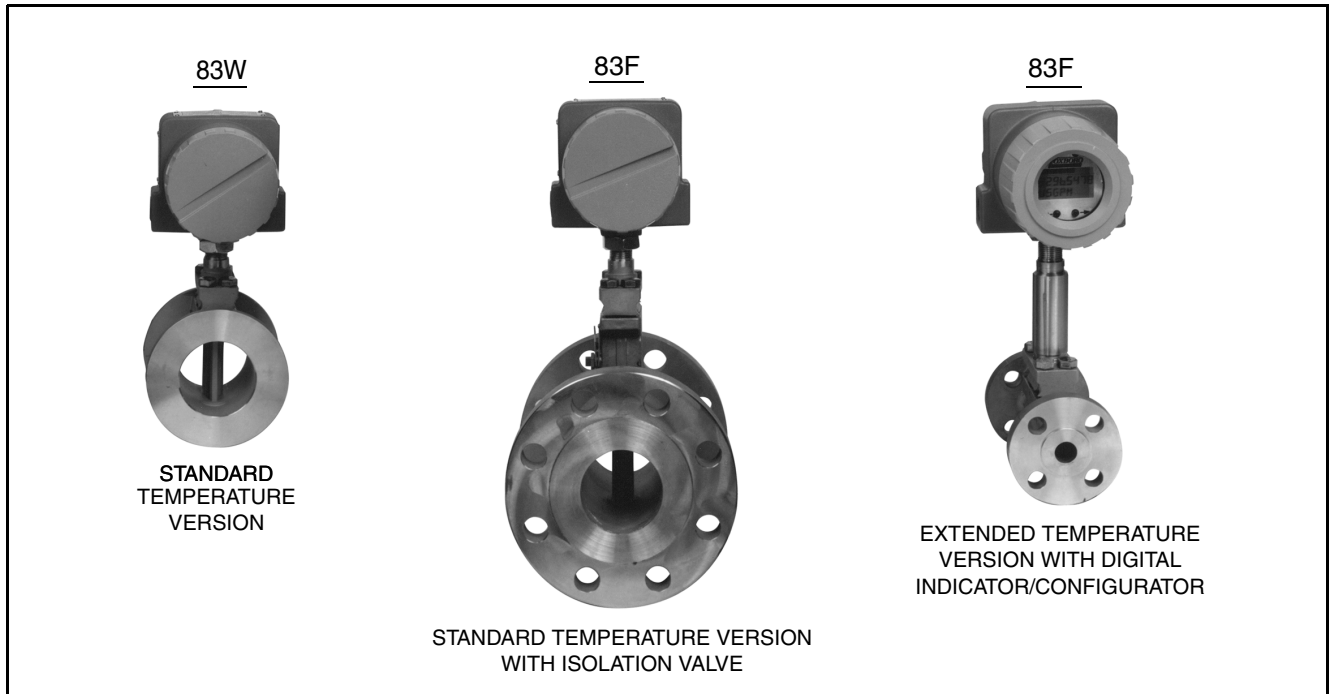


I/A Series[®] Intelligent Vortex Flowmeters

Foxboro Model 83F Flanged Body Flowmeters and Foxboro Model 83W Wafer Body Flowmeters with FOUNDATION Fieldbus Communication Protocol



The Foxboro Models 83F and 83W are part of a family of intelligent, high performance, flanged and wafer body vortex flowmeters. They are designed for engineers who want a meter with excellent hydraulic properties, and for plant operators who need the digital information, advanced diagnostics, and function capabilities of FOUNDATION fieldbus. They transmit a digital output signal for remote configuration, calibration, and control. An on-board LCD indicator with pushbuttons is also offered for local configuration.

FEATURES

- Used on liquids, gases, and steam.
- FOUNDATION fieldbus H-1 specification compliant.
- Interoperability tested – FOUNDATION registered.
- Transmitter includes fieldbus function blocks.
- Digital precision, stability, and resolution ensure top measurement performance.
- Supports all standard views, alarm messages, and trends.
- Automatic filter and low flow cut-in selections.
- Rangeability up to 100:1.
- On-line diagnostics.
- Wide temperature range up to 800°F (430°C).
- Improved accuracy at low Reynolds number.
- Internal flow totalization.
- Remote access to transmitter parameters for less maintenance and easier record keeping.
- Transmitter maintenance functions locally via the on-board LCD indicator, or remotely over fieldbus.
- Wiring savings in existing installations when mixing fieldbus segments with 4 to 20 mA wires.
- System piping effects and K-Factor corrections.
- Flanged Body: 3/4 to 12 in (DN 15 to DN 300)
Wafer Body: 3/4 to 8 in (DN 15 to DN 200).
- Dual measurement capability (83F only).
- FlowExpertPro[™] sizing program greatly simplifies flowmeter selection.
- Conforms to applicable European Union directives (including PED).

LIFETIME WARRANTY

Sensor Warranty against workmanship and material defects for lifetime of flowmeter – contact Invensys Foxboro.

FlowExpertPro™

FlowExpertPro is a program primarily used to size Foxboro flowmeters. It also ensures that the user has selected the proper flowmeter type for his application. Invensys provides this meter selection tool as a free web site to all users, without the need for registration. In addition to flowmeter selection and sizing, FlowExpertPro includes the following features:

- Incorporates a large library of the physical properties of typical process fluids.
- Displays results in tabular or graphic format.
- Allows user to save, print, or E-mail results.
- Provides reference to applicable flowmeter PSSs and other related flowmeter documentation.

The program calculates minimum and maximum flow rates, rangeability, pressure loss, and Reynolds Number, using established flow equations. It also allows for material and flange selection, and provides ANSI or metric flange recommendations for predicted flow pressures and temperatures. You are invited to visit www.FlowExpertPro.com to access this program, or contact Invensys for further information, and technical support.

DESIGNED FOR MEASUREMENT INTEGRATION

These Intelligent Vortex Flowmeters provide efficient integration of measurements into process control schemes.

Like their predecessors, these Intelligent flowmeters measure flow rates of liquids, gas, and steam, and use the same flowtube as the 83F-A and 83W-A analog output products, the 83F and 83W FoxCom and HART communication products, and the 84F and 84W HART communication products. The sensor selections offered cover a wide temperature range from 0 to 800°F (-20 to 430°C).

HIGH PERFORMANCE

The Invensys Foxboro patented family of vortex flowmeters has the high accuracy and rangeability of positive displacement and turbine flowmeters without the mechanical complexity and high cost. Maximum rangeability up to 100:1 is possible as compared to 3:1 for a nonlinear differential pressure producer (orifice plate). Because these flowmeters have no moving parts, they are very durable and reliable. This simplicity of design ensures low initial cost, low operating and maintenance costs, and therefore contributing to an overall low cost of ownership.

SIMPLIFIED FLOW START-UP

No primary device calculations or mechanical calibrations are required. The flowmeter is easily installed and configured. Simply wire it to a proper power source, an I/O module, or controller, and it is ready to measure flow.

Invensys Foxboro will preconfigure the flowmeter using flow data supplied by the customer. Generically configured flowmeters can be used as shipped, but for more precise application, the flowmeter should be configured to specific process usage. The configurators allow selection of the fluid type (liquid, gas, or steam) that provide general configurations when process conditions are not available.

WIDE VARIETY OF APPLICATIONS

The 83F is available in 3/4 to 12 in (DN 15 to DN 300) line sizes. The 83W is available in 3/4 to 8 in (DN 15 to DN 200) line sizes. Water velocities up to 25.3 ft/s (7.7 m/s), and gas or steam velocities up to 600 ft/s (185 m/s) can be measured. These meters set the example for industry standards whether the application requires accuracy for totalizing and batching; utility metering of fluids in the process industries; fuel, air, steam, or gas metering for the measurement of energy in any high use application; or stability and repeatability for process control.

COMPACT, EFFICIENT, AND DURABLE DESIGN

The flowmeter mounts between ANSI or metric raised face flanges. See Model Code section for end connections offered with each line size. Other flange face surfaces can be used as a custom design.

The electronics housing is of explosionproof construction and provides environmental protection to the enclosed electronics. It is offered integrally mounted to the flowtube, or can be mounted in a remote location.

The flowmeter's simple, modular design requires minimum maintenance. Common, field replaceable parts are used, including the sensor assembly and amplifier. The amplifier can be replaced without interrupting the flow in the pipe, and sensor can be replaced without process shutdown when an isolation valve is installed. Since a single device is used for multiprocess-fluid applications, ordering is simplified and spare part needs minimized.

REMOTE MOUNTED ELECTRONICS HOUSING

Remote mounting is offered to allow access to the amplifier and other housing electronics when the measurement is not in an easily accessible location. The remote housing is supported by a bracket, which in turn mounts to a surface or to a nominal 2-in or DN 50 pipe. This housing can be located up to a cable length of 50 ft (15.2 m) from the flowtube without loss of low level signal.

ISOLATION VALVE

An isolation valve allows the sensor to be removed or replaced without interrupting the flow in the pipe.

DUAL MEASUREMENT FLOWMETER (84F ONLY)

Dual Measurement Vortex Flowmeters provide the user with redundant sensors and electronics. Two electronics housings and sensors are mounted to a common flowmeter body. Should one transmitter fail, the redundant measurement avoids the necessity of shutting down the process. The failed transmitter can then be replaced at some later noncritical time. Applications include Safety Shutdown Systems (independent of Process Measurement Network), Safety Backup for critical flow loops, Comparative Verification of Measurement for high accuracy precision loops, or just for dual communications paths with the same primary element.

LOCAL DIGITAL INDICATOR/CONFIGURATOR

A 16-character indicator is available. Total flow and/or the instantaneous flow rate may be displayed in user-selected flow units. The indicator may be configured for either flow or total, or to toggle between them. Four keys, located on the indicator panel, can be used to configure the flowmeter. This feature is a Model Code selection.

DESIGNED FOR USE IN HAZARDOUS LOCATIONS

These flowmeters have been designed to meet the certification and approval requirements of many testing agencies for use in hazardous area locations. Refer to "Product Safety Specifications" section.

CE COMPLIANCE

This family of flowmeters displays the CE designation indicating conformance to the applicable European Community Standards for immunity to sources of electromagnetic interference. This compliance also includes conformance to a maximum level of self-generated electromagnetic energy, and includes PED (Harmonized Pressure Equipment Directive for the European Community). See table below for details.

PED

Invensys Foxboro has elected to offer the PED (Harmonized Pressure Equipment Directive for the European Community) certification only with meters ordered with the ATEX Electrical Safety Code Model Code selections. ATEX electrical certifications are in place for the N and E Codes. Therefore the CE marking carries the ATEX number. See table below.

Meter Size	ATEX Electrical Certification Code	CE Marking
3/4 in and 1 in (DN 15 and DN 25)(a)	N or E	CE 0344
1 1/2 in (DN 40) and larger	N or E	CE 0344, CE 0575

(a) Line sizes 1 inch and smaller are only required to meet SEP - Sound Engineering Practice to be compliant with the PED directive.

FOUNDATION Fieldbus TECHNOLOGY

This is an all digital, serial, two-way communication system which interconnects field devices, such as transmitters, actuators, and controllers. It is a Local Area Network (LAN) with built-in capability to distribute control application across the network. This communication technology consists of the Physical Layer, the Communication Stack, and the User Application Blocks. See paragraphs below.

Physical Layer Standards

The Fieldbus Foundation Specification FF816 uses IEC 1158-2 and ISA S50.02 Physical Layer Standards as references to define the signaling and electrical properties of a device's Physical Layer interface. The properties of these transmitters are:

- Polarity Independent
- Open Circuit Level of 35 V dc maximum
- Intrinsically Safe Parameters per table below.

Parameter	Recommended Value
Approval Voltage	24 V dc
Approval Current	250 mA
Input Power	1.2 W
Residual Capacitance	< 5 nF
Residual Inductance	< 20 μ H

Communication Stack

The Communication Stack comprises a Data Link Layer (DLL), a Fieldbus Access Sublayer (FAS), and a Fieldbus Message Specification (FMS).

The Data Link Layer (DLL) provides:

- Scheduled Communication – As authorized by the Link Active Scheduler (LAS)
- Device can be assigned an LAS, if required
- Unscheduled Communication – This allows all devices on the fieldbus to send "unscheduled" messages between the transmission of scheduled messages.

The Fieldbus Access Sublayer (FAS) provides:

- Client/Server VCR (Virtual Communication Relationship) – This is used for queued, unscheduled, user-initiated, one-to-one communication between the devices on the fieldbus; typically user-initiated requests, such as setpoint changes, alarm acknowledgments, and device uploads/downloads.
- Report Distribution VCR – Typically allows fieldbus devices to send alarm notifications to operator console.
- Publisher/Subscriber VCR – Allows fieldbus device to publish data, and send function block I/O data, such as transmitter process variable and primary output data to operator console.

Communication Stack (Cont.)

The Fieldbus Message Specification (FMS)

FMS services allow user applications to send messages to each other across the fieldbus. The FMS describes communication services, message formats, and protocol required for user application.

User Application Blocks

These software blocks represent different user functions, such as analog input (AI) and proportional, integral, derivative (PID) function blocks. See paragraphs that follow.

Analog Input (AI) Function Block

Analog Input (AI) function blocks contain all configurable parameters needed to define the input data for use with other function blocks. Parameters include revision level, tag description, alarms, process variables, transducer scale values, and strategy.

Proportional, Integral, Derivative (PID) Function Block

A single PID function block contains all the standard parameters required to implement a general purpose automatic PID control scheme.

Device Address Assignment

Each device is assigned an ID (comprising at least a tag and address) via a configurator. A “Find Tag Service” initiates a tag search for the convenience of host systems and maintenance devices.

Device Descriptors (DDs)

DD and function block parameters allow device interoperability. The DD allows the host to interpret device data, including calibration and diagnostics. The Fieldbus Foundation provides standard DDs, while the device manufacturer provides “incremental” DDs. Standard and incremental DDs are read directly from the device over fieldbus.

Fieldbus Characteristics

Parameter	Specification	
	No	Yes
Intrinsically Safe	No	Yes
Maximum No. of Devices(a)	32	6
Maximum Total Bus Length(b)	6235 ft (1900 m) (b)	
Maximum Spur Length(b)(c)	395 ft (120 m) (c)	

- (a) Maximum number of devices may be less depending on device power consumption, type of cable used, addition of accessory devices such as repeaters, etc.
- (b) Total bus length including all spurs is based on use of #18 AWG (0.8 mm²) shielded twisted pair cable. See Installation Manual for the precise relationship between cable length, spur lengths, cable type, and number of devices.
- (c) Maximum spur length is as listed. However, for hybrid installations, the maximum intrinsically safe (I.S.) spur length is dependent on the field barrier used. For I.S. installations, the maximum spur length is 98 ft (30 m). Minimum spur length is 3.3 ft 1 m().

Bus Sizing Parameters

- Current Consumption: 12 mA, nominal
- Minimum Voltage: 9 V dc
- Virtual Communication Relationships: 20 VCR
- Conforms to Profile Type

Fieldbus Device Installation Topologies

Typical topologies are shown in Figures 1 and 2, including a bus with spurs, a daisy chain, and a tree.

Bus with Spurs Topology

Devices connected to bus segment via a spur. The length of the spur can limit the total fieldbus length.

Daisy Chain Topology

Fieldbus cable routed from device to device on the same segment. Installation practices should ensure that one device can be disconnected without disrupting the continuity of the segment.

Tree Topology

Devices on a single segment are connected to a common junction box using individual twisted pair wire. Maximum spur lengths must be considered.

Mixed Topology

Allows connection of other topologies in a series configuration. A mixed topology must follow total fieldbus length rules.

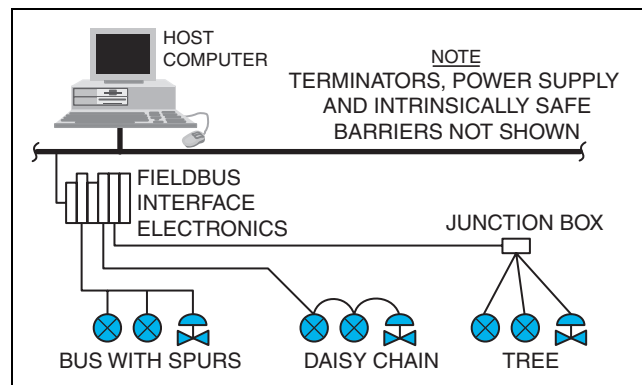


Figure 1. Miscellaneous Installation Topologies

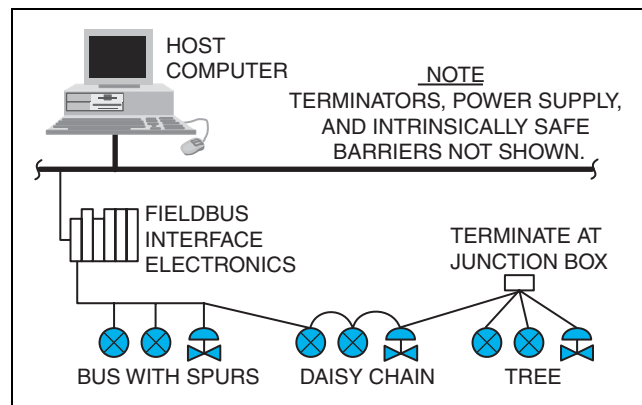


Figure 2. Installation with Mixed Topologies

OPERATING CONDITIONS (a)

Influence	Calibration Operating Conditions (b)	Normal Operating Conditions	Operating Limits
Process Fluid	Clear Water	Liquid, Gas, and Steam	Liquid, Gas, and Steam
Process Temperature	70 to 85°F (20 to 30°C)	0 to +800°F (-20 to +430°C)	0 and +800°F (-20 and +430°C)
Ambient Temperature (Electronics Housing)	70 to 85°F (20 to 30°C)	-58 to +185°F (-50 to +85°C)	-58 and +185°F (-50 and +85°C)
Relative Humidity	50 to 90%	0 to 100%	0 and 100%
Supply Voltage (by Fieldbus)	24 ±0.5 V dc	9 to 32 V dc	9 and 32 V dc

(a) Limited to nonflashing, noncavitating conditions. Flow rate and temperature of process may induce flashing and cavitation which is dependent on pressure drop and process vapor pressure. A minimum positive back pressure is required for proper operation.

(b) Assumes ANSI Schedule 40 process piping; flanges bored to interfacing pipe inside diameter; process piping and flowmeter body bores aligned to within 2% of meter bore; gaskets to be 0.125 in (3.18 mm) thick and not protruding into process line; a minimum of thirty pipe diameters of straight pipe upstream of flowmeter and eight pipe diameters downstream of flowmeter; clear water is free from air or particles.

PERFORMANCE SPECIFICATIONS

(Under Calibration Operating Conditions unless Otherwise Stated)

Factory Calibration Flow Ranges

Nominal Meter Size	Nominal Mean K-Factor in Pulses/ft ³ (Pulses/L)	Factory-Calibrated Flow Range for Water (c)		
		Range in US gpm	Range in L/s	Reynold Number (R _D) Range
3/4 in (DN 15)	5580 (197)	6.9 to 34	0.43 to 2.1	30 000 to 150 000
1 in (DN 25)	2250 (79.5)	8.9 to 56	0.56 to 3.5	30 000 to 190 000
1 1/2 in (DN 40)	570 (20.1)	14 to 140	0.88 to 8.7	30 000 to 300 000
2 in (DN 50)	258 (9.11)	18 to 230	1.1 to 15	30 000 to 380 000
3 in (DN 80)	78.7 (2.78)	34 to 500	2.1 to 32	38 000 to 570 000
4 in (DN 100)	34.8 (1.23)	59 to 890	3.7 to 56	50 000 to 750 000
6 in (DN 150)	10.00 (0.353)	140 to 2000	8.5 to 130	76 000 to 1 100 000
8 in (DN 200)	4.26 (0.150)	240 to 3600	15 to 220	100 000 to 1 500 000
10 in (DN 250) (b)	1.99 (0.0703)	390 to 5800	24 to 370	130 000 to 1 900 000
DN 300 (12 in) (b)	1.16 (0.0410)	560 to 8400	36 to 530	160 000 to 2 300 000

(a) The K-factor is the relationship between input (volumetric flow rate) and the output (pulse rate).

Reference K-factor: The arithmetic mean value of K-factor over a designated flow rate range (reference conditions).

The mean K-factor is derived as:

$$\text{Mean K-factor} = (K_{\text{MAX}} + K_{\text{MIN}}) / 2$$

Where KMAX is the Maximum K-factor and KMIN is the Minimum K-factor over the calibrated flow range.

(b) The 10 and 12 in (DN 250 and DN 300) flowmeters are available with the Model 83F only.

(c) Factory calibrated Reynolds Number range applies to standard temperature sensor without isolation valve. Other sensor selections and manifold selections may alter the calibration range. See FlowExpertPro for specific calibration ranges.

PERFORMANCE SPECIFICATIONS (Cont.)

Improved Accuracy

For situations that deviate from ideal installation conditions, the I/A Series Vortex Flowmeter automatically compensates for the following influences when the requested process and piping information is entered during configuration:

PROCESS PIPING

Installation parameters, such as pipe bore, location of valves, proximity to elbows, etc., affect the accuracy of the flow measurement.

PROCESS TEMPERATURE

Changes in the process temperature cause a shift in the K-Factor.

OPERATION AT LOW FLOW RATES

At low flow rates ($R_D < 20\,000$) the K-factor deviates from the mean value determined via the water calibration. An algorithm, requiring values for the flowing density and viscosity, is embedded in the flowmeter to correct for this nonlinearity.

Accuracy for Liquids (See Figure 3 and NOTE)

Accuracy within the calibrated Reynolds Number (R_D) range is $\pm 0.5\%$ of reading. Above 20 000 R_D and outside the calibrated range, the accuracy is $\pm 1\%$ of reading. Within the R_D range of 5 000 to 20 000, the accuracy is $\pm 2\%$ of reading.

Accuracy for Gases and Steam (See NOTE)

Accuracy is $\pm 1\%$ of reading for flow rates with R_D of 20 000 or greater. Within the R_D range of 5 000 to 20 000 the accuracy is $\pm 2\%$ of reading.

NOTE

To achieve the accuracy stated for the fluids above, the flowing density and viscosity must be input during meter configuration.

Relative Humidity Effect

None as long as covers/seals properly installed.

Ambient Temperature Effect (Amplifier only)

$\pm 0.01\%$ of reading from -58° to $+185^\circ\text{F}$
(-50° to $+85^\circ\text{C}$)

Process Temperature Effect on K-Factor

There is an effect on the reference K-factor due to a diameter change of the flowmeter bore with temperature. The effect is -0.3% of flow rate per 100°F (55°C) increase in temperature. The flowmeter will automatically recompute a flowing K-factor when process temperature is entered.

Electromagnetic Compatibility (RFI)

The output error from RFI at radio frequencies ranging from 27 to 1000 MHz is less than $\pm 1\%$ of span at a field intensity of 10 V/m; and less than $\pm 2\%$ of span at a field intensity of 30 V/m. This applies only when the electronics housing is properly earthed (grounded).

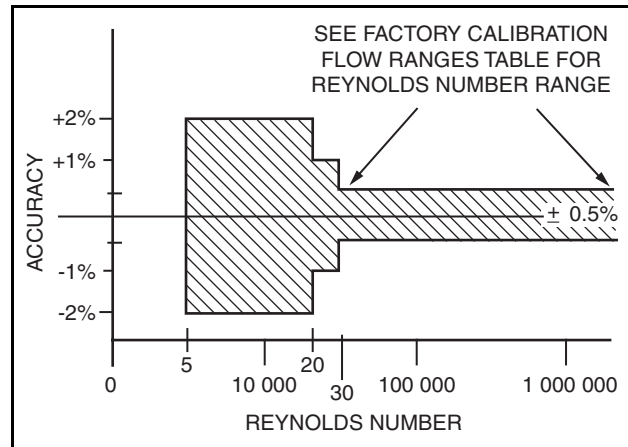


Figure 3. Flowmeter Accuracy for Liquids

Vibration Effect

Vibration can affect the flow measurement output of a Vortex flowmeter in the form of added pulses, but with the built-in Tuning functions and Low Flow Cut-in adjustability, these effects can be minimized. Invensys Foxboro has tested this meter with vibrations up to 3 “g” of acceleration with no physical damage, no shift in calibration after the test, and no loss of communications throughout the test.

Emission Effect

Radiated and conducted electromagnetic emissions meet North America and NAMUR requirements.

Supply Voltage Effect (Within Stated Limits)

No effect on accuracy

Position Effect (Filled Pipe Conditions)

For most applications, the flowmeter can be mounted in a pipeline which may run in any direction from the vertical (flow in upward direction) to the horizontal. Measurement of liquid and gas streams is not affected by the pipeline orientation or the flowmeter orientation in the pipeline.

For saturated steam, the recommended flowmeter position is in a horizontal pipe with the electronics housing located below the pipeline.

For superheated steam, the flowmeter is usually best mounted in a horizontal or inclined pipe with the electronics housing located above the pipeline. Measuring superheated steam in vertical pipelines requires that the electronics housing and sensor compartment be free of intermittent condensate. It is recommended that the sensor be insulated to ensure at least 10°F (6°C) of superheat.

Refer to Recommended Mounting Arrangements section for further information.

FUNCTIONAL SPECIFICATIONS

Fieldbus Characteristics and Bus Sizing Parameters

See previous pages.

Supply Voltage

9 to 32 V dc, by a specially designed fieldbus power source connected to the bus. For intrinsically safe (I.S.) applications, the supply voltage allowed can vary depending on the rating of the I.S. barrier.

Output Signal

FOUNDATION fieldbus digital, serial, two-way communication system that runs at 31.25 kbits/s. The digital output signal is superimposed on the dc power signal on the bus, and controlled by a strict cycle schedule and protocol.

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. 801-5.)

Host/Transmitter Communication

You may monitor, configure, and calibrate your transmitter using the following:

- The On-board Digital Indicator/Configurator for local interrogation and configuration of transducer block parameters.
- FOUNDATION fieldbus Host consisting of an I/A Series System Workstation having a FOUNDATION fieldbus interface electronics PWA.
- FOUNDATION fieldbus Host consisting of a PC equipped with a FOUNDATION fieldbus interface electronics PWA.

Remote Communication

Using FOUNDATION fieldbus protocol, transmitter communications includes the following:

- Resource State
- Manufacturer ID
- Device Type, Revision
- DD Resource, Revision
- Resource Diagnostic Parameters
- Output in % or EGU (Engineering Units)
- Electronic Damping
- Resource Diagnostic
- Alarms
- Calibration
- Date of Last Calibration
- Calibrator's Name

Low and High Frequency Filter Settings

Low and high frequency filters are automatically set based on the flowmeter configuration. The parameters required to set the filters are Model Number, reference K-factor, flowing density, and full scale flow rate. The low frequency filter is set with the 3 dB point ⁽¹⁾ at approximately one half the low flow cut-off frequency. The high frequency filter is set with the 3 dB point approximately at one half the upper range value frequency. The density values corresponding to the following conditions have been embedded in the flowmeter for use when general default configurations are selected.

- Liquid – Water at 70°F (21°C)
- Gas – Air at 100 psig (6.9 bar/690 kPa) and 70°F (21°C)
- Steam – Saturated Steam at 125 psig (862 bar/862 kPa)

Improved performance at other flow conditions can be achieved by inputting the actual process parameters.

Adaptive Filtering

The flowmeter provides an adaptive mode which automatically moves the high and low frequency filters closer to the vortex frequency to affect an improved signal-to-noise ratio. This feature provides:

- Low Flow Measurability
- Improved Vibration Immunity

Totalization

The flowmeter transducer block has a built-in flow totalizer eight digit display. Flow total is not lost in the event of a power interruption, but is resettable if desired.

Low Flow Cut-Off Selections

There are eight configurable low flow cut-off selections ranging from minimum flow rate to ten times the minimum low flow rate.

Automatic Low Flow Cut-Off Feature

The flowmeter can be configured to automatically select the lowest Low Flow Cut-Off selection that produces a zero output under no-flow conditions.

Flowmeter Rangeability

Meter has an enhanced rangeability compared to other vortex meters due to its lower Low Flow Cut-Off capability and improved frequency filtering. Rangeability of up to 100:1 is achievable.

Signal Conditioning

A digital smoothing algorithm can be enabled to condition the raw vortex signal. This results in improved performance, particularly at low flow.

(1) The 3 dB point is the frequency at which the filter attenuation is 50%.

FUNCTIONAL SPECIFICATIONS (Cont.)

Process Temperature Correction

Meter computes a corrected K-factor at the specific process temperature which is entered by the user.

Output Damping

Meter provides user-selectable damping to smooth the flow rate output, or to optimize the response time of the flowmeter to the control system. Damping can be set between 0 (none) and 32 seconds. Damping is an exponential filter with a selectable time constant. An eight second damping factor will pass 64% of the step change in this time period.

Response Time (Without Damping)

0.1 second or the vortex shedding period for frequencies less than 10 Hz.

On-Line Diagnostics

Meter uses a number of internal diagnostic functions including hardware checks, and internal code and database validation. Error checking and diagnostic codes are also embedded in the communications protocol. These diagnostics are performed at startup and as continuous background checks.

Offline Diagnostics (Self-Test)

Self-tests can be initiated to validate the transmitter electronics. This test uses an internally generated frequency signal.

Password Protection

Password protection is provided in the local display/configurator mode to assure operating security. A second level of protection is provided for configuration security.

Nominal Flow Velocity Limits

Can be calculated using Table 1, where ρ_f is the process fluid density at flowing conditions in lb/ft³ or kg/m³ as applicable. The specifications apply for most applications, but can deviate slightly for some combinations of density and line size. Also refer to FlowExpertPro.com.

Table 1. Nominal Flow Velocity Limits

Range Limit	Std. Temperature Range		High Temperature Range	
	ft/s	m/s	ft/s	m/s
Lower	$2.0/\sqrt{\rho_f}$	$2.4/\sqrt{\rho_f}$	$4.0/\sqrt{\rho_f}$	$4.8/\sqrt{\rho_f}$
Upper	$200/\sqrt{\rho_f}$	$240/\sqrt{\rho_f}$	$200/\sqrt{\rho_f}$	$240/\sqrt{\rho_f}$

Flowmeter Ranges

Flowmeter is shipped with flow range specified in the sales order or with a default flow range equal to the meter capacity. It can be reranged by the user keeping the same flowrate units, choosing new flowrate units from a built-in menu-selectable list, or entering custom flowrate units. Also refer to FlowExpertPro.com.

Flowing K-Factor

The flowing K-factor is computed from the K-reference expressed in specified flowing units, and can be corrected for the following:

- Process Temperature
- Mating Pipe
- Upstream Disturbances

K-Factor Bias

Provisions are made in the configuration menu to bias the flowmeter K-factor by a percent (%) value. Flowing K-factor value will be automatically recalculated when the % bias is entered.

Static Pressure Limits

MINIMUM

The minimum static pressure is that pressure which is sufficient to prevent flashing (see Minimum Back Pressure paragraph).

MAXIMUM

1500 psi (10 340 kPa) or that imposed by process piping. See Figure 4 to 9 for flange pressure-temperature limits.

NOTE

For higher static pressure limits, contact Invensys Foxboro.

Approximate Pressure Loss

Maximum pressure loss at maximum flow for every flowmeter with any fluid is 8 psi (55 kPa). Note that for many flow conditions, the actual pressure loss is much less than 8 psi (55 kPa). Use the FlowExpertPro Sizing Program to determine actual pressure loss for a given set of conditions.

Minimum Back Pressure (Volatile Liquids or Low Pressure Conditions)

Any condition that tends to contribute to the release of vapor from the liquid (flashing, which may also induce cavitation) shall be avoided by proper system design and operation of the flowmeter within the rated flow rate range. Location of flowmeter should determine the need for incorporating or considering a back-pressure valve, or for increasing inlet pressure. To avoid flashing and to ensure stable vortex generation, the minimum back pressure should be:

$$P_G = (3)(\Delta P) + (1.25)(p_v) - (p_{atm})$$

- where,
- P_G = Gauge pressure in kPa or psi five pipe diameters downstream of the flowmeter
 - ΔP = Calculated pressure loss in kPa or psi (see "Approximate Pressure Loss" section)
 - p_v = Vapor pressure at line conditions in kPa or psi absolute
 - p_{atm} = Atmospheric pressure in kPa or psi absolute

FUNCTIONAL SPECIFICATIONS (Cont.)

Flange Pressure-Temperature Ratings

See Figures 4 to 9 for ANSI and metric flange pressure-temperature ratings. Also see Figure 10 for pressure-temperature limits when isolation valves are used. Also note the temperature limit when fluorolube fill (200°F/90°C) or silicone fill (400°F/200°C) is used, or when no fill (800°F/430°C) is used with extended temperature applications. The flange ratings in Figures 4 through 9 are also embedded in the FlowExpertPro sizing program.

European Union Directives

- Complies with Electromagnetic Compatibility Requirements of European EMC Directive 89/336/EEC by conforming to the following CENELEC and IEC Standards: EN 50081-2, EN 50082-2, EN61326, and IEC 61000-4-2 through EN 61000-4-6.
- Complies with NAMUR NE 21 Interference Immunity Requirement (EMC).
- Conforms to Applicable European Union Directives ("CE" Logo marked on product).

FUNCTIONAL SPECIFICATIONS (Cont.)

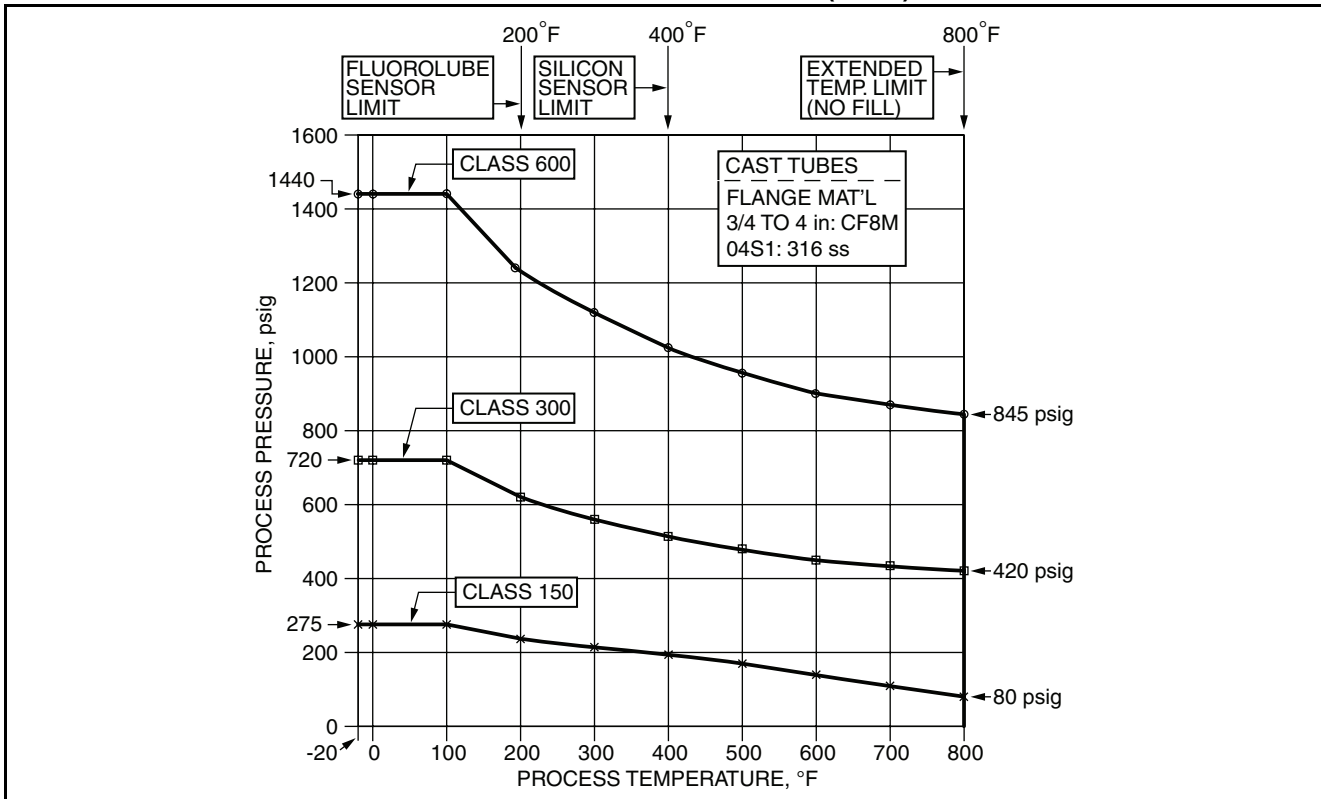


Figure 4. ANSI Flange Ratings; per ASME B16.5; Group 2.2 Materials

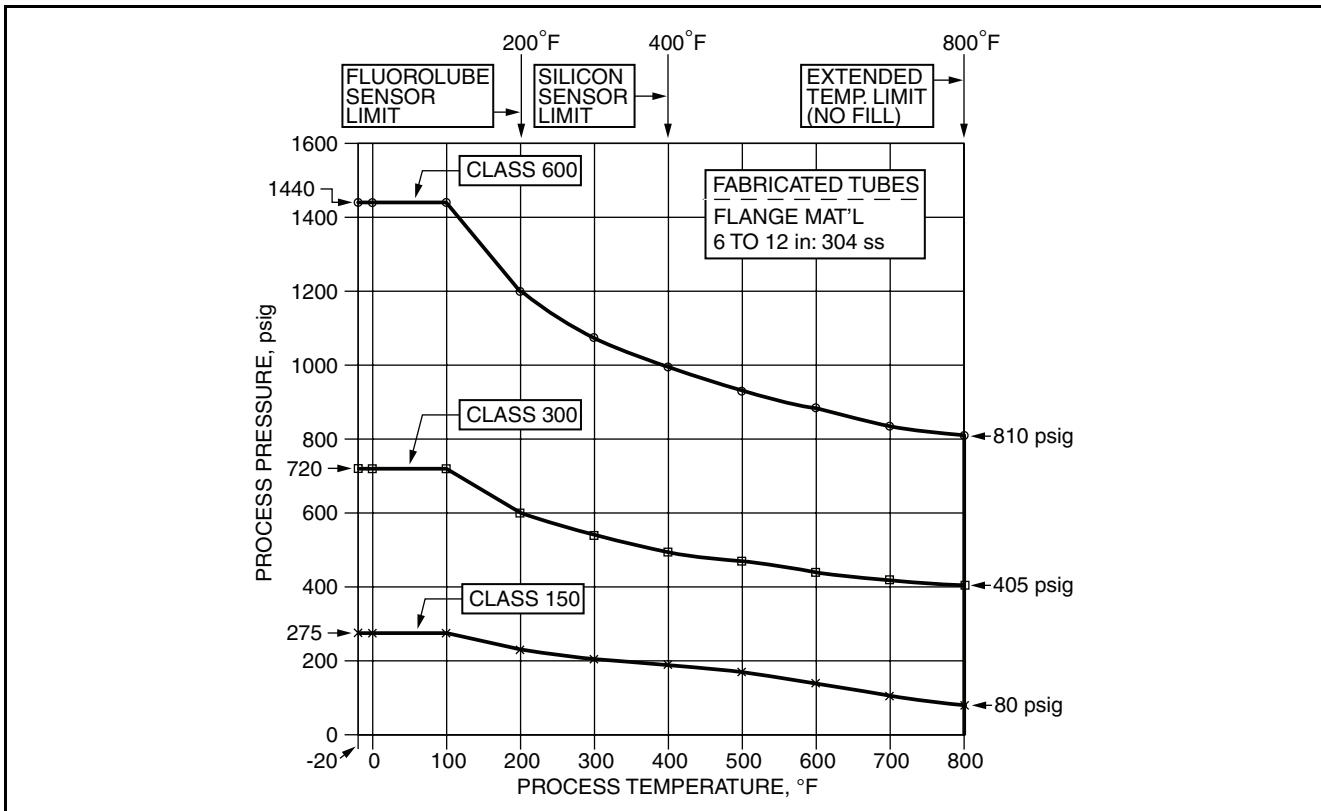


Figure 5. ANSI Flange Ratings; per ASME B16.5; Group 2.1 Materials

FUNCTIONAL SPECIFICATIONS (Cont.)

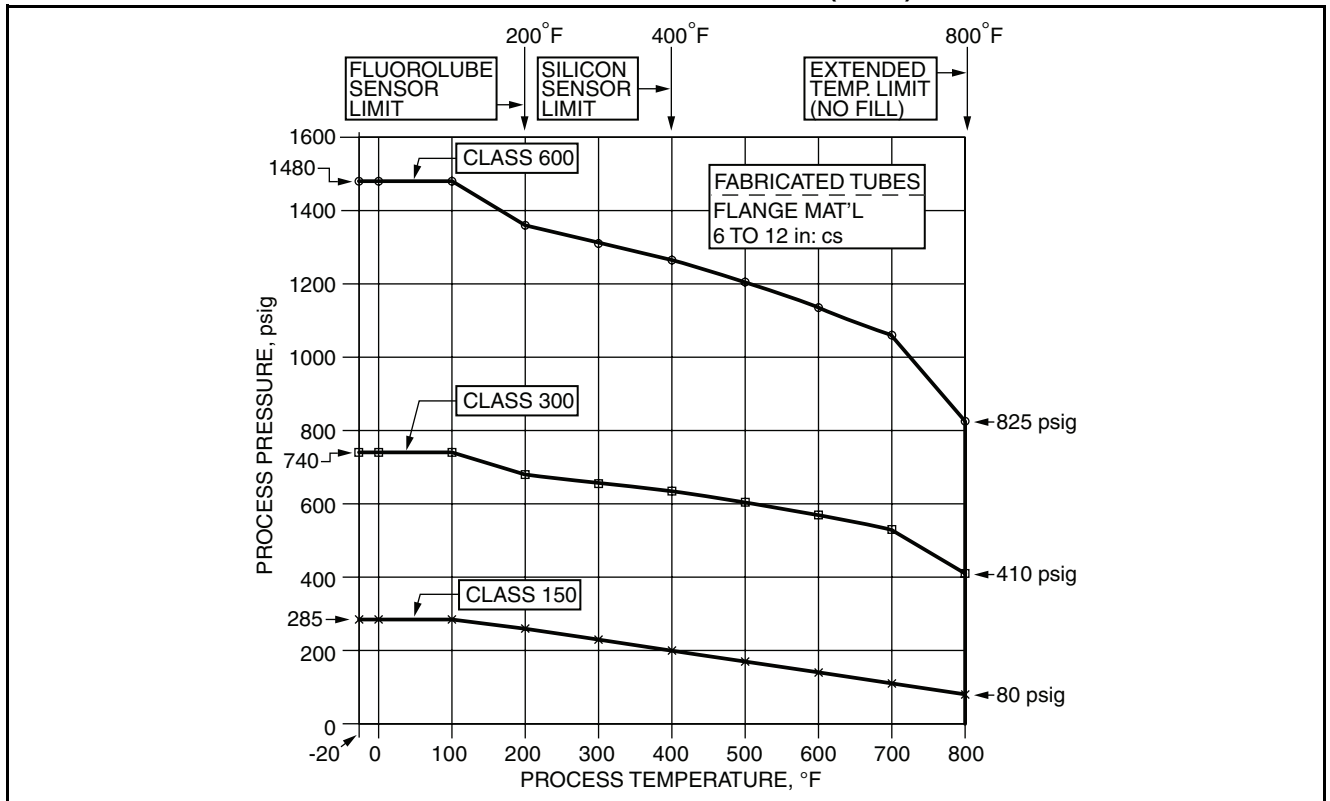


Figure 6. ANSI Flange Ratings; per ASME B16.5; Group 1.1 Materials

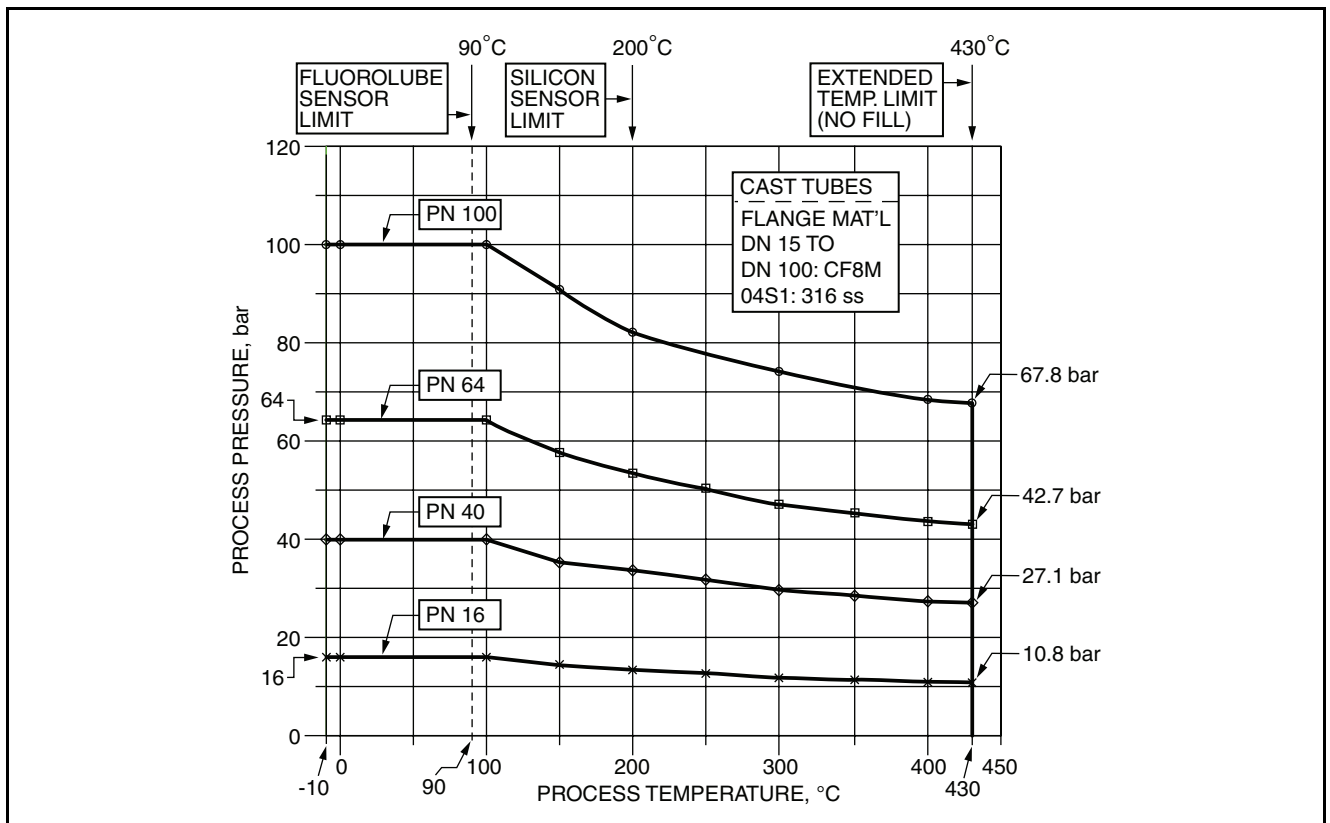


Figure 7. Metric Flange Ratings; Material Group 14E0

FUNCTIONAL SPECIFICATIONS (Cont.)

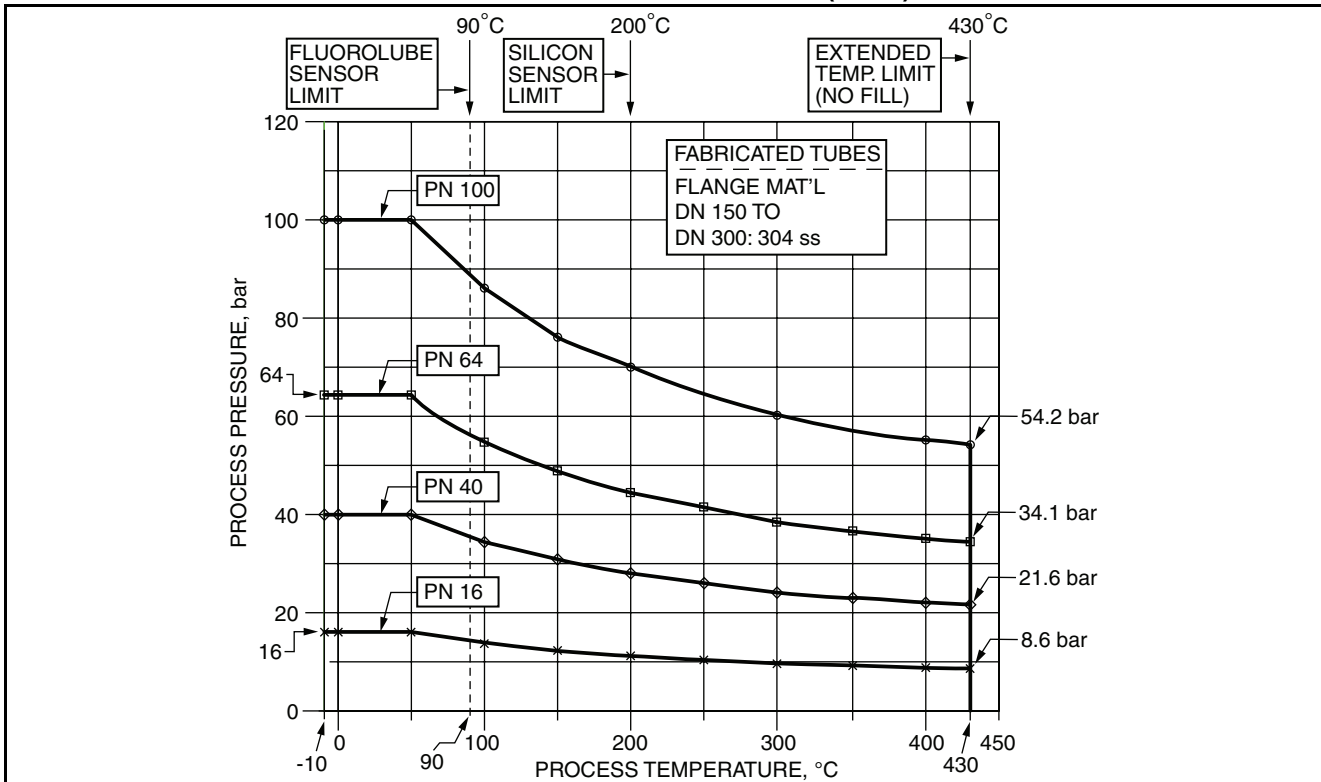


Figure 8. Metric Flange Ratings; Material Group 10E0

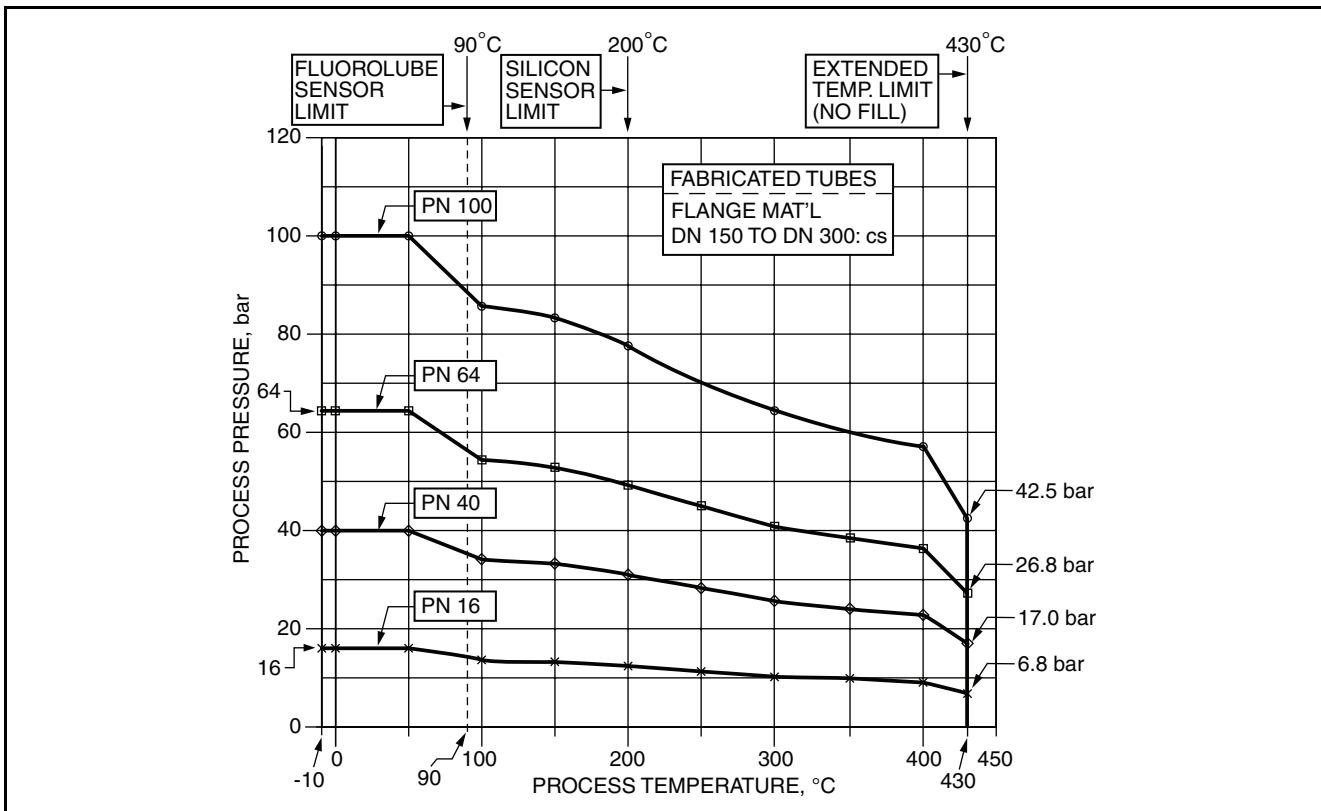


Figure 9. Metric Flange Ratings; Material Group 3E0

FUNCTIONAL SPECIFICATIONS (Cont.)

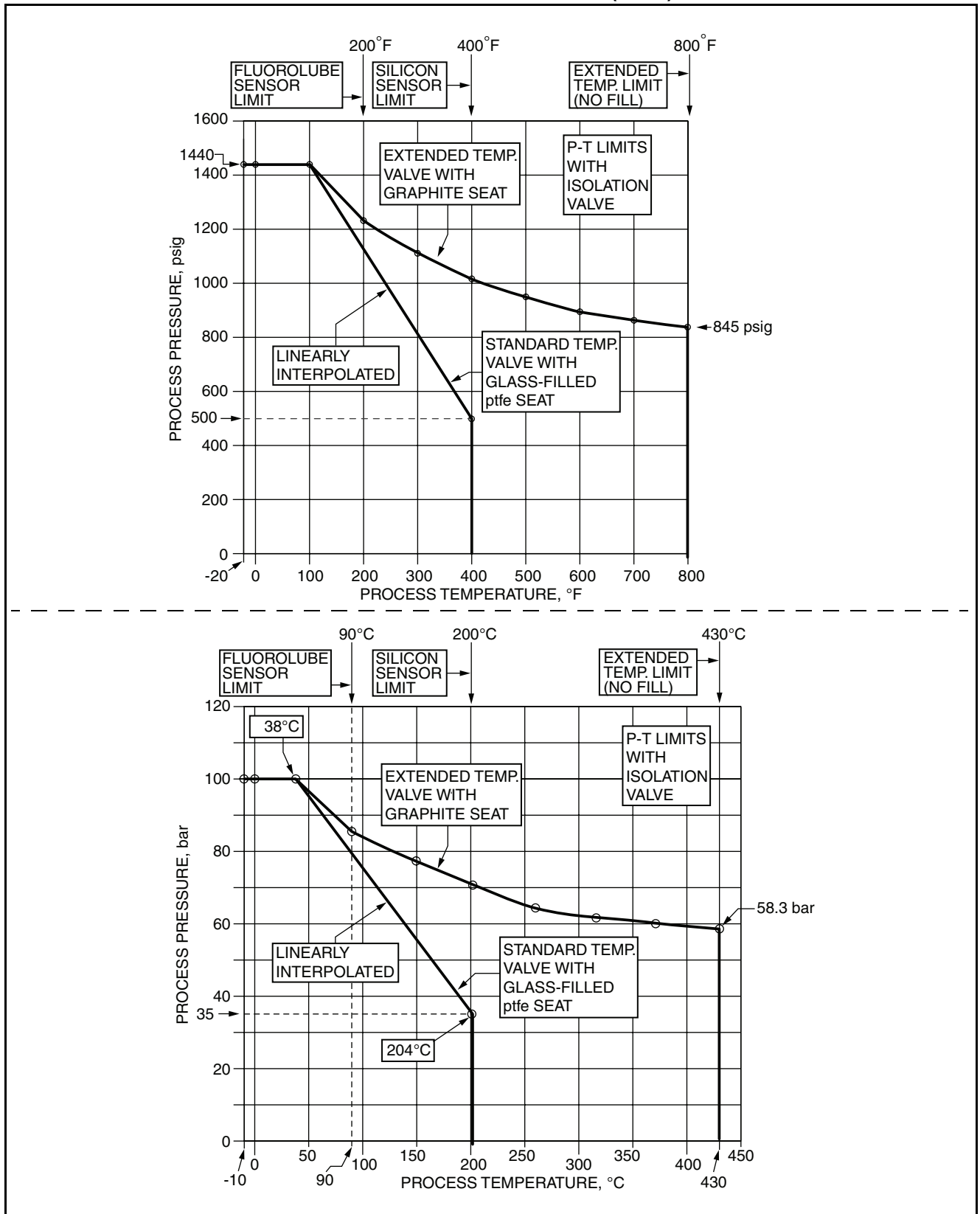


Figure 10. Pressure-Temperature Limits with Isolation Valve; U.S. Customary and Metric Units

PHYSICAL SPECIFICATIONS

Process-Wetted Parts - Model 83F

FLOWMETER BODY, FLANGES, AND SHEDDING BAR (ALSO SEE MODEL CODE)

- 316 ss up to 4 in (DN 100) sizes;
- 304 ss body and shedder, and cs or ss flange, for sizes >4 in (>DN 100).

GASKETS AND FLOW DAM (SENSOR SEALS)

- Standard Temperature Sensor
 - ptfе gasket and flow dam
- High Temperature Sensor
 - 316 ss gasket; 316 ss/grafоil flow dam
 - Hastelloy C gasket; Hastelloy C/grafоil flow dam

Process-Wetted Parts - Model 83W

FLOWMETER BODY AND SHEDDING BAR (ALSO SEE MODEL CODE)

- 316 ss for all sizes; or
- Hastelloy C for 3/4 to 4 in (DN 15 to DN 100) sizes.

GASKETS AND FLOW DAM (SENSOR SEALS)

- Standard Temperature Sensor
 - ptfе gasket and flow dam
- High Temperature Sensor
 - 316 ss gasket; 316 ss/grafоil flow dam
 - Hastelloy C gasket; Hastelloy C/grafоil flow dam

Dual Measurement Manifold - Model 83F Only

CF8M stainless steel; pressure and temperature rating of dual manifold same as flowmeter body.

Flowmeter Mounting

Flowmeter can be located in a pipeline which may run in any direction from the vertical (upward flow) to the horizontal. The electronics housing can also be rotated 270° (in 90° increments) with respect to the body. A vertical pipeline is preferred for batch operations to provide improved full line assurance. See Recommended Mounting Arrangements section.

Electrical Connections

Field wires enter through 1/2 NPT conduit threaded entrances on either side of the electronics housing. Wires terminate under screw terminals and washers on terminal block (see Figure 11) in the field terminal compartment. Unused entrance is plugged to insure moisture and RFI/EMI protection.

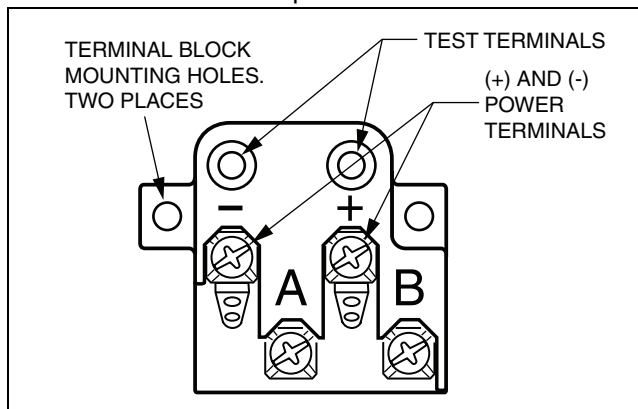


Figure 11. Terminal Block

Electronics Module

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

Environmental Protection

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

Isolation Valve (if specified, see Model Code for Selection Options)

VALVE BODY
Grade CF8M stainless steel

VALVE BALL
316 ss

VALVE SEATS
Standard Temperature: Glass-Filled ptfе
Extended Temperature: Graphite

STEM SEAL
The valve stem seal meets the external leakage requirements for fire safety per API Standard 607.

VALVE HANDLE
Use adjustable wrench.

SEAT LEAKAGE
Standard Temperature
Class IV – Less than 5 mL/h per MSS-SPG1.
High Temperature
Class IV per ANSI/FCI-70.2

FLOW VELOCITY LIMITS
See “Flow Velocity Limits” section.

APPLICATIONS
Recommended for use with clean liquids, saturated steam, and all gases.

LIMITATIONS
Not recommended for use with superheated steam without insulation, or liquids with suspended solids.

MOUNTING
See MI 019-202 for installation guidelines.

PRESSURE/TEMPERATURE RATING
Both standard and extended (high) temperature isolation valves have a maximum pressure rating of 1440 psi at 100°F (100 bar at 38°C). The standard temperature valve with ptfе seats is further limited to a maximum pressure of 500 psi at 400°F (35 bar at 204°C). The extended temperature valve has an ANSI Class 600 temperature and pressure rating. See Figure 10.

NACE Certification

The stainless steel material option has been designed, and materials selected, to meet the requirements of NACE (National Association of Corrosion Engineers) Standard MR-01. A NACE compliance certificate is available by selecting the -Q option.

PHYSICAL SPECIFICATIONS (Cont.)

Process Connections

83F FLANGED BODY FLOWMETERS

Refer to the 83F Model Code for the availability of body material, flange material, flange types, and body/flange construction for each line size.

83W WAFER BODY FLOWMETERS

Refer to the 83W Model Code for the availability of body material and mounting/centering system for each line size when mounted between the different flange types. Wafer body flowmeters must be properly aligned to provide optimum accuracy, and alignment spacers are provided to achieve this alignment. Carbon steel bolting kits can also be provided as listed in the Optional Selections and Accessories section.

Dimensions

Refer to Dimensions - Nominal section for general outline data. For more dimensional details, refer to the following Dimensional Prints (DPs).

Model	Configuration	Dimensional Print
83F	Single Measurement	DP 019-150
83F	Dual Measurement	DP 019-151
83W (a)	Single Measurement (a)	DP 019-152

(a) The 83W is not available as Dual Measurement Flowmeter.

Approximate Weight

See Tables 3 to 7.

Table 2. 83F Vortex Flowmeters – Flanged Body: Approximate Weight with ANSI Class 150 Flanges

Nominal Line Size		With Integral Mounted Electronics Housing				With Remote Mounted Electronics Housing					
		Flowmeter Weight(a)				Flowmeter Weight(b)				Electronics Housing Weight(c)	
		Sensor Types D, F, R, & S		Sensor Types C & T		Sensor Types D, F, R, & S		Sensor Types C & T			
in	DN	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
3/4	DN 15	11.0	5.0	11.7	5.3	9.0	4.1	9.9	4.5	5.0	2.3
1	DN 25	13.2	6.0	13.9	6.3	11.0	5.0	11.9	5.4	5.0	2.3
1 1/2	DN 40	16.0	7.3	16.7	7.6	14.0	6.4	15.0	6.8	5.0	2.3
2	DN 50	20.2	9.2	21.0	9.5	18.0	8.2	19.0	8.6	5.0	2.3
3	DN 80	33.2	15.1	33.9	15.4	29.0	13.2	30.0	13.6	5.0	2.3
4	DN 100	45.0	20.5	45.8	20.8	43.0	19.5	44.0	20.0	5.0	2.3
6	DN 150	72.2	32.8	72.8	33.1	70.0	31.8	71.3	32.3	5.0	2.3
8	DN 200	125.0	56.6	125.4	57.0	121.0	54.9	122.0	55.3	5.0	2.3
10	DN 250	190	86.2	190.0	86.2	185.0	83.9	187.0	84.8	5.0	2.3
12	DN 300	265.0	120.0	265.0	120.0	260.0	118.0	262.0	119.0	5.0	2.3

(a) Weight of complete flowmeter, including integral electronics housing.

(b) Flowmeter Weight is weight of flowtube with sensor plus bonnet plus junction box.

(c) Housing Assembly Weight (for all Sensor Type selections) is weight of electronics housing assembly plus mounting bracket.

Table 3. 83W Vortex Flowmeters – Wafer Body: Approximate Weight

Nominal Line Size		With Integral Mounted Electronics Housing				With Remote Mounted Electronics Housing					
		Flowmeter Weight(a)				Flowmeter Weight(b)				Electronics Housing Weight(c)	
		Sensor Types D, F, R, & S		Sensor Types C & T		Sensor Types D, F, R, & S		Sensor Types C & T			
in	DN	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
3/4	DN 15	7.0	3.2	7.3	3.3	5.0	2.3	5.5	2.5	5.0	2.3
1	DN 25	8.1	3.7	8.4	3.8	6.0	2.7	6.4	2.9	5.0	2.3
1 1/2	DN 40	9.0	4.1	9.2	4.2	7.0	3.2	7.5	3.4	5.0	2.3
2	DN 50	12.0	5.4	12.3	5.6	10.0	4.5	10.3	4.7	5.0	2.3
3	DN 80	17.2	7.8	17.4	7.9	15.0	6.8	15.4	7.0	5.0	2.3
4	DN 100	25.0	11.3	25.3	11.5	23.0	10.4	23.5	10.7	5.0	2.3
6	DN 150	37.0	16.8	37.2	16.9	35.0	16.0	35.6	16.2	5.0	2.3
8	DN 200	61.1	27.7	61.3	27.8	59.0	26.8	59.4	27.0	5.0	2.3

(a) Weight of complete flowmeter, including electronics housing.

(b) Flowmeter Weight is weight of flowtube with sensor plus bonnet plus junction box.

(c) Housing Assembly Weight (for all Sensor Type selections) is weight of electronics housing assembly plus mounting bracket.

PHYSICAL SPECIFICATIONS (Cont.)

Table 4. Additional Weight for Single Measurement Flowmeter with Isolation Valve
(Add Weight in this table to Tables 3 and 4 Weights as Applicable)

Nominal Line Size(a)		With Integral Mounted Electronics Housing				With Remote Mounted Electronics Housing			
		Added Weight with Sensor Types				Added Weight with Sensor Types			
		D, F, R, & S		C & T		D, F, R, & S		C & T	
in	DN	lb	kg	lb	kg	lb	kg	lb	kg
All	All	2.1	1.0	2.1	1.0	2.1	1.0	2.1	1.0

(a) Sizes 10 and 12 in (DN 250 and DN 300) not available with wafer body flowmeter.

Table 5. Additional Weight for Dual Measurement Flowmeter without Isolation Valves
(Add Weight in this table to Table 3 Weight)

Nominal Line Size(a)		With Integral Mounted Electronics Housing				With Remote Mounted Electronics Housing			
		Added Weight with Sensor Types(b)				Added Weight with Sensor Types(c)			
		D, F, R, & S		C & T		D, F, R, & S		C & T	
in	DN	lb	kg	lb	kg	lb	kg	lb	kg
All	All	11.9	5.4	12.6	5.7	7.2	3.3	8.8	4.0

(a) Dual Measurement Flowmeters are only available with Flanged Body Flowtubes.

(b) Added weight includes dual manifold without valves, one sensor, a bonnet, an electronics housing, and a support bracket.

(c) Added weight includes dual manifold without valves, one sensor, a bonnet, a junction box assembly, and a support bracket.

Table 6. Additional Weight for Dual Measurement Flowmeter with Isolation Valves
(Add Weight in this table to Table 3 Weight)

Nominal Line Size(a)		With Integral Mounted Electronics Housing				With Remote Mounted Electronics Housing			
		Added Weight with Sensor Types(b)				Added Weight with Sensor Types(c)			
		D, F, R, & S		C & T		D, F, R, & S		C & T	
in	DN	lb	kg	lb	kg	lb	kg	lb	kg
All	All	15.0	6.8	15.7	7.1	10.3	4.7	11.8	5.4

(a) Dual Measurement Flowmeters are only available with Flanged Body Flowtubes.

(b) Added weight includes dual manifold with valves, one sensor, a bonnet, an electronics housing, and a support bracket.

(c) Added weight includes dual manifold with valves, one sensor, a bonnet, a junction box assembly, and a support bracket.

PRODUCT SAFETY SPECIFICATIONS

Pressure Safety

Designed to withstand ANSI and metric pressure-temperature ratings as shown in Figures 4 to 9. Note, for Wafer Body Flowmeters, the flowtube face outside diameter is designed to center between ANSI Class 150 flanges. For other flange ratings, centering spacers are provided.

Personnel and Electrical Fire Safety

This device is designed to be a minimum fire hazard by using low energy power and adequate insulation and separation of electrical circuits. The required standards of worldwide testing agencies such as FM and CSA have been fulfilled.

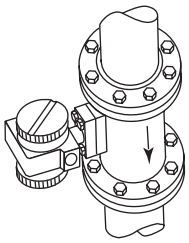
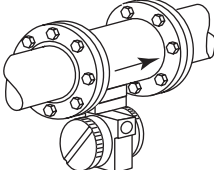
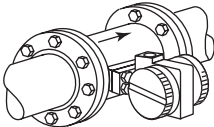
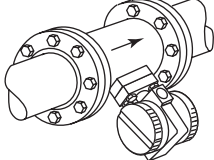
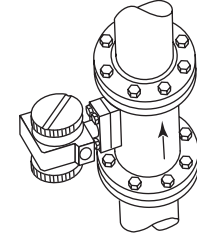
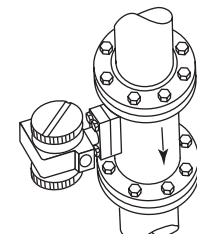
Electrical Safety Specifications

Testing Laboratory, Types of Protection and Area Classification	Application Conditions	Electrical Safety Design Code
CSA explosionproof for Class I, Division 1, Groups C and D; dust-ignitionproof for Class II, Division 1, Groups E, F, and G; and Class III.	Maximum Ambient = 85°C	A
FM explosionproof for Class I, Division 1, Groups C and D; dust-ignitionproof for Class II, Division 1, Groups E, F, and G; and Class III.	Temperature Class T5; Ta = 85°C	A

NOTE

These I/A Series Intelligent Vortex Flowmeters have been designed to meet the electrical classifications listed in the table above. Contact Invensys Foxboro for more approval and certification information.

RECOMMENDED MOUNTING ARRANGEMENTS

Flowmeter Mounting Arrangement Model 83F Single Measurement Flowmeter Shown (Dual Measurement Flowmeters follow same arrangements)		Flowmeter for Use With:			
		Liquid	Gas	Saturated Steam	Superheated Steam
	Housing Above Pipe; Isolation Valve and Dual Measurement Flowmeter NOT Used.	Yes (1)	Yes	No	Yes (2)
	Housing Above Pipe; Isolation Valve and Dual Measurement Flowmeter CAN be Used.	No (5)	Yes	No	Yes (2)
	Housing Below Pipe.	Yes (3) (4) (6)	Yes (4)	Yes	Yes (2)
	Housing to Side of Pipe.	Yes	Yes	No	Yes (2)
	Housing to Side and Below Pipe.	Yes (6)	Yes	No	Yes (2)
	Vertical Pipe, Flow upward.	Yes	Yes	No	Yes (2)
	Vertical Pipe, Flow Downward.	Yes (7)	Yes	No	Yes (2)

(1) Possibility of temporary start-up error due to trapped air.
 (2) Requires adequate insulation.
 (3) Best choice when errors due to start-up cannot be tolerated.

(4) Recommended only for clean fluids.
 (5) Not recommended for liquids with isolation valve.
 (6) Preferred for liquids with isolation valve.
 (7) Not preferred; must maintain full pipe with no voids in fluid.

OPTIONAL SELECTIONS AND ACCESSORIES

Options -B, -D, -F, -G; Cable Assembly to Remote Electronics Housing

When selecting Code R for a Remote Mounted Electronics Housing, an optional cable length selection must also be made. Invensys Foxboro offers four cable lengths as follows:

Optional Suffix	Cable Length
-B	20 ft (6 m)
-D	30 ft (9 m)
-E	40 ft (12 m)
-G	50 ft (15 m)

Option -H; Oxygen or Chlorine Service

Wetted parts are cleaned for oxygen or chlorine service in compliance with Compressed Gas Association's CGA-4.1 and ASTM G93. Cleaning is not offered when an isolation valve, or dual measurement or extended temperature meters are selected. Select Option -H.

Option -J; Gold Plated Sensor

Ideally suited for H₂ or extremely corrosive processes. Specify Optional Suffix -J.

Options -L, -M, -Q; Material Certificates

Three material certificates are offered. Optional Suffix -L provides a certificate of compliance to Invensys Foxboro specifications. The Invensys Foxboro quality system conforms to ISO 9001. Suffix -M is a certification of material for process wetted metal (conforms to BS EN 10204-3.1). And, Suffix -Q certifies that stainless steel materials meet NACE Standard MR-01.

Option -N; Certified Calibration Certificate

A calibration and test certificate come standard with each flowmeter. A certified flow calibrated K-factor and pressure test certificate is available by selecting Optional Suffix -N.

Options -F, -V, -X; Welding Certificates - with Flanged Body Flowtubes Only

Three certificates are available. Option -F certifies that the fabrication of 150 to 300 mm (6 to 12 in) flowtubes by welders is to ASME Boiler Code, Section IX. Option -V provides radiographic examination (X-ray) certification of circumferential welds (not available with ANSI Class 150 or Metric PN 16 flanges). And Option -X certifies that welding is per ASME Boiler Code and Radiographic Examination (except as noted for Option -F).

Option -P; Hawke-Type Cable Gland

Brass cable gland with 1/2 NPT external thread. Provides support for field cable. Available with Electrical Safety Codes E and Z only. Used with Electrical Housing Codes T and R only (1/2 NPT). Select Option -P.

Options -R and -S; PG11 and PG13.5 Cable Glands

Cable glands with 1/2 NPT external thread provide strain relieved support for field cable. The PG11 has an I.D. of 0.50 in (12.7 mm) and the PG13.5 has an I.D. of 0.53 in (13.5 mm). They are not for use with units having explosionproof or flameproof certifications. Available with Electrical Housing Codes T and R only (1/2 NPT). Select Option -R for the PG11 and Option -S for the PG13.5.

AS Code MTS; Stainless Steel Customer Tag

This accessory adds a 40 x 90 mm (1.5 x 3.5 in) stainless steel tag for customer data that does not fit on the standard data plate. It is fastened to housing with stainless steel wire. It allows a maximum of 10 lines of data with 40 characters and spaces per line. This tag also shows the K-factor specific to customer application (information with flowing conditions as submitted to Invensys Foxboro with the purchase order). Specify AS Code MTS.

Bolting Kits – With Wafer Body Flowtubes Only

Sets of carbon steel studs and nuts which conform to line size, and ANSI or metric size and rating, are offered in 3/4 to 4 in line sizes for ANSI flanges, and 50 to 100 mm line sizes for metric flanges. See tables below to select the kit and part number required.

ANSI Flange Bolting Kits - Part Numbers

Size	Cl. 150	Cl. 300	Cl. 600
3/4 in	D0148ZF	D0148ZJ	D0148ZJ
1 in	D0148ZF	D0148ZJ	D0148ZJ
1 1/2 in	D0148ZF	D0148ZK	D0148ZS
2 in	A2044HB	A2044HB (a)	A2044HC (a)
3 in	A2044HC	A2044HD	A2044HD
4 in	A2044HC (a)	A2044HD	A2044HE

(a) Two kits required.

Metric Flange Bolting Kits - Part Numbers

Size	PN 16	PN 40	PN 64	PN 100
50 mm	N/A	D0148ZU	N/A	N/A
80mm	N/A	D0148ZZ (a)	N/A	N/A
100 mm	L0114NT	L0114NT	N/A	N/A

(a) Two kits required.

MODEL CODES

Model 83F Intelligent Vortex Flowmeters – Flanged Body

Description

83F = Intelligent Vortex Flowmeter – Flanged Body

Electronics Type (a)

-F = Intelligent; Digital, FOUNDATION Fieldbus Communication Protocol

Nominal Line Size

3Q = 3/4 in (DN 15) Line Size

01 = 1 in (DN 25) Line Size

1H = 1 1/2 in (DN 40) Line Size

02 = 2 in (DN 50) Line Size

03 = 3 in (DN 80) Line Size

04 = 4 in (DN 100) Line Size

06 = 6 in (DN 150) Line Size

08 = 8 in (DN 200) Line Size

10 = 10 in (DN 250) Line Size

12 = 12 in (DN 300) Line Size

Body and Flange Material

S = Sizes 3Q to 04: Cast Body/Flange and Shedder (except Code 04S1); CF 8M Material
Size 04S1: Fabricated from 316 ss Tubing and Flanges

Sizes 06 to 12: Body Fabricated from 304 ss Tubing with 304 ss Flanges

K = Sizes 06 to 12: Body Fabricated from 304 ss Tubing with Carton Steel (A105) Flanges

End Connections and Flange Rating

Description

Used with Line Sizes

1 = ANSI Class 150 Flange, RF, per ASME B16.5	All line sizes
2 = ANSI Class 300 Flange, RF, per ASME B16.5	All line sizes
3 = ANSI Class 600 Flange, RF, per ASME B16.5	Sizes 3Q through 08 only
4 = Metric PN 16 Flange, RF, Finish Form D, per ASME B16.5	Sizes 06 through 08 only
5 = Metric PN 40 Flange, RF, Finish Form D, per DIN 2501	All line sizes
6 = Metric PN 64 Flange, RF, Finish Form E, per DIN 2501	Sizes 02 through 12 only
7 = Metric PN 100 Flange, RF, Finish Form E, per DIN 2501	Sizes 3Q through 08 only
8 = Metric PN 40 Flange, RF, Finish Form C, per DIN 2501	Sizes 3Q through 04 only
A = Metric PN 40 Flange, RF, Finish Form N, per DIN 2501	All line sizes
B = Metric PN 64 Flange, RF, Finish Form N, per DIN 2501	Sizes 02 through 12 only
C = Metric PN 100 Flange, RF, Finish Form N, per DIN 2501	Sizes 3Q through 08 only
D = Metric PN 16 Flange, RF, Finish Type B1, per EN 1092-1	Sizes 06 through 08 only (f)
F = Metric PN 40 Flange, RF, Finish Type B1, per EN 1092-1	All line sizes (f)
H = Metric PN 100 Flange, RF, Finish Type B1, per EN 1092-1	All line sizes (f)

Single or Dual Measurement, Isolation Valve, and Manifold

S = Single Measurement; No Isolation Valve

D = Dual Measurement; Manifold with no Isolation Valve

K = Single Measurement, Manifold with one Isolation Valve; CF 8M Stainless Steel

L = Dual Measurement, Manifold with two Isolation Valves; CF 8M Stainless Steel

Sensor Fill, Temperature Range, and Material

Standard Temperature Range (with Fill Fluid)

D = Fluorolube Fill, 0 to 200 °F (–20 to +90 °C) Hastelloy Type CW2M
F = Fluorolube Fill, 0 to 200 °F (–20 to +90 °C) Stainless Steel Type CF3M
R = Silicone Fill, 0 to 400 °F (–20 to +200 °C) Hastelloy Type CW2M
S = Silicone Fill, 0 to 400 °F (–20 to +200 °C) Stainless Steel Type CF3M

High Temperature Range (No Fill Fluid) (e)

C = Unfilled, 400 to 800 °F (200 to 430 °C) Hastelloy Type CW2M
T = Unfilled, 400 to 800 °F (200 to 430 °C) Stainless Steel Type CF3M

Model 83F Code continued on next page

MODEL CODES (Cont.)**Model 83F Intelligent Vortex Flowmeters - Flanged Body (Cont.)****Mounting for Electronics Housing**

- T = Mounted to Flowtube; Aluminum Housing; 1/2 NPT Conduit Connections
- R = Remote Mounted; Aluminum Housing; 1/2 NPT Conduit Connections
Also must select Cable Length in Options Section.

Local Digital Indicator/Configurator

- N = No Digital Indicator/Configurator (Blind Unit)
- J = Full Function Digital Indicator/Configurator

Electrical Safety (See Electrical Safety Specifications Section for further details)

- A = CSA, Explosionproof, Dust-ignitionproof; Division 1
FM, Explosionproof, Dust-ignitionproof; Division 1
- Z = No Approval/Certification Required

Optional Selections***Cable Length Selection for Remote Electronics Housing***

- B = 20 ft (6 m) Cable to Connect to Remote Electronics Housing
- D = 30 ft (9 m) Cable to Connect to Remote Electronics Housing
- E = 40 ft (12 m) Cable to Connect to Remote Electronics Housing
- G = 50 ft (15 m) Cable to Connect to Remote Electronics Housing

Cleaning for Oxygen or Chlorine Service

- H = Cleaning of Process Wetted Parts for Oxygen/Chlorine Service per CGA G-4.1 and ASTM G93
(Not with Measurement/Isolation Valve Codes D, K, and L, Size Codes 10 and 12, or extended temperature Sensor Codes C and T)

Sensor Plating

- J = Gold Plated Sensor

Invensys Foxboro Certificates of Compliance/Conformance

- L = Standard Certificate of Compliance
- M = Invensys Foxboro Material Certification of Process Wetted Metal (Conforms to BS EN10204.3.1)
- Q = Process Wetted Parts Conform to NACE MR-01

Invensys Foxboro Certified Calibration Certificate

- N = Invensys Foxboro Calibration and Pressure Test Certification

Cable Connections - with Electrical Housing Codes T and R (1/2 NPT)

- P = Hawke-Type Cable Gland (with Electrical Safety Codes E and Z only)
- R = PG11 Trumpet Gland (not with flameproof/explosionproof certifications)
- S = PG13.5 Trumpet Gland (not with flameproof/explosionproof certifications)

Welding Certificate (Size Codes 06 through 12 only) (c)(d)

- F = Welding Certified to the ASME Boiler Code
- V = Radiographic Examination (X-ray) of Flange Welds (except ANSI 150 and Metric PN 16)
- X = Welding Certified to the ASME Boiler Code, includes Radiographic Examination

Examples: 83F-F02S1SDTNA-X; 83F-F06K7DCRJA-GQNX

(a) For FoxCom or HART Communication Protocol, see PSS 1-8A1 E; for flowmeters with analog and pulse output, see PSS 1-8A1 D.

(b) For Size Codes 3Q, 01, and 1H, order End Connection Code H.

(c) Select one certificate only. Note that Certificate "-X" includes both "-F" and "-V" certifications.

(d) Not available when Size Code 06 or 08 is combined with End Connection Code 1 or 4.

(e) Application ALERT: for Extended Temperature Range sensors used in hazardous or volatile gas applications, there is the potential of fugitive emissions to occur through the sensor vented restrictor if the sensor diaphragm were to fail.

(f) Contact Invensys Foxboro if metric flanges per EN 1092-1 are selected.

MODEL CODES (Cont.)**Model 83W Intelligent Vortex Flowmeters – Wafer Body****Description**

83W = Intelligent Vortex Flowmeter – Wafer Body

Electronics Type (a)

-F = Intelligent; Digital, FOUNDATION Fieldbus Communication Protocol

Nominal Line Size

3Q = 3/4 in (DN 15) Line Size
 01 = 1 in (DN 25) Line Size
 1H = 1 1/2 in (DN 40) Line Size
 02 = 2 in (DN 50) Line Size
 03 = 3 in (DN 80) Line Size
 04 = 4 in (DN 100) Line Size
 06 = 6 in (DN 150) Line Size
 08 = 8 in (DN 200) Line Size

Body Material

S = ASTM A351-CF8M (316 ss) Cast Body and Shedder
 H = ASTM A494-CW2M (Hastelloy C) Cast Body and Shedder; with Size Codes 3Q to 04 only.

Mounting and Centering System

1 = Centering for the following Flanges:
 ANSI Class 150 and ANSI Class 300
 ANSI Class 600 with Sizes 3Q to 04 only
 Metric PN 16 with Sizes 01 to 03 only
 Metric PN 40 with Sizes 01 to 03, and 06, and 08
 Metric PN 64 and Metric PN 100
 3 = Centering for ANSI Class 600 with 06 and 08 Sizes Only
 4 = Centering for Metric PN 16 (Sizes 04, 06, and 08 only)
 5 = Centering for Metric PN 40 (Size 04 only)
 9 = Centering for Metric PN 16, and PN 40 (Size 04 Only)

Isolation Valve

S = No Isolation Valve
 K = Isolation Valve, Type CF8M Stainless Steel

Sensor Fill, Temperature Range, and Material***Standard Temperature Range (with Fill Fluid)***

D = Fluorolube Fill, 0 to 200°F (–20 to +90°C) Hastelloy Type CW2M
 F = Fluorolube Fill, 0 to 200°F (–20 to +90°C) Stainless Steel Type CF3M
 R = Silicone Fill, 0 to 400°F (–20 to +200°C) Hastelloy Type CW2M
 S = Silicone Fill, 0 to 400°F (–20 to +200°C) Stainless Steel Type CF3M

High Temperature Range (No Fill Fluid) (b)

C = Unfilled, 400 to 800°F (200 to 430°C) Hastelloy Type CW2M
 T = Unfilled, 400 to 800°F (200 to 430°C) Stainless Steel Type CF3M

Mounting for Electronics Housing (b)

T = Mounted to Flowtube; Aluminum Housing; 1/2 NPT Conduit Connections (a)
 R = Remote Mounted; Aluminum Housing; 1/2 NPT Conduit Connections (a)
 Also must select Cable Length in Options Section.

Model 83W Code continued on next page

MODEL CODES (Cont.)

Model 83W Intelligent Vortex Flowmeters - Wafer Body (Cont.)

Local Digital Indicator/Configurator

- N = No Digital Indicator/Configurator (Blind Unit)
- J = Full Function Digital Indicator/Configurator

Electrical Safety (See Electrical Safety Specifications Section and Note below)

- A = CSA, Explosionproof, Dust-ignitionproof; Division 1
FM, Explosionproof, Dust-ignitionproof; Division 1
- Z = No Approval/Certification Required

Optional Selections

Cable Length Selection for Remote Electronics Housing

- B = 20 ft (6 m) Cable to Connect to Remote Electronics Housing
- D = 30 ft (9 m) Cable to Connect to Remote Electronics Housing
- E = 40 ft (12 m) Cable to Connect to Remote Electronics Housing
- G = 50 ft (15 m) Cable to Connect to Remote Electronics Housing

Cleaning for Oxygen or Chlorine Service

- H = Cleaning of Process Wetted Parts per Compressed Gas Association's CGA G-4.1 and ASTM G93
Not available with Isolation Valve, Code K, or Sensor Codes C and T

Sensor Plating

- J = Gold Plated Sensor

Invensys Foxboro Certificates of Compliance/Conformance

- L = Standard Certificate of Compliance
- M = Invensys Foxboro Material Certification of Process Wetted Metal
(Conforms to BS EN 10204 3.1)
- Q = Process Wetted Parts Conform to NACE MR-01

Invensys Foxboro Calibration Certificate

- N = Invensys Foxboro Calibration and Pressure Test Certification

Cable Connections - with Electrical Housing Codes T and R (1/2 NPT)

- P = Hawke-Type Cable Gland (with Electrical Safety Codes E, N, and Z only)
- R = PG11 Cable Gland, Trumpet Shaped (not with explosionproof/flameproof certifications)
- S = PG13.5 Cable Gland, Trumpet Shaped (not with explosionproof/flameproof certifications)

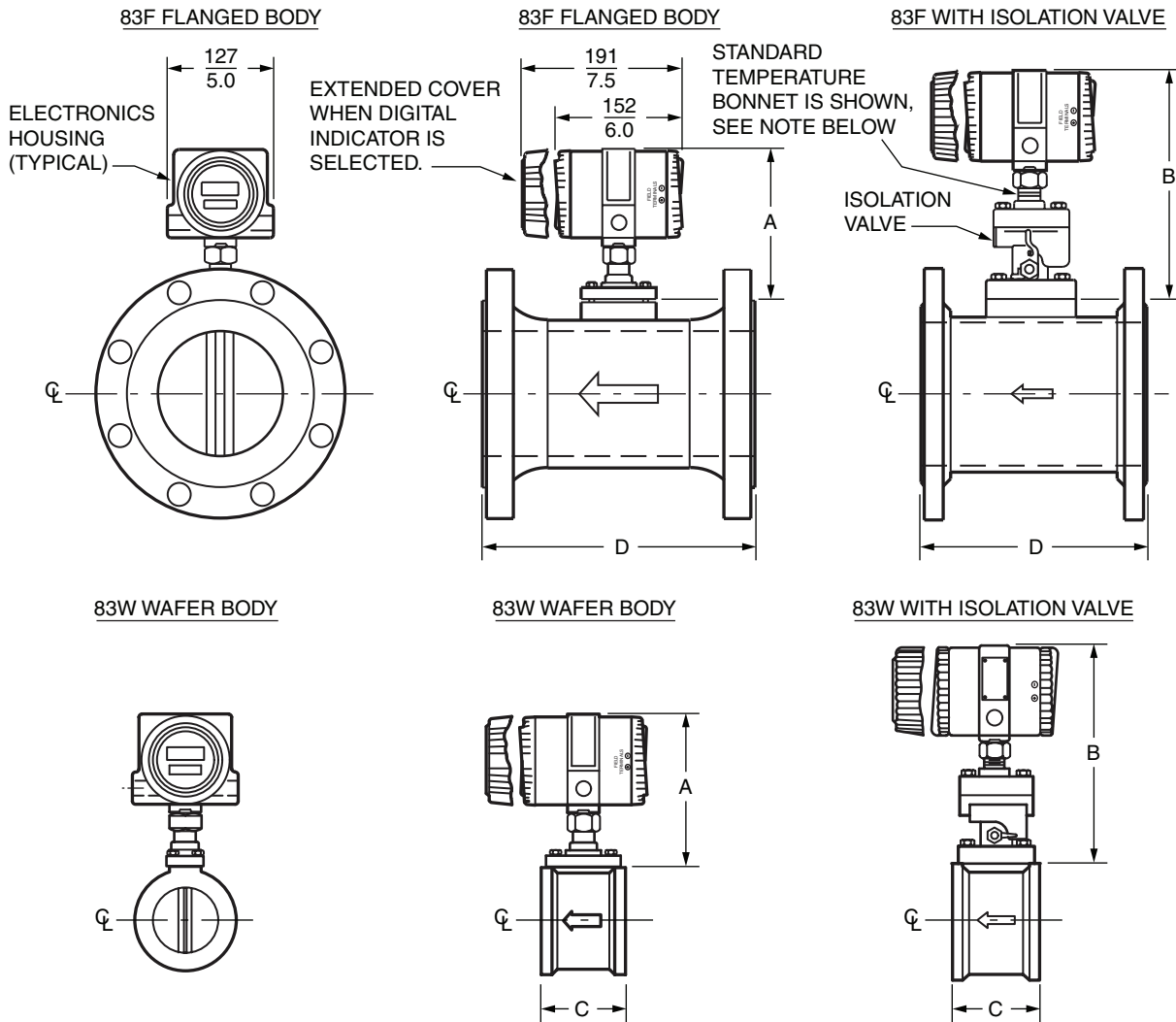
Examples: 83W-F02S1KFTJA-Q; 83W-F06S4SDRJA-GNP

- (a) For flowmeters with FoxCom or HART Communication Protocol, refer to PSS 1-8A1 E; and for flowmeters with analog and pulse output, refer to PSS 1-8A1 D.
- (b) Application ALERT: for Extended Temperature Range sensors used in hazardous or volatile gas applications, there is the potential of fugitive emissions to occur through the sensor vented restrictor if the sensor diaphragm were to fail.

DIMENSIONS - NOMINAL

**mm
in**

83F AND 83W FLANGED AND WAFER BODY FLOWTUBES; INTEGRAL MOUNT; SINGLE MEASUREMENT



Dimension	Dimensions - Nominal Line Size Code (a)									
	3Q	01	1H	02	03	04	06	08	10 (b)	12 (b)
A	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$	$\frac{188}{7.4}$
B	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$	$\frac{257}{10.1}$
C	$\frac{79.5}{3.13}$	$\frac{79.5}{3.13}$	$\frac{79.5}{3.13}$	$\frac{79.5}{3.13}$	$\frac{95.3}{3.75}$	$\frac{121}{4.75}$	$\frac{178}{7.0}$	$\frac{229}{9.0}$	N/A	N/A
D	Dimension D varies with flange type, rating, and size. See Table 7 further in document for dimensions.									

(a) Refer to Model Code section for nominal line sizes in DN or inches.

(b) Size Codes 10 and 12 are not available with wafer body flowtubes.

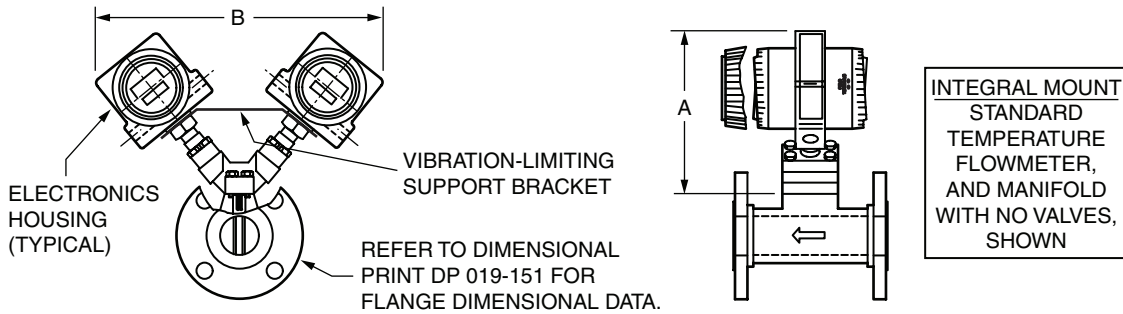
NOTE:

- Dimensions A and B are shown with the standard temperature bonnet. With extended temperature applications; add 2.6 in (66 mm) to Dimensions A and B because of the longer bonnet.
- For additional dimensions, also refer to DP 019-150 for the Model 83F, and DP 019-152 for the Model 83W.

DIMENSIONS - NOMINAL (Cont.)

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

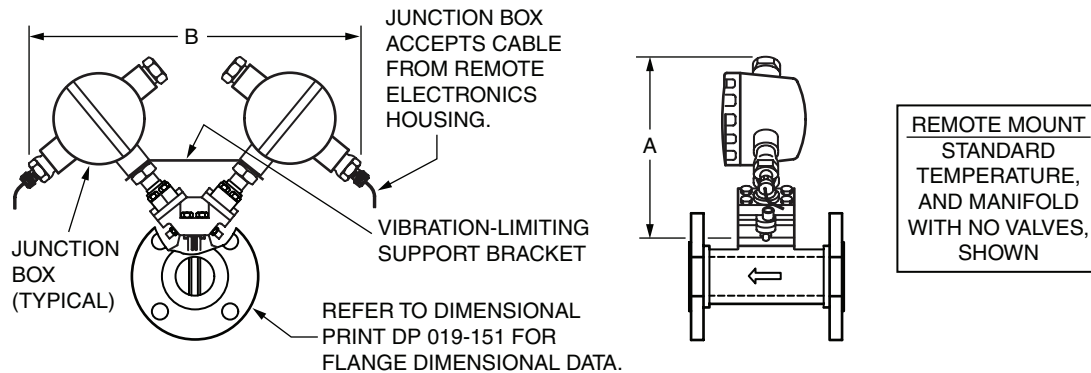
83F FLANGED FLOWTUBE; INTEGRAL MOUNT; DUAL MEASUREMENT



Integral Mount Dimensions

Dimension	Standard Temperature Flowmeter		Extended Temperature Flowmeter	
	No Isolation Valves	With Isolation Valves	No Isolation Vales	With Isolation Valves
A	$\frac{198}{7.8}$	$\frac{216}{8.5}$	$\frac{262}{10.3}$	$\frac{274}{10.8}$
B	$\frac{394}{15.5}$	$\frac{432}{17.0}$	$\frac{495}{19.5}$	$\frac{521}{20.5}$

83F FLANGED FLOWTUBE; REMOTE MOUNT; DUAL MEASUREMENT



Remote Mount Dimensions

Dimension	Standard Temperature Flowmeter		Extended Temperature Flowmeter	
	No Isolation Valves	With Isolation Valves	No Isolation Vales	With Isolation Valves
A	$\frac{211}{8.3}$	$\frac{236}{9.3}$	$\frac{265}{10.5}$	$\frac{292}{11.5}$
B	$\frac{401}{15.8}$	$\frac{457}{18.0}$	$\frac{503}{19.8}$	$\frac{533}{21.0}$

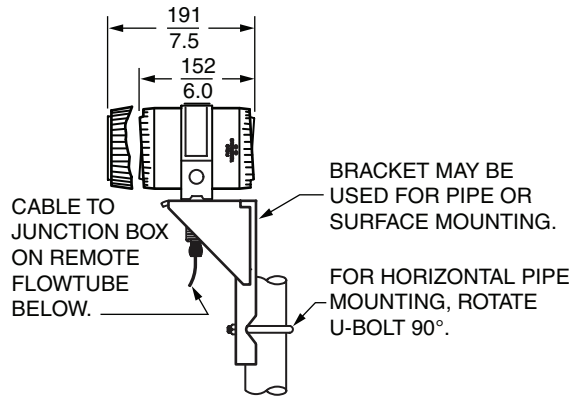
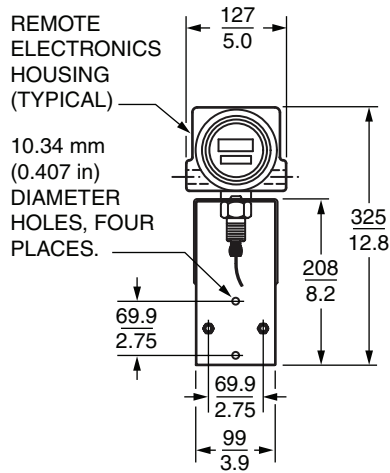
NOTE:

Also refer to DP 019-151 for additional dimensions.

DIMENSIONS - NOMINAL (Cont.)

**mm
in**

83F AND 83W FLANGED AND WAFER BODY FLOWMETERS WITH REMOTE MOUNTED ELECTRONICS

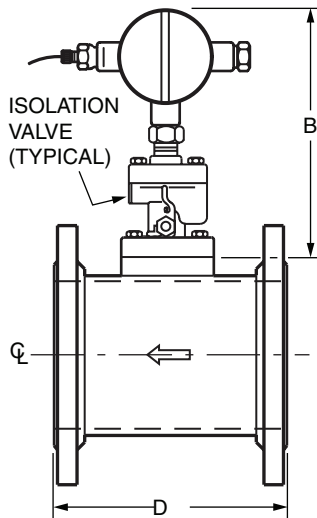
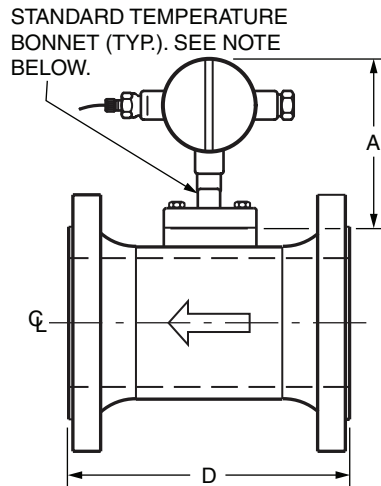
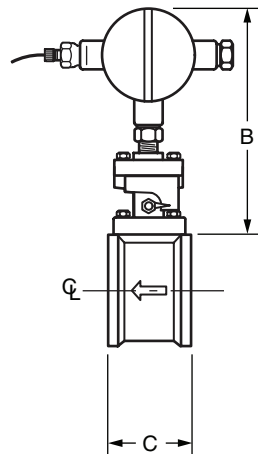
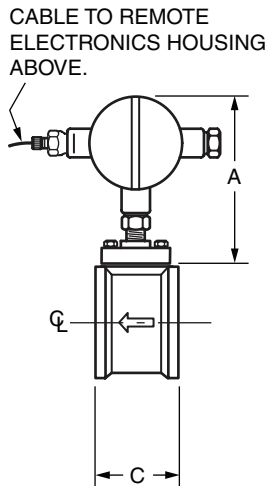


83W WAFER BODY

83W WITH ISOLATION VALVE

83F FLANGED BODY

83F WITH ISOLATION VALVE



Dimension	Dimensions - Nominal Line Size Code (a)									
	3Q	01	1H	02	03	04	06	08	10 (b)	12 (b)
A	188 7.4	188 7.4	188 7.4	188 7.4	188 7.4	188 7.4	188 7.4	188 7.4	188 7.4	188 7.4
B	257 10.1	257 10.1	257 10.1	257 10.1	257 10.1	257 10.1	257 10.1	257 10.1	257 10.1	257 10.1
C	79.5 3.13	79.5 3.13	79.5 3.13	79.5 3.13	95.3 3.75	121 4.75	178 7.0	229 9.0	N/A	N/A
D	Dimension D varies with flange type, rating, and size. See Table 7 further in document for dimensions.									

(a) Refer to Model Code section for nominal line sizes in DN or inches.

(b) Size Codes 10 and 12 are not available with wafer body flowtubes.

NOTE:

- Dimensions A and B are shown with the standard temperature bonnet. With extended temperature applications; add 2.6 in (66 mm) to Dimensions A and B because of the longer bonnet.
- For additional information, also refer to DP 019-150 for the Model 83F, and DP 019-152 for the Model 83W.

DIMENSIONS - NOMINAL (Cont.)

Table 7.

Dimension "D" (Face-to-Face) for Model 83F Flanged Body Flowtubes

ANSI Flanges			Metric Flanges		
Line Size	Flange Rating	Dimension "D" (a)	Line Size	Flange Rating	Dimension "D" (b)
3/4 in	Class 150	6.00 in	DN 15	PN 40	152 mm
	Class 300	6.00 in		PN 100	152 mm
	Class 600	6.50 in	DN 25	PN 40	166 mm
1 in	Class 150	6.50 in		PN 100	178 mm
	Class 300	6.50 in	DN 40	PN 40	179 mm
	Class 600	7.00 in		PN 100	196 mm
1 1/2 in	Class 150	7.25 in	DN 50	PN 40 (c)	195 mm
	Class 300	7.25 in		PN 64	205 mm
	Class 600	7.80 in		PN 100	205 mm
2 in	Class 150	7.75 in	DN 80	PN 40	220 mm
	Class 300	7.75 in		PN 64	230 mm
	Class 600	8.50 in		PN 100	320 mm
3 in	Class 150	8.75 in	DN 100	PN 40	240 mm
	Class 300	8.75 in		PN 64	250 mm
	Class 600	9.50 in		PN 100	260 mm
4 in	Class 150	9.50 in	DN 150	PN 16	305 mm
	Class 300	9.50 in		PN 40	320 mm
	Class 600	10.50 in		PN 64	360 mm
6 in	Class 150	12.00 in		PN 100	360 mm
	Class 300	12.75 in	DN 200	PN 16	381 mm
	Class 600	14.75 in		PN 40	396 mm
8 in	Class 150	15.00 in		PN 64	443 mm
	Class 300	15.75 in	PN 100	443 mm	
	Class 600	18.00 in	DN 250	PN 40	411 mm
10 in	Class 150	15.00 in		PN 64	481 mm
	Class 300	16.20 in	DN 300	PN 40	459 mm
12 in	Class 150	17.00 in		PN 64	513 mm
	Class 300	18.20 in			

(a) For 3/4 to 4 in sizes, overall face-to-face length (D) tolerance is ± 0.05 in.For 6 to 12 in sizes overall face-to-face length (D) tolerance is ± 0.250 in.(b) For DN 15 to DN 100 sizes, overall face-to-face length (D) tolerance is ± 1.3 mm.For DN 150 to DN 300 sizes, overall face-to-face length (D) tolerance is ± 6.4 mm.

(c) The DN 50 PN 40 flange may be used with a PN 25 mating flange.

ORDERING INSTRUCTIONS

1. Model Number
2. Flow Data:
 - a. Maximum, minimum, and normal flow rates, operating temperatures, and operating pressures.
 - b. Fluid composition and viscosity at operating temperatures.
 - c. Fluid density or relative density (specific gravity).
 - d. Mating pipe schedule.
 - e. Type and location (distance) of upstream disturbances.
3. Electrical Classification
4. Optional Features
5. Customer Tag Data

PATENT NOTICE

This product and its components are protected by one or more of the following U.S. Patents: 3,948,098; 4,085,614; 4,520,678; 5,003,827; 5,209,125; 5, 917, 840; and others pending. Corresponding patents have been issued or are pending in other countries.

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