight carrier and ONICON if any items are damaged in transit.

2.1 CHECKING THAT YOU HAVE RECEIVED EVERYTHING

The following items have been provided with your F-4600 Flow Meter:

- (2) Line size process connection meter couplings* with male NPT threads and sealing gaskets (shipped attached to meter)
- (1) F-4600 Meter Installation and Operation Guide
- (1) F-4600 Meter Certificate of Calibration

Please notify ONICON if any of these items are missing.

* Note: The 2½" version of the meter is provided with flanges.

SECTION 3.0: INSTALLATION

The F-4600 Flow Meter should be installed by experienced plumbers, electricians, and others with related knowledge and experience in the heating, cooling, and fluid metering fields. ONICON technical support personnel are available via telephone or e-mail to provide technical assistance before, during and after installation. On-site field engineering, installation, and service are also available at an additional cost. The installer should use good trade practices and must adhere to all applicable state and local building or other codes.

3.1 SITE SELECTION

Careful attention to the site selection for the meter will help the installers with the initial installation, reduce start-up problems, and make future maintenance easier. For example, do not install the meter where it will be difficult for personnel to perform periodic maintenance. When selecting a site, consider the criteria under Section 1.4: WORKING ENVIRONMENT, as well as the information below.

The following limitations apply to the installation of the meter:

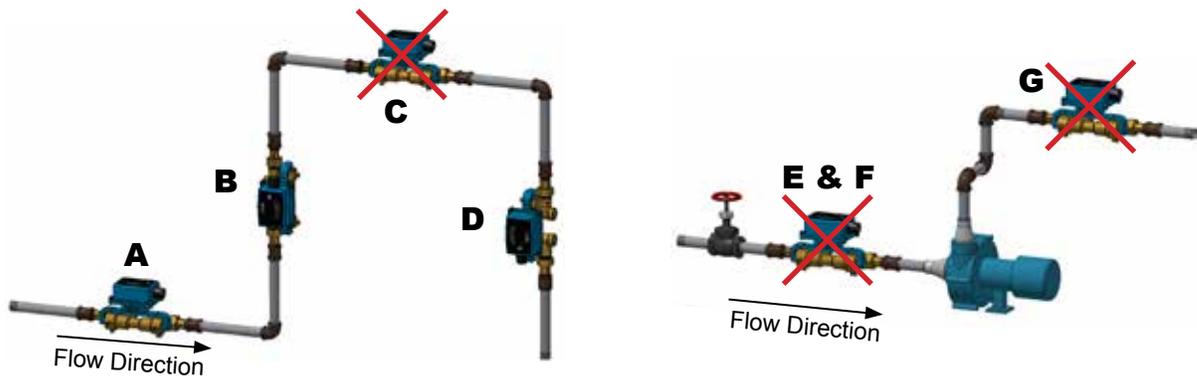
- The flow meter must be correctly oriented with respect to the direction of flow in the pipe. Meters installed with reversed flow will not function.
- The maximum operating pressure for the flow meter is 400 psi.
- Do not install the meter in close proximity to strong sources of electromagnetic interference (e.g. electric motors, VFD's, fluorescent light fixtures, etc.)

3.2 INSTALLING THE FLOW METER

Before you install the meter, the entire piping system should be flushed and free of debris. Please refer to the diagrams below when selecting the installation location. Upstream straight unobstructed pipe requirements vary considerably based on the nature of the upstream obstructions. As a general rule, ONICON recommends a minimum of 10 diameters of straight unobstructed pipe whenever possible; keeping in mind that it is always recommended that the meter be located with as much straight pipe upstream as possible.

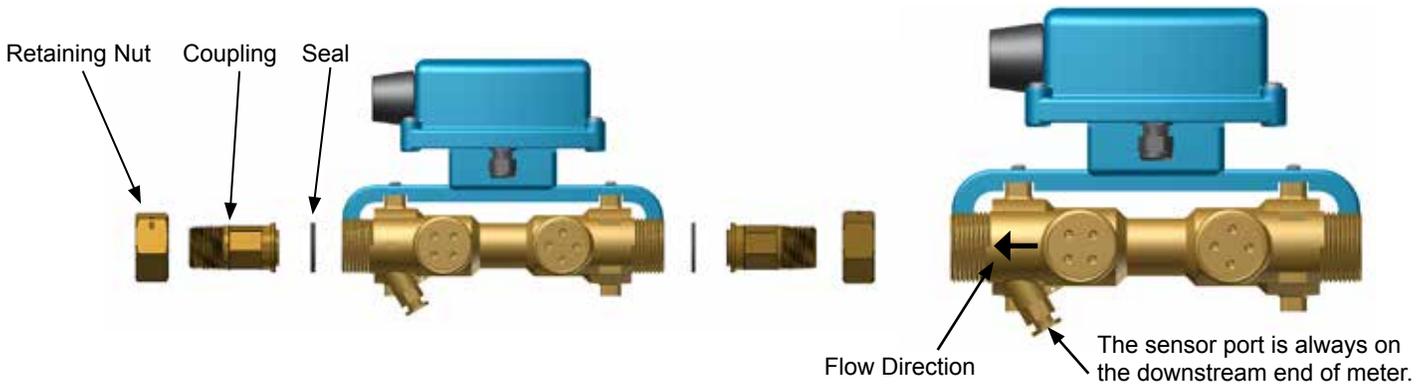
STRAIGHT RUN REQUIREMENTS

Upstream Obstruction	Minimum Upstream Straight Run Required (Pipe Diameters)	
	Meter Size	
	0.5" - 1.0"	1.25" - 2.5"
Single Elbow	0	0
Expander / Reducer	0	0
Coil, Upstream	3	3
Isolation Valve, 2 Position	3	5
Control Valve	10	15
Notes:		
1	Straight run is based on use of manufacturer provided couplings	
2	Avoid the following obstructions where possible: Modulating valves, pump discharge, multiple elbows out of plane.	



- A. This is a recommended position for the flow meter.
- B. This is a recommended position for the flow meter.
- C. Avoid installation locations where air can become trapped in the piping system.
- D. This is an acceptable installation location for closed loop pressurized systems.
- E. Do not install the meter downstream of modulating valves or partially open valves. Fully open isolation valves (e.g. ball valves) are OK.
- F. Do not install the flow sensor at the inlet of a pump. To prevent cavitation, the minimum operating pressure at the inlet of the meter must always exceed the pressure drop across the meter. Refer to Appendix A-1 for calculating pressure the drop at different flow rates.
- G. Avoid installing the meter downstream of multiple bends out of plane with each other where there are less than 10 diameters of straight unobstructed pipe between bends.

The flow meter is installed with threaded meter couplings and flat sealing gaskets as shown below. Orient the sensor body by aligning the flow direction arrow with the direction of flow in the pipe.



CAUTION

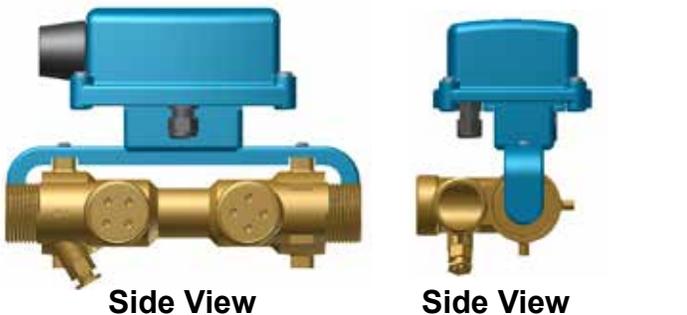
The flow meter body must be correctly oriented with respect to the direction of flow in the pipe. Meters installed with flow in the reverse direction will not function.

Orient the meter as shown below. The meter may be installed with upward or downward flow in vertical pipes in closed loop pressurized systems. Avoid any installation locations where the pipe may not be completely full.

Meter Sizes 1/2" - 1"

Preferred Orientation for Horizontal Pipes

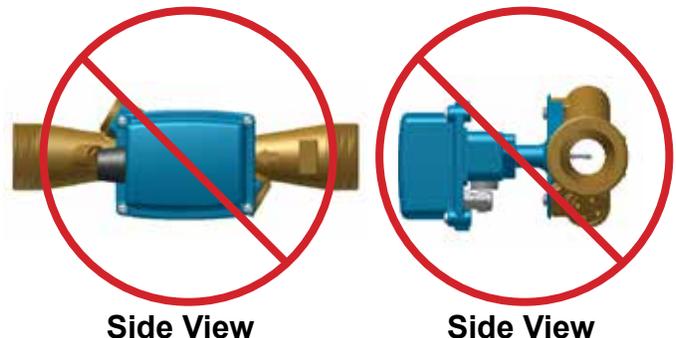
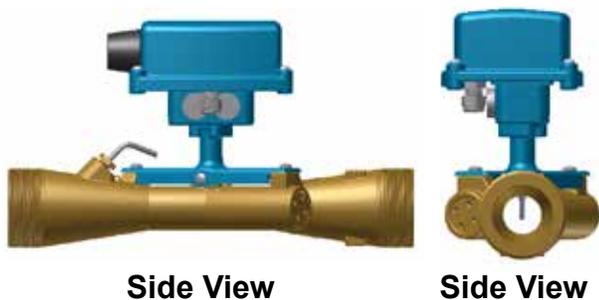
Do not orient meter as shown below



Meter Sizes 1 1/4" - 2.5"

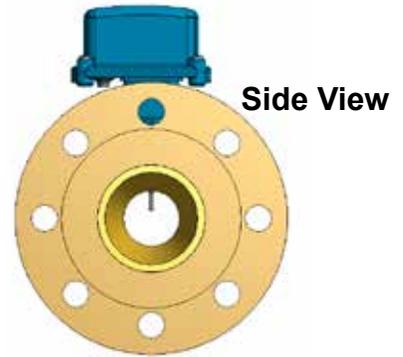
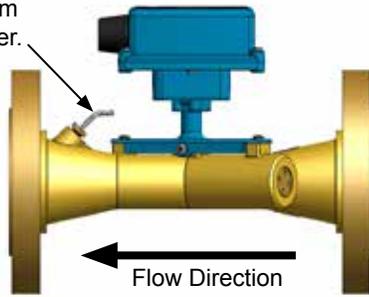
Preferred Orientation for Horizontal Pipes

Do not orient meter as shown below

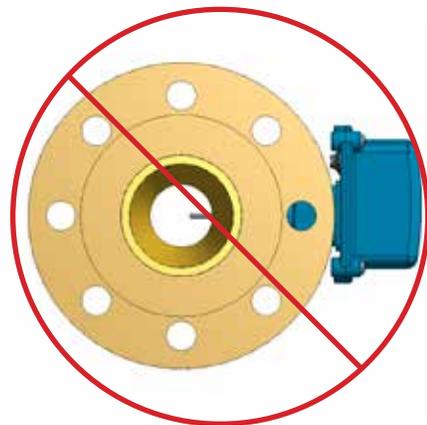
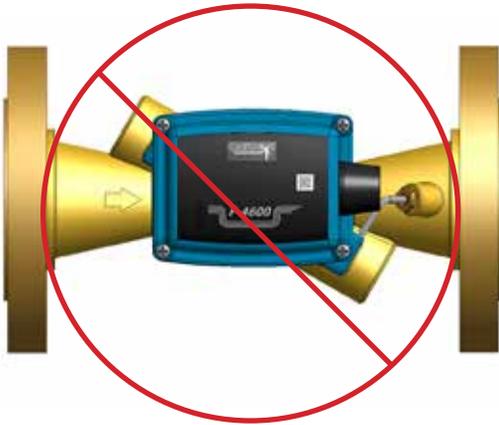


Preferred Orientation for Horizontal Housing

The sensor port is always on the downstream end of meter.



Do not orient meter as shown below



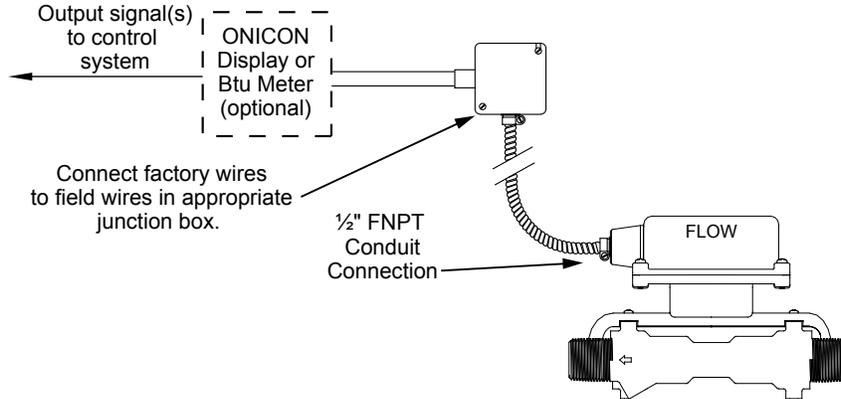


IMPORTANT NOTE

Open isolation valves, leak test and purge the piping system of air prior to wiring the meter.

3.3 POWER AND SIGNAL WIRING CONNECTIONS

The F-4600 is provided with an unterminated 10 foot PVC jacketed cable for power and signal connections. Do not attempt to remove this cable. Doing so will damage the weather-tight seal and may void the product warranty. Use AWG 18 – 22 shielded cable for power and signal connections.

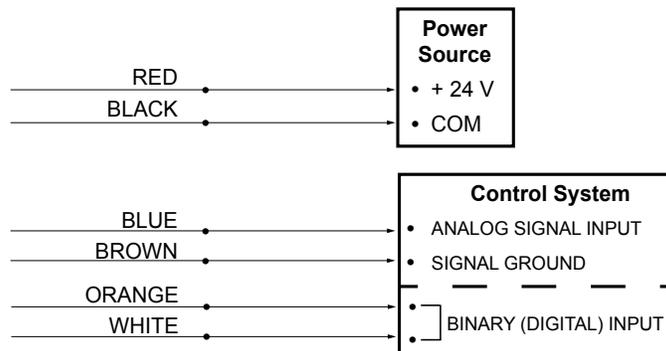


F-4600 Wiring Information		
Wire Color	Description	Notes
Red	(+) 20 – 26V ac/dc, 50/60Hz, 5 VA or 60 mA max. DC	Positive (+) supply connection
Black	(-) Common ground	Negative (-) supply connection
Blue	(+) Analog 4-20 mA signal	Active 4-20 mA (non-isolated) output*
Brown	(-) Analog 4-20 mA signal	
Orange	Non polarized dry contact switch output	Scaled to provide one pulse per unit volume
White		

*4-20 mA signal is active. Do not connect external voltage to the blue & brown wires.

F-4600 WIRING DIAGRAM

Flow meter into control system (no display or Btu meter)



APPENDIX A

A-1 SELECTING THE RIGHT METER & CALCULATING PRESSURE LOSS

A-2 CONDITIONS OF SALE

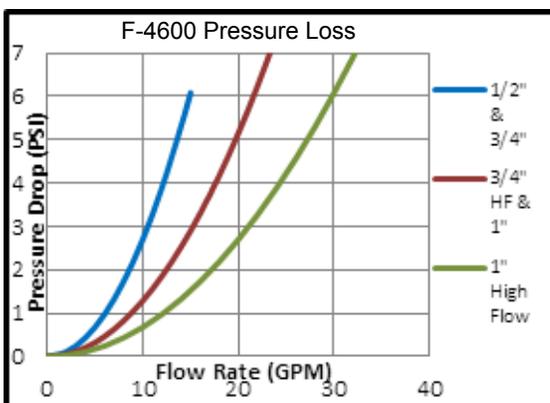
SELECTING THE RIGHT METER & CALCULATING PRESSURE DROP



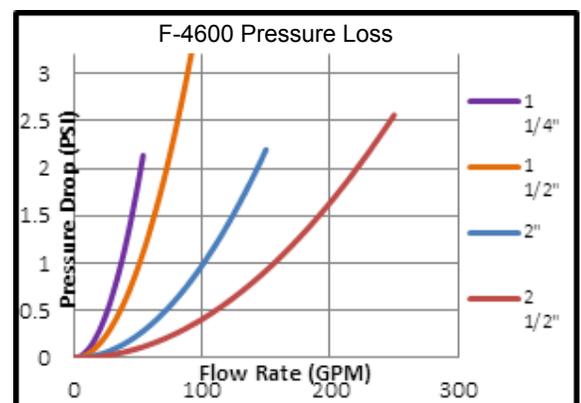
For optimum performance, meters should be selected by the process connection size and expected design* flow rate for the application. In some cases ONICON offers more than one flow rate range option based on the process connection size. The following information is provided to assist in selecting the most appropriate meter size for your application.

1. Select the preferred process connection size.
2. Review the design flow rate and maximum flow rate for the meter you have selected. Where more than one choice is available, choose the meter that most closely matches your expected design flow rate with the meter's stated design flow rate.
3. If your design flow rate is significantly higher than that of the meter you have chosen, determine the pressure drop for your design flow rate using the chart below and confirm that it is acceptable for your application. If necessary, select a meter with a larger process connection size to achieve an acceptable pressure drop for your application.

Meter Size	Process Connection Type	Typical Design Flow	1% of Rate Flow Range	2% of Rate Flow Range	Minimum Flow	C _v
(Nominal)	(Nominal)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
½"	Male NPT	6.6	0.6 – 15	0.15 – 15	0.03	6.08
¾"	Male NPT	6.6	0.6 – 15	0.15 – 15	0.03	6.08
¾" (high flow)	Male NPT	11	1 – 25	0.25 – 25	0.05	8.81
1"	Male NPT	11	1 – 25	0.25 – 25	0.05	8.81
1" (high flow)	Male NPT	15.4	1.4 – 35	0.35 – 35	0.07	12.17
1¼"	Male NPT	26.4	3 – 60	0.6 – 60	0.12	36.95
1½"	Male NPT	44	5 – 100	1 – 100	0.2	51.20
2"	Male NPT	66	8 – 150	1.5 – 150	0.3	101.2
2½"	Class 150 Flange	110	12 - 225	2.5 - 250	0.5	156.2



$$\Delta p = \left(\frac{Q}{C_v} \right)^2$$



*ONICON defines the “design” flow rate as the maximum continuous flow expected by the application under normal operating conditions. The pressure drop for the ONICON design flow rates are ≤1.7 psi.

CONDITIONS OF SALE

1. **ACCEPTANCE:** The following Conditions of Sale apply to all sales of ONICON's products. These provisions shall apply even if ONICON fails to object to provisions appearing on, incorporated by, referenced in, or attached to Buyer's purchase order form. Buyer's acceptance of delivery of ONICON's products constitutes its acceptance of these Conditions of Sale.
2. **DELIVERY AND TITLE:** All product shipments are Ex Works shipping point and title passes to the Buyer at the time ONICON delivers the merchandise to the carrier. Risk of loss or damage to the product passes to the Buyer at the time ONICON delivers the product to the carrier. The Buyer immediately upon receipt should inspect all shipments, and should there be any evidence of damage or loss in transit, Buyer must file claims or tracers upon carrier. ONICON will assist in tracing shipments upon request.
3. **LIMITED WARRANTY:** ONICON warrants that for a period of two (2) years following the date of original shipment of an ONICON product: (i) the product will conform to ONICON's standard written specifications applicable to such product in effect on the date of Buyer's order, or as modified by ONICON's quotation or Buyer's purchase order accepted by ONICON, (ii) the product will be free from defects in workmanship, and (iii) that ONICON has title to the product prior to shipment to the Buyer; provided, however, that the warranties provided herein shall be void and may not apply in the event Buyer misuses or damages a product, including, but not limited to, any use by the Buyer of a product for an application other than one of a type approved by ONICON. ONICON's sole liability and Buyer's sole remedy for any breach of the foregoing warranty is for ONICON to repair or replace, at ONICON's option, any defective product that is returned to ONICON during the warranty period. EXCEPT AS MAY BE SPECIFICALLY AGREED BY ONICON IN WRITING IN RELATION TO EACH SALE, NO OTHER WARRANTIES SHALL APPLY, WHETHER EXPRESSED, IMPLIED OR STATUTORY, AND THERE SHALL BE NO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.
4. **REMEDIES:** ONICON's OBLIGATION UNDER THE FOREGOING WARRANTIES IS LIMITED SOLELY TO REPAIR OR REPLACEMENT, AT ONICON's OPTION, OF DEFECTIVE OR NONCONFORMING PRODUCTS. ONICON SHALL NOT BE LIABLE FOR CONSEQUENTIAL, INDIRECT, PUNITIVE, INCIDENTAL, OR SPECIAL DAMAGES WHETHER FOUND ON CONTRACT, TORT OR ANY OTHER THEORY OF LAW. No products shall be returned to ONICON without its prior consent and transportation and insurance costs shall be prepaid. Any repair or replacement of ONICON's products under the foregoing warranty will be at no charge to the Buyer provided such repair is done at the ONICON factory or authorized service center. ONICON products that are repaired or replaced under this warranty will be returned to Buyer via the same method of shipment use to return the product to ONICON. Repair or replacement of ONICON products is conditioned upon ONICON's acknowledgement of any alleged defect or nonconformance during the warranty period and issuance of a Return Authorization number. All product returns must reference the Return Authorization number on the outside of the shipping carton and on any paperwork referencing the return.
5. **PRICES AND PAYMENT TERMS:** The prices set forth in the most recent quote or acknowledgement as applicable, supersede all previous prices or quotations. All quotations are subject to change or withdrawal without notice except as may be specifically noted on the face of the quotation. The prices shown do not include sales, excise or government charges payable by ONICON to Federal, State, or local authority. Any such tax or charge now or hereafter imposed upon the sale or shipment of the products under this contract will be added to the purchase price. Buyer agrees to reimburse ONICON for such tax or charge or provide ONICON with an acceptable exemption certificate. Payment of invoices will be due 30 days from the date of shipment of the products contained therein. In the event that payment of an invoice is not received by the invoice due date, ONICON will assess a late fee not to exceed 1.5% per month or 18% per year, or the maximum allowable by law whichever is lower.
6. **CANCELLATION:** Buyer may cancel its order, or any part of it, by sending written notice of cancellation to ONICON and paying a reasonable cancellation fee as determined by ONICON. The reasonable cancellation fee will reflect, among other factors, the expenses already incurred and commitments made by ONICON, sales and administrative costs and profit as determined by ONICON. If Buyer received a reduced price based on the quantity of products ordered, but has not purchased the applicable quantity at the time of cancellation, Buyer will pay the price it would have paid had ONICON's sale price been based on the quantity actually purchased.
7. **CHANGES:** If Buyer makes any changes in its drawings, designs, or specifications applicable in any contract with ONICON that cause an increase or decrease in the cost of performance of the contract, or if such changes result in rework or obsolescence, an equitable adjustment shall be made to the contract. Such changes are subject to ONICON's prior written consent.
8. **EXCUSABLE DELAY:** ONICON shall under no circumstance be responsible for failure to fill any order or orders when due to: fires, floods, riots, strikes, freight embargoes or transportation delays, shortage of labor, inability to secure fuel, material supplies, or power at current price or on account of shortages thereof, acts of God or of the public enemy, any existing or future laws or acts of the Federal or State Government (including specifically, but not exclusively, and orders, rules or regulations issued by any official or agency of any such government) affecting the conduct of ONICON's business with which ONICON in its judgment and discretion deems it advisable to comply as a legal or patriotic duty, or due to any cause beyond ONICON's reasonable control.
9. **PATENTS:** ONICON shall defend all suits or proceedings brought against Buyer or its customers arising from claimed infringements of any patent, trademark, service mark or copyright for any product furnished by ONICON and shall indemnify it against all costs, fees, and damages on the condition Buyer promptly notifies ONICON in writing and provides information and assistance to enable ONICON to conduct the defense, provided that ONICON shall have no such obligation in case of infringement resulting from ONICON's conformance to special requirements of Buyer. If ONICON is not able to settle any such suit or proceeding on acceptable terms, ONICON may, at its option, require return of the infringing product and refund the purchase price to Buyer less a reasonable allowance for depreciation or use.
10. **FAIR LABOR STANDARDS ACT:** ONICON represents that all products delivered under this contract are furnished in accordance with the applicable provisions of the Fair Labor Standards Act as amended.
11. **APPLICABLE LAW:** This document and any resulting contract shall be governed by and construed in accordance with the laws of the State of Florida. The courts of the State of Florida and the federal courts located in Florida shall have jurisdiction and venue with respect to litigation to this contract. In the event of litigation, the prevailing party shall be entitled to recover attorney's fees and costs from the non-prevailing party, including appellate attorney's fees.
12. **MODIFICATIONS:** These Conditions of Sale along with the prices, quantities, delivery schedules and other provisions and instructions in applicable quotations by ONICON or Buyer's purchase orders accepted by ONICON shall constitute the entire agreement between ONICON and Buyer pertaining to any resulting contract. They can be modified only in writing.