

Rosemount 405 Compact Primary Element



- Fully integrated solution eliminates the need for fittings, tubing, valves, adapters, manifolds, and mounting brackets
- Unique wafer body allows for installation in any flange location
- Integrated centering ring ensures proper alignment within the pipe resulting in higher accuracy

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Rosemount 405 Compact Primary Element



Rosemount 405 Compact Primary Element utilizes an easy to install direct mount primary element assembly.

- Available with Conditioning Orifice Plate Technology or Annubar Primary Element Technology
- 405P/C orifice primary elements are based on ASME/ISO corner tap design
- Available in 1/2 to 12-in. (15 - 300 mm) line sizes

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Table 1. Rosemount 405 Compact Primary Element Ordering Information

★ The Standard offering represents the most common options. The starred options (★) should be selected for best delivery. The Expanded offering is subject to additional delivery lead time.

Model	Product Description	
405	Compact Orifice Flowmeter	
Primary Element Technology		
Standard		Standard
A	Annubar Sensor Size 1	★
C	Conditioning Orifice Plate	★
P	Orifice Plate	★
Material Type		
Standard		Standard
S	316 SST	★
Line Size		
Standard		Standard
005 ⁽¹⁾	1/2-in. (15 mm)	★
010 ⁽¹⁾	1-in. (25 mm)	★
015 ⁽¹⁾	1 1/2-in. (40 mm)	★
020	2-in. (50 mm)	★
030	3-in. (80 mm)	★
040	4-in. (100 mm)	★
060	6-in. (150 mm)	★
080	8-in. (200 mm)	★
100 ⁽²⁾⁽³⁾	10-in. (250 mm)	★
120 ⁽²⁾⁽³⁾	12-in. (300 mm)	★
Temperature Measurement		
Standard		Standard
T ⁽⁴⁾	Integral RTD	★
N	No Temperature Measurement	★
Primary Element Type		
Standard		Standard
000	Annubar Sensor Size 1	★
040	0.40 Beta Ratio (β)	★
065 ⁽⁵⁾	0.65 Beta Ratio (β)	★

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Transmitter Connection		
Standard		Standard
D3	Direct mount	★
R3	Remote mount, NPT connections	★
Expanded		
A3 ⁽⁶⁾	Traditional, Direct mount, 3-valve Integral Manifold with adapter plate, SST	
Options (Include with selected model number)		
Installation Accessories		
Standard		Standard
A	ANSI Alignment Ring (150#)	★
C	ANSI Alignment Ring (300#)	★
D	ANSI Alignment Ring (600#)	★
G	DIN Alignment Ring (PN 16)	★
H	DIN Alignment Ring (PN 40)	★
J	DIN Alignment Ring (PN 100)	★
Expanded		
B	JIS Alignment Ring (10K)	
R	JIS Alignment Ring (20K)	
S	JIS Alignment Ring (40K)	
Remote Adapters		
Standard		Standard
E	Flange adapters 316 SST (¹ / ₂ -in. NPT)	★
High Temperature Application		
Expanded		
T	Graphite valve packing (Tmax = 850 °F)	
Flow Calibration		
Expanded		
WC ⁽⁷⁾	Flow Calibration, 3 Pt, Conditioning Orifice Option C (All Pipe Schedules)	
WD ^{(8) (9)}	Flow Calibration, 10 Pt, Conditioning Option C (All Schedules), Annubar Option A (Schedule 40)	
Pressure Testing		
Expanded		
P1	Hydrostatic testing	
Special Cleaning		
Expanded		
p2 ⁽¹⁰⁾	Cleaning for Special Processes	
PA	Cleaning per ASTM G93 Level D (section 11.4)	
Special Inspection		
Standard		Standard
QC1	Visual & Dimensional Inspection with Certificate	★
QC7	Inspection & Performance Certificate	★
Material Traceability Certification		
Standard		Standard
Q8	Material Traceability Certification per EN10204:2004 3.1	★
Code Conformance		
Expanded		
J2	ANSI / ASME B31.1	
J3	ANSI / ASME B31.3	
J4	ANSI / ASME B31.8	

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Materials Conformance		
Expanded		
J5 ⁽¹¹⁾	NACE MR-0175 / ISO 15156	
Country Certification		
Expanded		
J1	Canadian Registration	
Typical Model Number: 405 C S 040 N 040 D3		

- (1) Available with primary element technology P only.
- (2) For the 10-in. (250 mm) and 12-in. (300 mm) line size, the alignment ring must be ordered (Installation Accessories).
- (3) 10-in. (250 mm) and 12-in. (300 mm) line sizes not available with Primary Element Technology A.
- (4) Available with Primary Element Technology A only.
- (5) For 2-in. (50 mm) line sizes the Beta Ratio is 0.6 for Primary Element Type code C.
- (6) A3 transmitter connection available with primary element technology C or P only.
- (7) Available with primary element technology C only.
- (8) Available with primary element technology C or A only.
- (9) For Annubar Option A, consult factory for pipe schedules other than Sch. 40.
- (10) Available with primary element technology C or P only.
- (11) Materials of Construction comply with metallurgical requirements within NACE MR0175/ISO for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.

405 Specifications

405 Performance specifications

Table 2. 405C Compact Conditioning Orifice Technology

Beta Ratio	Discharge Coefficient Uncertainty
$\beta = 0.40$	$\pm 0.50\%$
$\beta = 0.65^{(1)}$	$\pm 1.00\%$

(1) For 0.65 beta and $ReD < 10,000$ add an additional 0.5% to the Discharge Coefficient Uncertainty.

Table 3. 405P Compact Orifice Technology

Line Size	Discharge Coefficient Uncertainty
1/2-in. (15 mm)	$\pm 2.25\%$
1 to 1 1/2-in. (25 to 40 mm) line size	$\pm 1.75\%$
2 to 12-in. (50 to 300 mm) line size	$\pm 1.25\%$

Table 4. 405A Compact Annubar Technology

K Factor Uncertainty		
All Sizes	Uncalibrated	$\pm 1.50\%$
	Calibrated	$\pm 0.75\%$

Line sizes

- 1/2-in. (15 mm) – not available for the 405C and 405A
- 1-in. (25 mm) – not available for the 405C and 405A
- 1 1/2-in. (40 mm) – not available for the 405C and 405A
- 2-in. (50 mm)
- 3-in. (80 mm)
- 4-in. (100 mm)
- 6-in. (150 mm)
- 8-in. (200 mm)
- 10-in. (250 mm)
- 12-in. (300 mm)

Sizing

Contact an Emerson Process Management sales representative assistance. A "Configuration Data Sheet" is required prior to order for application verification.

405 Functional specifications

Service

- Liquid
- Gas
- Vapor

Process Temperature limits

Direct Mount Transmitter

- -40 to 450 °F (-40 to 232 °C)
- Up to 400 °F (204 °C) when top mounted in steam service

Remote Mount Transmitter

- -148 to 850 °F (-100 to 454 °C) – Stainless Steel

Differential Pressure Limits for Primary Element Technology C and P for All Sizes

Table 5. Maximum Allowable DP (measurement in inH₂O (bar))

Max DP < 400 °F (200 °C)	Max DP = 400-800 °F (200-454 °C)
800 inH ₂ O (2bar)	400 inH ₂ O (1bar)

Differential Pressure Limits for Primary Element Technology A

Table 6. Maximum Allowable DP (measurement in inH₂O (bar))

Line Size	Max DP @ < 450 °F (200 °C)	Max DP @ 450-850 °F (200-454 °C)
2 (50 mm)	1500 (3.73)	1500 (3.73)
3 (80 mm)	900 (2.24)	790 (1.97)
4 (100 mm)	570 (1.42)	500 (1.24)
6 (150 mm)	290 (0.72)	250 (0.62)
8 (200 mm)	190 (0.47)	160 (0.40)
10 (250 mm)	130 (0.32)	110 (0.27)
12 (300 mm)	100 (0.25)	80 (0.20)

Maximum Working Pressure

Pressure retention per ANSI B16.5 600# or DIN PN100

Vibration Effect for 405A, 405C, and 405P

Qualified per IEC61298-3 (2008) for field with general application or pipeline with low vibration level (10-1000 Hz test frequency range, 0.15 mm displacement peak amplitude, 20 m/s² acceleration amplitude).⁽¹⁾

The weight and length of the transmitter assembly shall not exceed 9.8 lbs (4.45 kg) and 8.60-in. (218.44 mm).

Assembly to a transmitter

Select option code C11 for the Rosemount 3051S transmitter (or option code S3 for the Rosemount 3051C or 3095MV transmitters) to factory assemble the Rosemount 405 to a Rosemount pressure transmitter. If the 405 and transmitter are not factory assembled, they may be shipped separately. For a consolidated shipment, inform the Emerson Process Management representative when placing the order.

(1) Stainless steel temperature housing is not recommended with primary element technology A in applications with mechanical vibration.

405 Physical specifications

Temperature Measurement for Primary Element Technology P and C

Integral RTD⁽¹⁾

- 100 Ohm platinum RTD temperature sensor assembly (316 SST Mineral Insulated Cable) with 1/4-in. NPT connection to wafer side and 1/2-in. NPT connection to transmitter RTD sensor is separated from process fluid by 1/16-in. and is pressure retaining rated for ANSI 600#. Complies with IEC-751 Class B accuracy. Meets Intrinsic Safety certification.

(1) Only available with 3051SFC or 3095MFC Compact Orifice Flowmeter models.

Remote RTD⁽¹⁾

- 100 Ohm platinum with 1/2-in. NPT nipple and union (078 series with Rosemount 644 housing) Model 0078D21N00A025T32Ex Connection Head: 00644-4410-0011
- Standard RTD cable is shielded armored cable, length is 12 ft. (3.66 m)
- Remote RTD material is SST Thermowell
- 1/2-in. x 1/2-in. NPT, 316 SST

(1) Only available with 3051SFC, 3095MFC, 3051CFC or 2051CFC Compact Orifice Flowmeter models.

Temperature Measurement for Primary Element Technology A

Integral RTD

- 100 Ohm platinum RTD
- 4-wire RTD ($\alpha = 0.00385$)

Physical Details

Body

- 316/316L SST

Manifold Head/Valves

- 316 SST

Orifice Plate for primary element technologies C and P

- 50 micro-inch Ra surface finish

Annubar Primary Element for primary element technology A

- Roughened surface finish

Flange Studs and Nuts

- Customer supplied
- Available as a spare part

Transmitter Connection Studs and Nuts

- Studs— A193 Grade B8M.
- Nuts— A194 Grade 8M.

Gasket and O-rings

- Gaskets are customer supplied.
- Gaskets and O-rings are available as spare parts

NOTE

Gaskets and O-rings should be replaced when the 405 is disassembled.

Transmitter Connections

Direct Mount

- Available with 3051SMV, 3051S, 3051, 2051 and 3095 transmitters, ranges 1, 2, and 3.

Remote Mount

- Primary element technology C or P available with 1/4-in. NPT (standard) or 1/2-in. NPT (option code E) connections
- Remote Mount transmitter connections available with 1/2-in. NPT for primary element technology A

Orifice Plate Design

Orifice Type

- Square edged

Orifice Pressure Taps

- Corner

Alignment Rings

Table 7. Mounts between the following flange configurations

ASME B16.5 (ANSI)	DIN	JIS
Class 150	PN16 (option code G)	10k (option code B)
Class 300	PN40 (option code H)	20k (option code R)
Class 600	PN100 (option code H)	40k (option code S)

ANSI 150 - 600# alignment ring is included as standard when ordering for up to 8-in. line size. For the 10-in. and 12-in. line size, the alignment ring must be ordered (Installation Accessories).

Typical Orifice Hole Sizes

For 405C, beta is calculated by: $\beta = d_C / \text{Pipe ID}^{(1)}$, where the calculated bore is equal to 2 x typical orifice hole size ($d_C = 2d$). The tables below show the diameter of the typical orifice holes.

(1) Based on Schedule 40.

Table 8. $\beta = 0.4$ (measurement in inches (mm))⁽¹⁾

Line Size	405C	405P
1/2-in. (15 mm)	Not Available	0.249 (6.325)
1-in. (25 mm)	Not Available	0.420 (10.668)
1 1/2-in. (40 mm)	Not Available	0.644 (16.358)
2-in. (50 mm)	0.413 (10.490)	0.827 (21.006)
3-in. (80 mm)	0.614 (15.596)	1.227 (31.166)
4-in. (100 mm)	0.805 (20.447)	1.610 (40.894)
6-in. (150 mm)	1.213 (30.810)	2.426 (61.620)
8-in. (200 mm)	1.596 (40.538)	3.192 (81.077)
10-in. (250 mm)	2.004 (50.902)	4.008 (101.80)
12-in. (300 mm)	2.400 (60.960)	4.800 (121.92)

(1) Tolerance = ± 0.002 -in.

Table 9. $\beta = 0.65$ (measurement in inches (mm))⁽¹⁾

Line Size	405C	405P
1/2-in. (15 mm)	Not Available	0.404 (10.262)
1-in. (25 mm)	Not Available	0.682 (17.323)
1 1/2-in. (40 mm)	Not Available	1.047 (26.594)
2-in. (50 mm)	0.620 (15.748) ⁽²⁾	1.344 (34.138)
3-in. (80 mm)	0.997 (25.324)	1.994 (50.648)
4-in. (100 mm)	1.308 (33.223)	2.617 (66.472)
6-in. (150 mm)	1.971 (50.063)	3.942 (100.127)
8-in. (200 mm)	2.594 (65.888)	5.188 (131.775)
10-in. (250 mm)	3.257 (82.728)	6.513 (165.43)
12-in. (300 mm)	3.900 (99.060)	7.800 (198.120)

(1) Tolerance = ± 0.002 -in.(2) For 2-in. (50 mm) line size, the Beta (β) = 0.60.

Table 10. 405 P or C Weight (measurement in lb. (kg))

Line Size	Direct Mount (D3)	Remote Mount (R3)
1/2-in. (15 mm)	3.50 (1.73)	7.5 (3.70)
1-in. (25 mm)	4.25 (2.10)	8.25 (4.07)
1 1/2-in. (40 mm)	4.75 (2.34)	8.75 (4.32)
2-in. (50 mm)	5.00 (2.47)	9.00 (4.44)
3-in. (80 mm)	7.00 (3.45)	11.00 (5.43)
4-in. (100 mm)	9.50 (4.69)	13.50 (6.67)
6-in. (150 mm)	13.00 (6.41)	17.00 (8.40)
8-in. (200 mm)	18.25 (9.00)	22.25 (10.99)
10-in. (250 mm)	23.50 (11.59)	27.50 (13.58)
12-in. (300 mm)	29.50 (14.55)	33.50 (16.54)

Table 11. 405A Weight (measurement in lb. (kg))

Line Size	Direct Mount (D3)	Remote Mount (R3)
2-in. (50 mm)	5.59 (2.53)	7.26 (3.29)
3-in. (80 mm)	7.41 (3.36)	9.08 (4.12)
4-in. (100 mm)	9.18 (4.16)	10.85 (4.92)
6-in. (150 mm)	13.10 (5.94)	14.76 (6.70)
8-in. (200 mm)	17.12 (7.77)	18.78 (8.52)
10-in. (250 mm)	21.26 (9.64)	22.93 (10.40)
12-in. (300 mm)	27.49 (12.47)	29.16 (13.23)

Dimensional Drawings

Rosemount 405 Compact Orifice Plate (Direct Mount)		
	Front View (transmitter connection A3)	Front View (transmitter connection D3)
Compact Orifice Plate (Primary Element Type code P)		
Conditioning Orifice Plate (Primary Element Type code C)		
Compact Annubar Primary Element (Primary Element Type Code A)	<p>Transmitter Connection A3 not available with Primary Element Technology A</p>	

Note

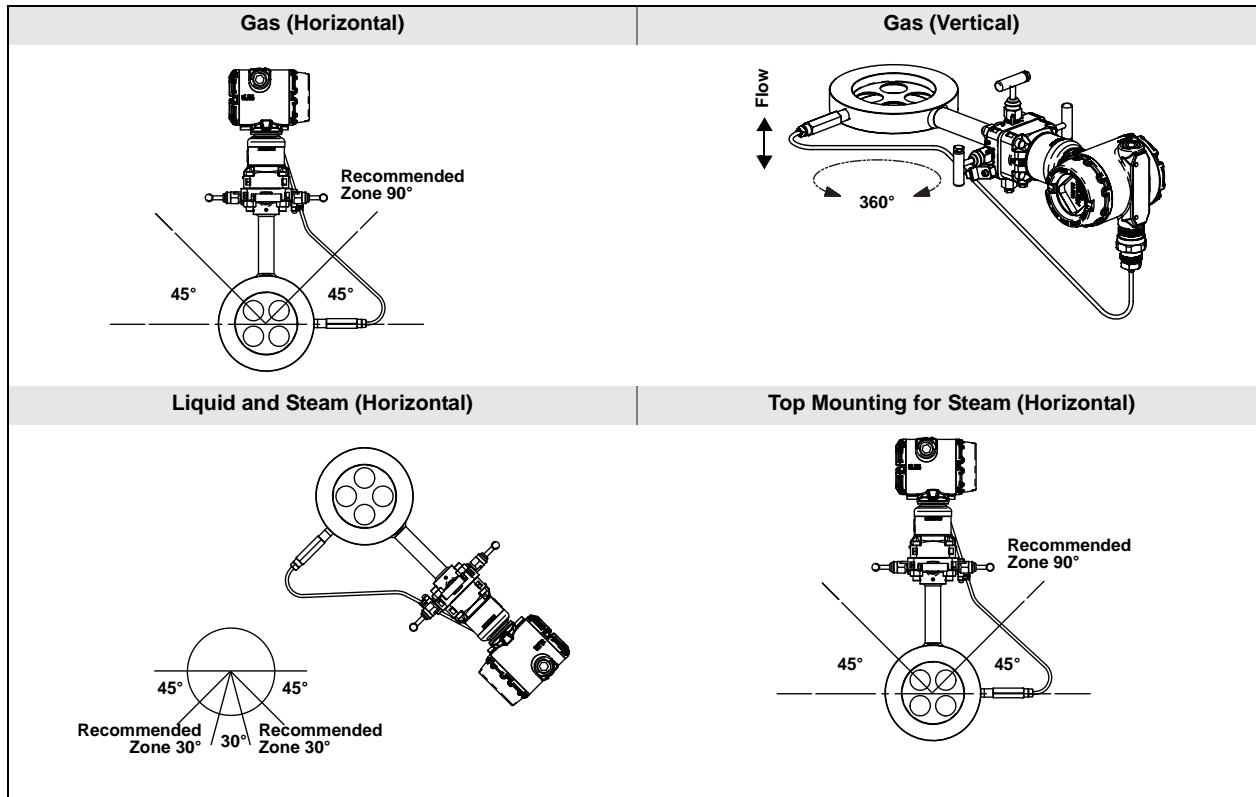
Transmitter connection code A3 is to be used with a traditional style transmitter. This is a stainless steel adapter plate for allowing the direct mount of traditional style transmitters.

Rosemount 405 Compact Orifice Plate (Remote Mount Transmitter)		
	Adapter Plate (R3)	Flange Adapter (R3 with option E)
Compact Orifice Plate (Primary Element Type code P)		
Conditioning Orifice Plate (Primary Element Type code C)		
Compact Annubar Primary Element (Primary Element Type Code A)	<p>Transmitter Connection R3 not available with Primary Element Technology A</p>	

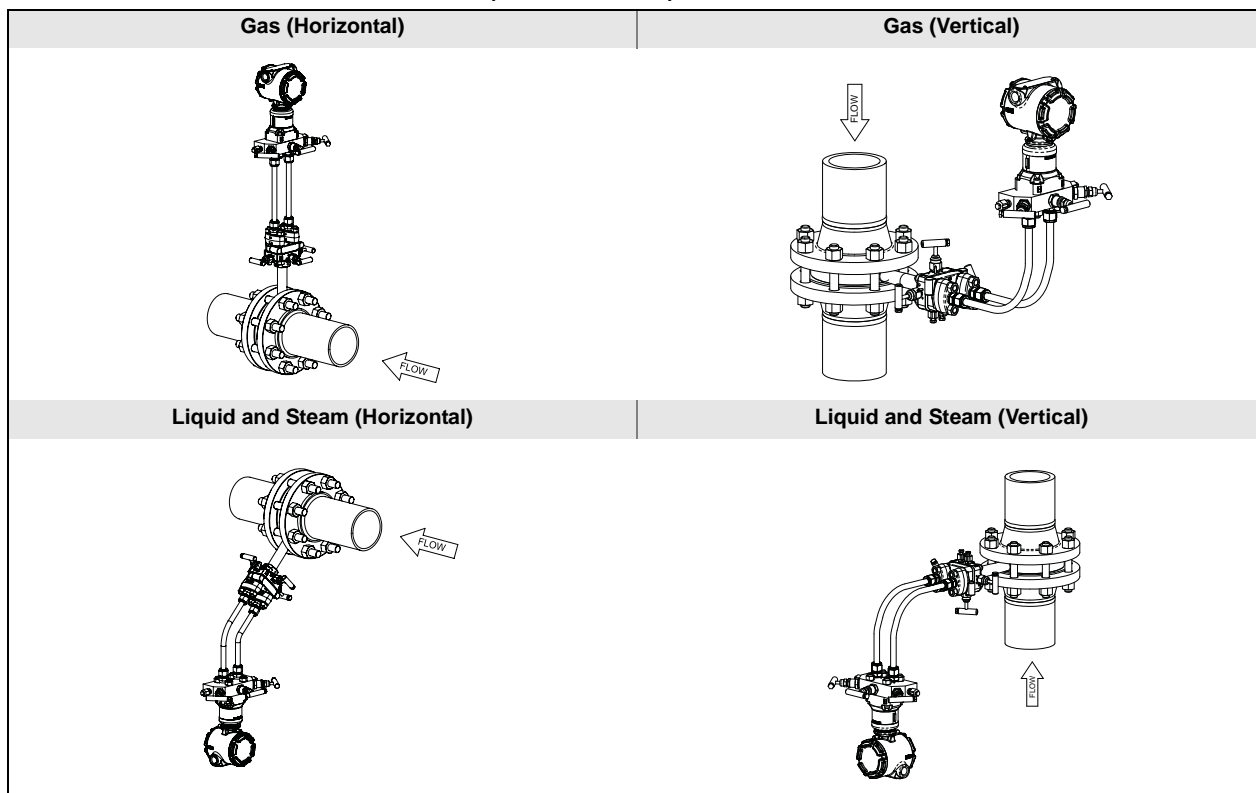
405 Flowmeter Orientation

For 3051SFC_C, 3051SFC_P, 3051CFC_C, 3051CFC_P, 3051SFC_A, 3051CFC_A, 2051CFC_C, 2051CFC_P, 2051CFC_A, 405C, 405P, 405A

405 Direct Mount Flowmeter Orientation (Recommended)



405 Remote Mount Flowmeter Orientation (Recommended)



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