

## Smart In-Line Thermal Gas Mass Flow Meter with Flow Conditioner

### Features

- Direct mass flow monitoring eliminates need for separate temperature and pressure inputs
- Built-in flow conditioner which eliminates velocity-profile distortions caused by upstream disturbances
- Accuracy +/- 1% of reading plus 0.5% of full scale
- Patented Dry-sense™ technology eliminates sensor drift
- State-of-the-art calibration facility insures a highly accurate calibration that matches the application
- Field validation of meter electronics and sensor resistance verifies flow meter performance
- One-second response to changes in flow rate
- FM, CSA, PED and ATEX certified for hazardous areas
- CE approved
- Multipoint options available
- Integrated purge option available
- Optional MODBUS, Foundation Field BUS and Profibus PA available

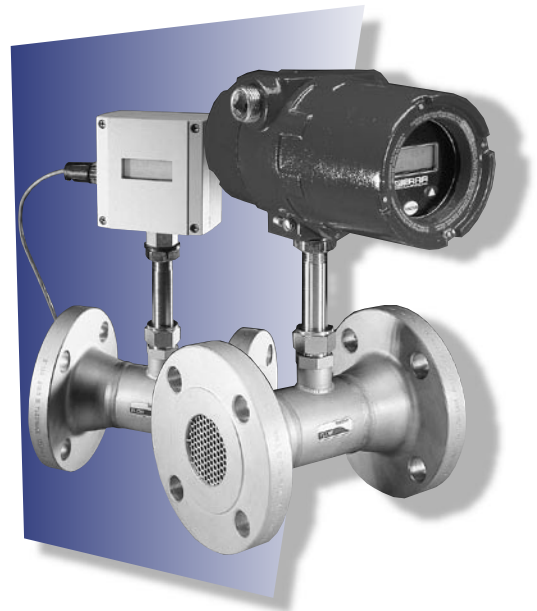
**SIERRA**<sup>®</sup>  
**INSTRUMENTS**  
THE MASS FLOW COMPANY

ISO  
REGISTERED  
9001

For information online...

[www.sierrainstruments.com](http://www.sierrainstruments.com)

# 7Flat-Trak™ Model 780S



### Description

**T**he Flat-Trak™ Model 780S flow body eliminates velocity profile distortions, swirl and temperature stratifications in the gas stream and reduces the amount of upstream piping required for accurate flow measurement.

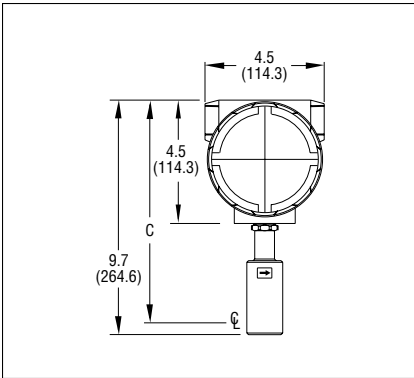
The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow-range adjustment, meter validation and diagnostics, in either a probe-mounted or remote housing. Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the meter's optional 2 x 12 LCD display. The programmable transmitter is easily configured via an RS-232 communication port and Sierra's Smart Interface™ software, or via the display and magnetic switches on the instrument panel.

Sierra's State-of-the-art calibration facility insures that the calibration will match the application, and our patented Dry-sense™ thermal sensor insures the Model 640S will hold this calibration over time.

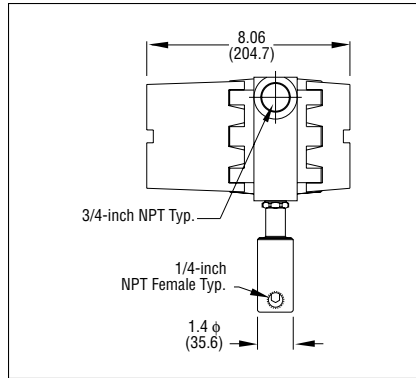
Sierra's Smart Interface™ software guides you through a procedure to fully validate instrument performance. The meter is available with a variety of input power, output signals, mounting and packaging options.

## Dimensional Specifications

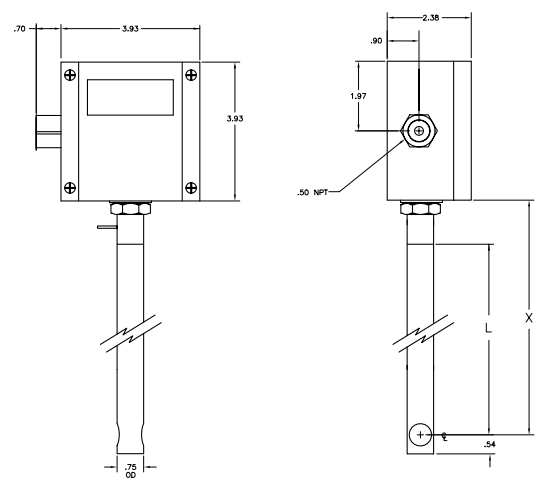
### 1/4-inch NPT—Front View (E2)



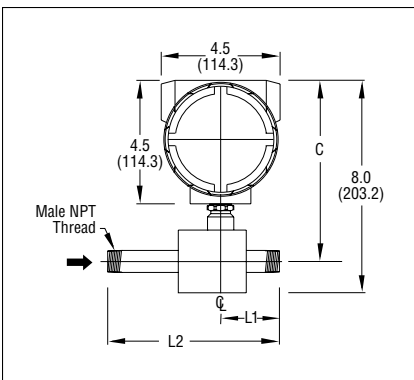
### 1/4-inch NPT—Side View (E2)



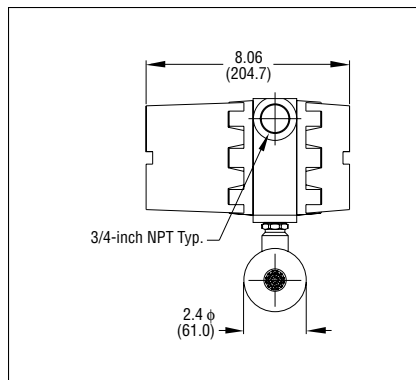
### NEMA 4X Enclosure (EN2)



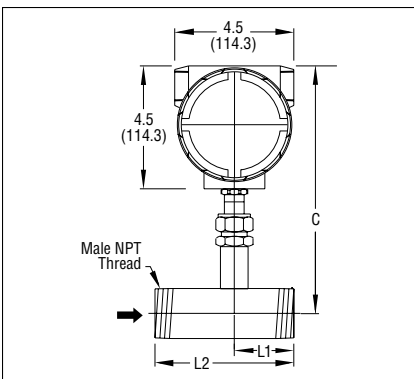
### 1/2-inch and 3/4-inch NPT—Front View (E2)



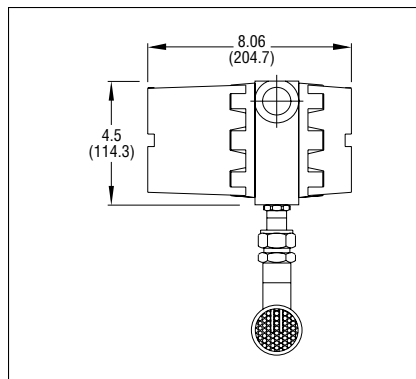
### 1/2-inch and 3/4-inch NPT—Side View (E2)



### 1-inch Through 8-Inch NPT—Front View (E2)

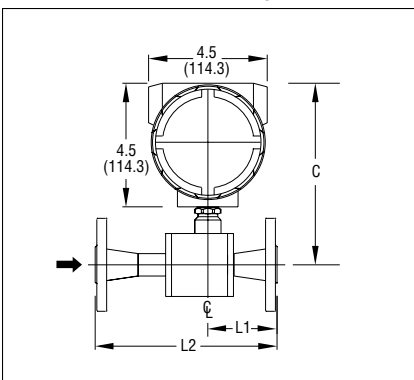


### 1-inch Through 8-Inch NPT—Side View (E2)

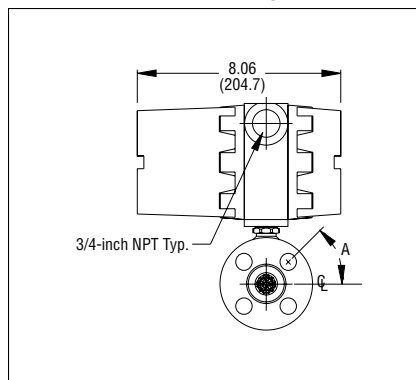


SIZES FOR NPT				
Size	H1	C	L1	L2
1/4-inch	7.80 (198.1)	8.40 (213.4)	—	—
1/2-inch	6.30 (160.0)	6.90 (175.3)	2.20 (55.9)	6.50 (165.1)
3/4-inch	6.30 (160.0)	6.90 (175.3)	2.20 (55.9)	7.00 (177.8)
1-inch	8.50 (215.9)	9.10 (228.6)	1.50 (38.1)	3.50 (88.9)
1.5-inch	8.80 (223.5)	9.40 (238.8)	2.25 (57.2)	5.25 (133.4)
2-inch	9.60 (243.8)	10.20 (259.1)	3.50 (88.9)	7.50 (190.5)
3-inch	10.60 (269.2)	11.20 (284.5)	4.00 (101.6)	10.00 (254)
4-inch	10.60 (269.2)	11.20 (290.8)	4.00 (101.6)	12.00 (304.8)
6-inch	11.60 (294.6)	12.20 (309.9)	6.00 (152.4)	18.00 (457.2)
8-inch	12.60 (320.0)	13.20 (335.3)	8.00 (203.2)	24.00 (609.6)

### 1/2 and 3/4-inch 150 lb Flange—Front View (E2)



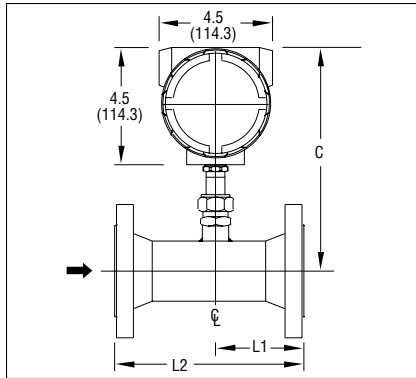
### 1/2 and 3/4-inch 150 lb Flange—Side View (E2)



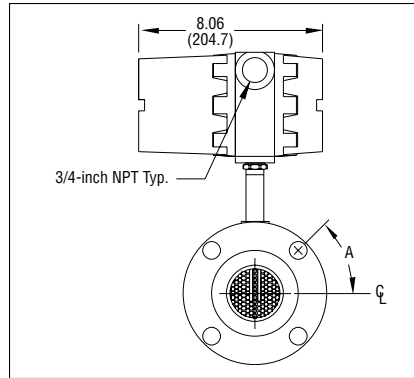
SIZES FOR 150 LB ANSI FLANGES					
Size	H1	C	L1	L2	A
1/2-inch	7.79 (197.9)	6.94 (176.3)	2.60 (66.0)	6.95 (176.5)	45°
3/4-inch	7.79 (197.9)	6.94 (176.3)	2.78 (70.6)	7.56 (192.0)	45°

## Dimensional Specifications

### 1" Through 8" 150 lb Flange—Front View (E2)



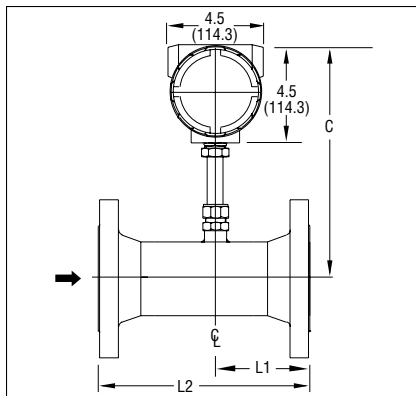
### 1" Through 8" 150 lb Flange—Side View (E2)



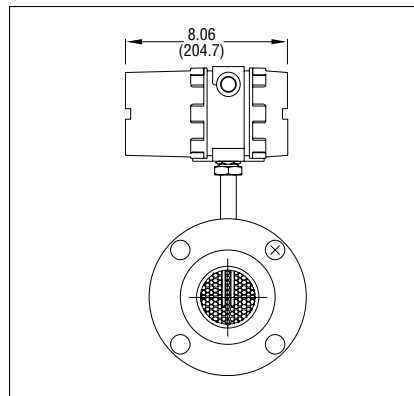
#### SIZES FOR 150 LB ANSI FLANGES

Size	H1	C	L1	L2	A
1-inch	8.50 (215.9)	9.10 (238.8)	3.60 (91.4)	7.40 (188.0)	45°
1.5-inch	8.80 (223.5)	9.40 (238.8)	3.80 (96.5)	7.50 (190.5)	45°
2-inch	9.60 (243.8)	10.20 (259.1)	3.50 (88.9)	7.50 (190.5)	45°
3-inch	10.60 (269.2)	11.20 (284.5)	4.00 (101.6)	10.00 (254.0)	45°
4-inch	10.60 (269.2)	11.20 (284.5)	4.00 (101.6)	12.00 (304.8)	22.5°
6-inch	11.60 (294.6)	12.20 (309.9)	6.00 (152.4)	18.00 (457.2)	22.5°
8-inch	12.60 (320.0)	13.20 (335.3)	8.00 (203.2)	24.00 (609.6)	22.5°

### DN Flange—Front View (E2)



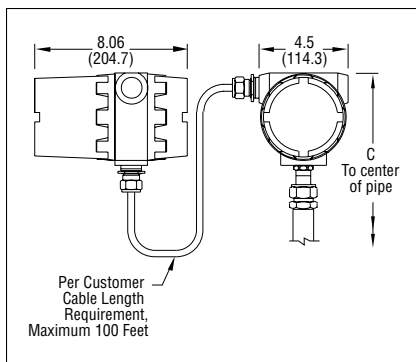
### DN Flange—Side View (E2)



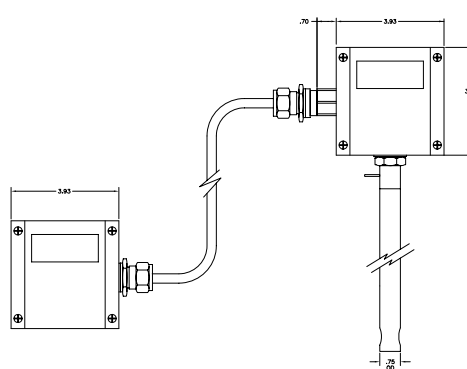
#### SIZES FOR PN16 DN FLANGES

Size	H1	C	L1	L2
DN25	8.30 (210.8)	8.88 (225.6)	3.18 (80.8)	7.40 (188.0)
DN40	8.90 (226.1)	9.50 (241.3)	3.61 (91.7)	7.40 (188.0)
DN50	10.10 (256.5)	10.70 (271.8)	3.34 (84.8)	7.10 (180.3)
DN80	9.90 (251.5)	10.50 (266.7)	4.14 (105.2)	10.20 (259.1)
DN100	10.00 (254.0)	10.60 (269.2)	4.57 (116.1)	12.60 (320.0)
DN150	11.80 (299.7)	12.40 (315.0)	6.77 (172.0)	18.90 (480.1)
DN200	13.90 (353.1)	14.50 (368.3)	8.47 (215.1)	24.40 (619.8)

### Remote Mounted with Junction Box (E4)



### Remote Mounted with Junction Box (EN4)



#### SIZES FOR REMOTE MOUNTED

Size	H2
1/4-inch	6.28 (159.5)
1/2-inch	5.21 (132.3)
3/4-inch	5.21 (132.3)
1-inch	6.41 (162.8)
1.5-inch	6.41 (162.8)
2-inch	7.32 (185.9)
3-inch	8.32 (211.3)
4-inch	6.32 (160.5)
6-inch	8.32 (211.3)
8-inch	10.32 (262.1)

## Performance Specifications

### Accuracy

+/- 1% of reading + 0.5 % of full scale

### Repeatability

+/- 0.2% of full scale

### Temperature Coefficient

+/- 0.02% of reading per °F within +/- 50° F of customer specified conditions

+/- 0.03% of reading per °F within +/- 50° F to 100° F of customer specified conditions

+/- 0.04% of reading per °C within +/- 25° C of customer specified conditions

+/- 0.06% of reading per °C within +/- 25° C to 50° C of customer specified conditions

### Pressure Coefficient

.02% per psi for air, consult factory for other gases

### Response Time

One second to 63% of final velocity value

## Operating Specifications

### Gases

Most gases compatible with 316 L stainless steel (consult factory)

### Gas Pressure (2 limitations)

Mechanical design pressure:

Compression fittings: 500 psig (34.5 barg)

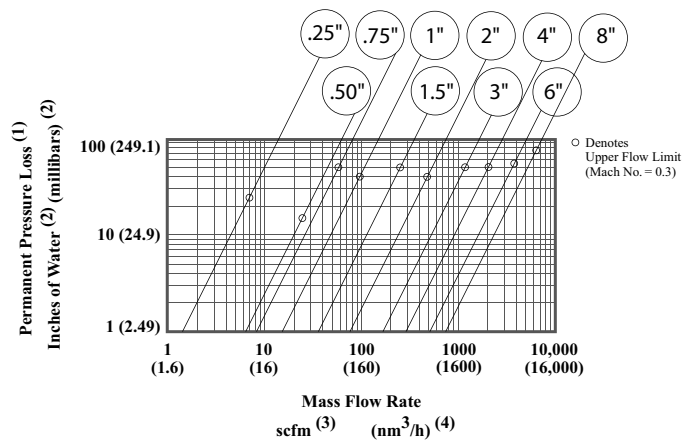
150 lb flange or PN16 DN (-40° F to 100° F): 230 psig (15.9 barg)

150 lb flange or PN16 DN (250° F): 185 psig (12.8 barg)

150 lb flange or PN16 DN (450° F): 155 psig (10.7 barg)

NPT (-40° F to 250° F): 500 psig (34.5 barg)

### Pressure Drop



#### Notes:

(1) For air and nitrogen at 20 °C temperature and 1 atmosphere pressure.

(2) 1 inch of water at 60 °F = 0.0361 psi.

1 millibar = 0.001 bar = 100 pascal = 0.0145 psi.

(3) At base conditions of 21.1 °C temperature and 1 atmosphere pressure.

(4) At base conditions of 0 °C temperature and 1 atmosphere pressure.

(5) Built-in flow conditioner consists of two separate perforated plates in series.

### Gas & Ambient Temperature

Gas . . . . . -40° F to 350° F (-40° C to 177° C) Gas dependent,  
Ambient . . . . . -40° F to 120° F (-40° C to 50° C)

### Leak Integrity

5 X 10<sup>-9</sup> cc/sec of helium maximum

### Power Requirements

18 to 30 VDC (regulated), 625 mA maximum  
100 to 240 VAC, 50/60 Hz, 15 watts maximum

### Output Signal

Linear 0–5 VDC or 0–10 VDC, 1000 ohms minimum load resistance or  
Linear 4–20 mA proportional to mass flow rate,  
700 ohms maximum resistance power supply dependent  
User-selectable . . . Active non-galvanically separated or  
Passive galvanically separated (loop power required)

### Alarms

Hard contact user-adjustable high and low  
Dead band adjustable with Smart Interface™ software  
Relay ratings . . . . . Maximum 400 VDC or VAC (peak), 140 mA

### Displays

Alphanumeric 2 x 12 digit backlit LCD  
Adjustable variables via on-board switches (password protected)  
or with Smart Interface™ software  
Adjustable variables. . . Full scale (50 to 100 %)  
Time Response (1 to 7 seconds)  
Correction factor setting (0.5 to 5)  
Zero and span  
High and low alarm settings

### Totalizer

Seven digits (9,999,999) in engineering units  
Resettable by software, on-board switches or external magnet

### Software

Smart Interface™ Windows®-based software  
Minimum 8 MB of RAM, preferred 16 MB of RAM  
RS 232 communication  
Additional features. . . Alarm dead band adjustment  
Zero cut-off adjustment  
Linearization adjustment  
Save / Load configurations  
Fully guided flow meter validation

### Digital Communications Options

Foundation Fieldbus (read only; flow and totalized flow)  
Profibus PA (read only; flow and totalized flow)  
MOBDBUS RTU (read/write most parameters)  
RS 232 (standard; command set available)

### Physical Specifications

#### Wetted Materials

316L stainless steel  
Carbon steel flow bodies available in some sizes

#### Enclosure

Hazardous-Area Location Enclosure (IP66) and NEMA 4X (IP65) are  
powder-coated cast aluminum

#### Electrical Connections

Two 3/4 inch NPT . . . Hazardous-Area Location Enclosure (IP66)  
One 1/2 inch NPT . . . NEMA 4X Enclosure (IP65)

#### Piping Requirements

Piping Condition	780S Flat-Trak™		Orifice Plate <sup>(3)</sup>
	Upstream <sup>(1)</sup>	Downstream <sup>(2)</sup>	
Single 90° Elbow or T-Piece	1D	0D	28D
Reduction (4:1)	3D	0D	14D
Expansion (4:1)	3D	0D	30D
After Control Valve	3D	0D	32D
Two 90° Elbows (In Same Plane)	3D	0D	36D
Two 90° Elbows (Different Planes)	5D	0D	62D

Notes: (1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.  
(2) Number of diameters (D) of straight pipe required downstream of the flow meter.  
(3) For comparison purposes only. Table shows number of diameters (D) of upstream straight pipe length required for an ISO Standard 5167 Orifice Plate with a Beta Ratio of 0.7.  
(4) Consult factory for pressure effects.

#### Certifications

CE (All enclosures)  
CSA (Explosion proof for Class I, Division 1, Groups B, C, D)  
ATEX ( II 2 GD Ex d IIC T6 ... T2  
IP 66 T70 °C ... T280 °C )  
FM (Explosion proof for Class I, Division 1, Groups B, C, D; dust-ignition  
proof for Class II, III, Division 1, Groups E, F, G)  
IP66, NEMA 4X T6 -40° C to 70° C ambient  
PED optional

# Ordering the Model 780S

**780S**

**Parent MODEL Number**  
780S Flat-Trak™ Industrial In-Line Meter

**Agency Approvals**  
**NAA** Non-Agency Approved Meter  
**CSA** Explosion Proof for Class I, Division 1, Groups B, C, D  
**ATEX** II 2 GD Ex d IIC T6 ... T2  
 IP 66 T70 °C ... T280 °C  
**FM** Explosion Proof for Class I, Division 1, Groups B, C, D

**FLOW BODY—STAINLESS STEEL**

NPT	ANSI Flange	DIN Flange		Size
	150 lb	PN16	PN40	
N1	N/A			1/4-inch
N2	F2			1/2-inch
N3	F3			3/4-inch
N4	F4	D4	DD4	1-inch (DN25)
N5	F5	D5	DD5	1.5-inch (DN40)
N6	F6	D6	DD6	2-inch (DN50)
N7	F7	D7	DD7	3-inch (DN80)
N8	F8	D8	DD8	4-inch (DN100)
N9	F9	D9	DD9	6-inch (DN150)
N10	F10	D10	DD10	8-inch (DN200)

**ENCLOSURES**  
**E2** Hazardous-Area Location Enclosure  
**E3(ft)** Remote Hazardous-Area Location Enclosure (Only with EEx Meters)  
**E4(ft)** Remote Hazardous-Area Location Enclosure with Junction Box  
**EN2** NEMA 4X  
**EN4(ft)** Remote NEMA 4X with Junction Box  
 Specify Cable Length in Parentheses, Maximum 200 feet (60 m),  
 Length in Feet using 5 ft. increments to 20 ft., 10 ft. increments to 200 ft.

**INPUT POWER**  
**P2** 18–30 VDC  
**P3** 100–240 VAC (Not Available on EN Enclosures)

**OUTPUT SIGNAL**  
**V1** 0–5 VDC, Linear  
**V3** 0–10 VDC, Linear  
**V4** 4–20 mA, Linear

**DISPLAY**  
**NR** No Readout  
**DD** Digital Display

**GAS CODE**  
**0** Air  
**1** Argon  
**2** CO<sub>2</sub>  
**3** Chlorine (Correlation)  
**4** Digester  
**5** Digester (Correlation)  
**6** Helium  
**7** Hydrogen  
**8** CH<sub>4</sub>  
**9** CH<sub>4</sub> (Correlation)  
**10** Nitrogen  
**11** Oxygen (Correlation)  
**12** Propane  
**13** Propane (Correlation)  
**99** Other

**OPTION 1 (DIGITAL COMMUNICATIONS)**  
**PULSE** Pulse (not avail. w/ E2-NR)  
**MB** MODBUS (not avail. w/ P3)  
**FF** Foundation Fieldbus (E2/P2 only)  
**PB** Profibus (E2/P2 only)

**OPTION 2 (PURGE)**  
**PURGE** Includes valve, tube and purge nozzle.

**OPTION 3 (CERTIFICATES)**  
**PT** Pressure Test Certificate  
**CC** Certificate of Conformance  
**NC** NACE Certificate  
**MC** Materials Certificate  
**NC** NACE Certificate