

Rosemount™ 405

Compact Primary Element



Safety information

NOTICE

This guide provides basic guidelines for installing the Rosemount 405. It does not provide instructions for configuration, diagnostics, maintenance, service, troubleshooting, explosion-proof, flameproof, or intrinsically safe (I.S.) installations. Refer to the [Rosemount 405 Reference Manual](#) for more information.

If the Rosemount 405 was ordered assembled to a Rosemount 3051S Transmitter, the new assembly is the Rosemount 3051SFC Compact Flow Meter. See [Rosemount 3051S Quick Start Guide](#) for information on configuration and hazardous locations certifications.

If the Rosemount 405 was ordered assembled to a Rosemount 3051S MultiVariable Transmitter, the new assembly is the Rosemount 3051SFC Compact Flow Meter. See [Rosemount 3051SMV Quick Start Guide](#) for information on configuration and hazardous locations certifications.

To ensure correct operation, download the most current version of the [Engineering Assistant software](#).

⚠ WARNING

Process leaks could result in death or serious injury.

To avoid process leaks, only use the gasket and O-ring designed to seal with the corresponding flange adapter.

⚠ WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental in protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

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1 Primary element location

Install the Rosemount 405 in the correct location within the piping branch to prevent inaccurate measurements caused by flow disturbances.

NOTICE

Consult an Emerson representative if a disturbance is not listed.

Table 1-1: Rosemount 405C straight pipe requirements

	Beta	0.40	0.50	0.65
Upstream (inlet) side of primary	Reducer	2	2	2
	Single 90° bend or tee	2	2	2
	Two or more 90° bends in the same plane	2	2	2
	Two or more 90° bends in different planes	2	2	2
	Up to 10° of swirl	2	2	2
	Butterfly valve (75% to 100% open)	2	5	5
Downstream (outlet) side of primary		2	2	2

Table 1-2: Rosemount 405P straight pipe requirements

	Beta	0.40	0.50	0.65
Upstream (inlet) side of primary	Reducer	5	8	12
	Single 90° bend or tee	16	22	44
	Two or more 90° bends in the same plane	10	18	44
	Two or more 90° bends in different planes	50	75	60
	Expander	12	20	28
	Ball/gate valve fully open	12	12	18
Downstream (outlet) side of primary		6	6	7

Table 1-3: Rosemount 405A straight run requirements

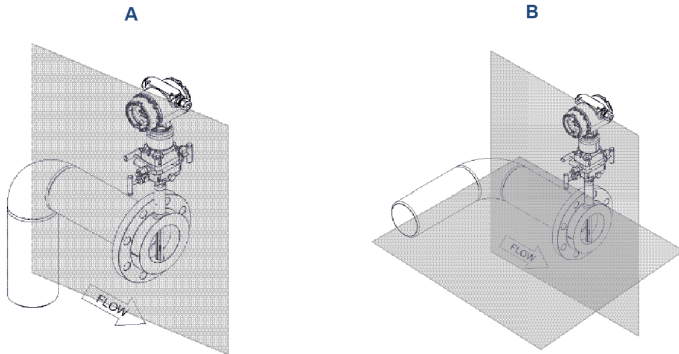
		Without straightening vane		With straightening vane ⁽¹⁾	
	Annubar™ averaging pitot tube - sensor size 1	In plane ⁽²⁾	Out of plane ⁽²⁾	From disturbance	From straightening vane
Upstream (inlet) side of primary	Reducer	12	12	8	4
	Expander	18	18	8	4
	Single 90° bend or tee	8	10	8	4
	Two or more 90° bends in the same plane	11	16	8	4
	Two or more 90° bends in different planes	23	28	8	4
	Butterfly Valve (75–100% open)	30	30	8	4
	Ball/Gate Valve fully open	8	10	8	4
Downstream (outlet) side of primary		4	4	4	4

- (1) Use straightening vane to reduce the required straight run length.
- (2) In plane means the Rosemount 405 is in the same plane as the elbow. Out of plane means the bar is perpendicular to the plane of the upstream elbow. Refer to [Figure 1-1](#).

Note

Recommended lengths are represented in pipe diameters. If longer lengths of straight run are available, position the Rosemount 405 so 80 percent of the pipe run is upstream and 20 percent is downstream. Flow conditioners may be used to reduce the required straight run length, improving performance.

Figure 1-1: Compact Annubar flow meter in plane and out of plane



This figure depicts in plane and out of plane orientations only.

- A. *In plane*
- B. *Out of plane*

1.1 Vibration limits for Rosemount 405 products

Qualified per IEC61298-3 (2008) for field with general application or pipeline with low vibration level (10–1000 Hz test frequency range, 0.006-in (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 lb (4.45kg) and 8.6-in. (218 mm).

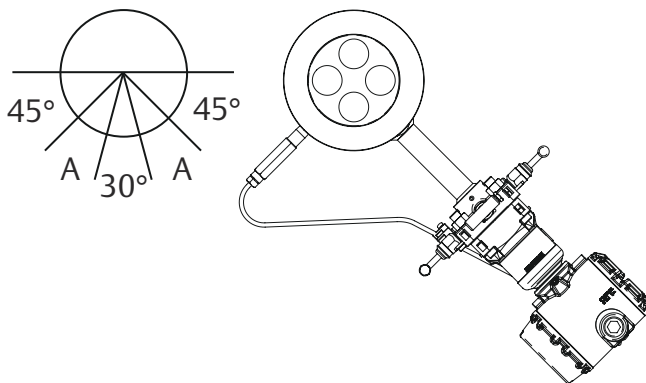
⁽¹⁾ *Stainless steel temperature housing is not recommended with primary element technology A in applications with mechanical vibration.*

2 Primary element orientation

The primary element can be installed in any position around the circumference of the pipe, provided the vents are positioned properly for bleeding or venting. Optimal results for liquid or steam in a vertical line are obtained when flow is up.

Liquid - Rosemount 405C, 405P, and 405A

Figure 2-1: Direct mount: horizontal liquid



A. Recommended zone 30°

Figure 2-2: Direct mount: vertical liquid

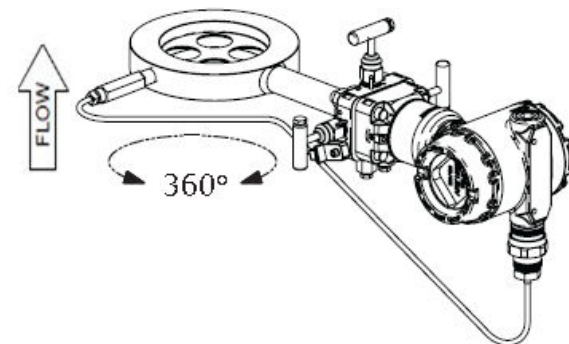


Figure 2-3: Remote mount: horizontal liquid

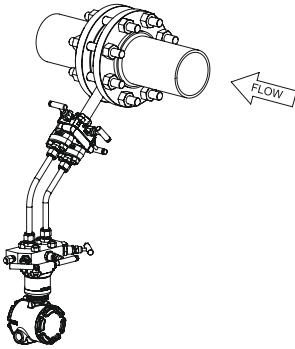
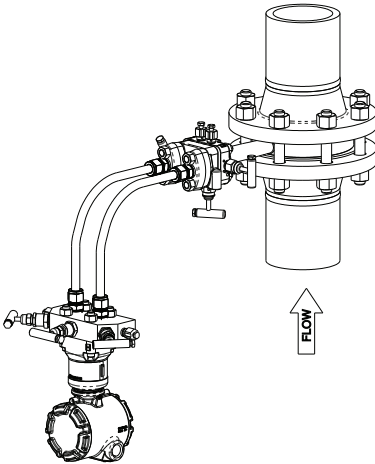


Figure 2-4: Remote mount: vertical liquid

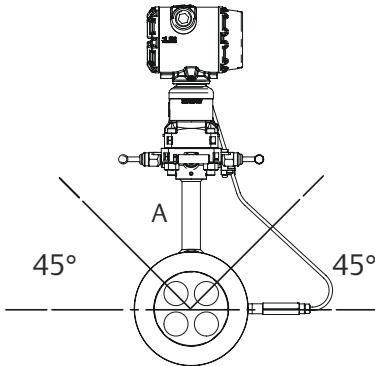


Gas and Cryogenic - Rosemount 405C, 405P, and 405A

Note

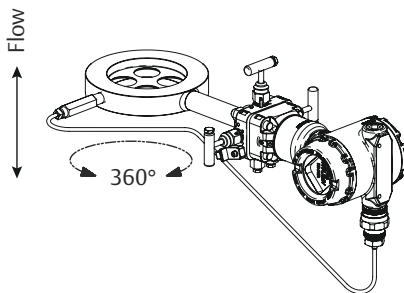
For cryogenic applications, a direct mount flow meter can be used down to ambient temperatures of 40 °F (4 °C) provided the head and neck are uninsulated. Below this temperature, provisions should be made to maintain the temperature of the transmitter above 40 °F (4 °C).

Figure 2-5: Direct mount: horizontal



A. Recommended zone 45°

Figure 2-6: Direct mount: vertical



A. Recommended zone 90°

Figure 2-7: Remote mount: horizontal

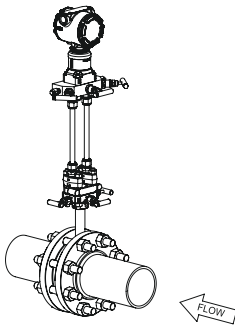
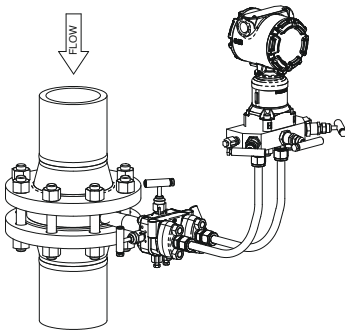
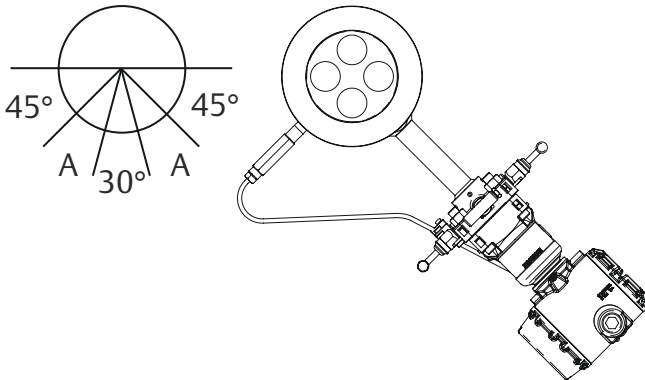


Figure 2-8: Remote mount: vertical

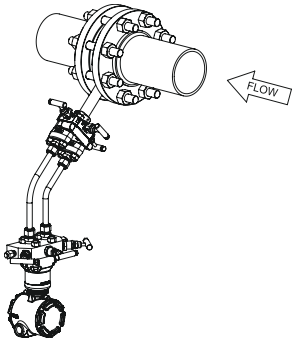
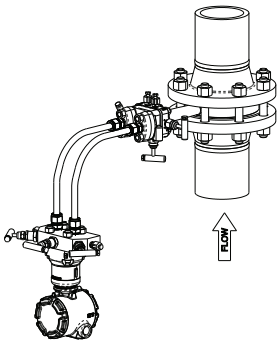


Steam - Rosemount 405C, 405P, and 405A

Figure 2-9: Direct mount: horizontal steam



A. Recommended zone 30°

Figure 2-10: Remote mount: horizontal steam**Figure 2-11: Remote mount: vertical steam****Note**

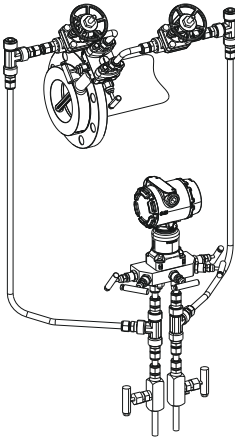
For the Rosemount 405A model in steam applications, with DP readings in a low flow condition as low as 0.75 in H₂O in horizontal pipes, consider installing the primary element/flow meter in the top mounting for steam configuration.

2.1 Top mounting for steam

Top mounting in steam is an alternative mounting method for steam installations that can be used if there are space restrictions or other concerns.

This installation method is intended for applications that run with limited interruptions or shutdowns. Also, for outdoor applications, top mounting can eliminate the need for heat tracing if steam is flowing.

Figure 2-12: Remote mount up to 850 °F (454 °C) (454 °C) – Rosemount 405C, 405P, and 405A



Note

When top mounting with a remote mount transmitter, use enough impulse piping to dissipate the process heat to avoid damaging the transmitter.

Suggested top mounting orientation:

- For remote mount installations, the impulse piping should slope up slightly from the instrument connections on the Rosemount 405A to the cross fittings, allowing condensate to drain back into the pipe.

From the cross fittings, the impulse piping should be routed downward to the transmitter and the drain legs. The transmitter should be located below the instrument connections of the Rosemount 405A.

For technologies C, P, and A, depending on the environmental conditions, it may be necessary to insulate the mounting hardware.

3 Primary element installation

Procedure

1. Orient the assembly according to the guidelines provided in [Primary element orientation](#).

Ensure that the flow arrow stamped on the Rosemount 405 is pointing in the same direction as the process flow.

Note

ANSI 150 - 600# alignment ring is included as standard when ordering for up to 8-in line sizes.

- For the 10-in and 12-in line size, you must order the alignment ring.
- If a DIN or JIS alignment ring is required, order it with the primary element.

Contact an Emerson sales representative for additional information.

Note

For ease of installation, you can secure the gasket to the flange face with small pieces of tape. Be sure the gasket or tape does not protrude into the pipe.

2. If using an alignment ring with through holes, proceed to [Step 7](#).
3. Insert two studs through the flange holes located opposite the head of the Rosemount 405.
4. Place the alignment ring on the Rosemount 405 body.
See [Figure 3-1](#).
5. Insert gaskets.
6. Insert the Rosemount 405 between the flanges so the indentations on the alignment ring contact the installed studs.
The studs must contact the alignment ring in the indentation marked with the appropriate flange rating to ensure proper alignment.
7. Place the alignment ring on the Rosemount 405 body.
See [Figure 3-1](#).
8. Insert the Rosemount 405 between the flanges.
 - a) Starting on the side opposite the Rosemount 405 head, rotate the alignment ring such that the radius

corresponding to the alignment ring marking matches that of the application flange rating.

- b) Insert one stud through both the upstream and downstream flanges and allow the ring to rest on the bolt. This will ensure proper alignment.
9. Repeat [Step 8](#) for the installation of the remaining bolts that will contact the alignment ring.
10. Insert gaskets.
11. Install remaining studs and nuts (hand tight). Ensure three of the studs are in contact with the alignment ring.
12. Lubricate studs and tighten nuts in a cross pattern to the appropriate torque per local standards.

Note

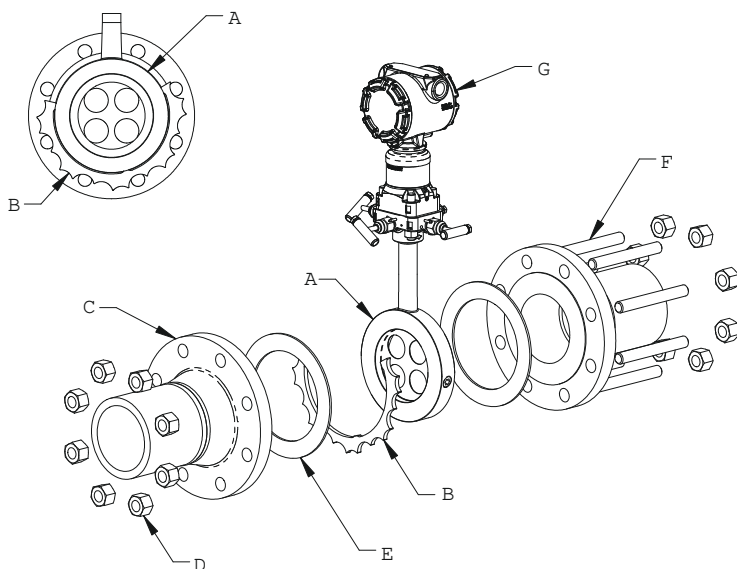
We recommend using standard 1/16-in gaskets with the Rosemount 405. Using other gaskets could potentially cause a bias shift in the measurement.

3.1 Recommended insulation guidelines

For flow meters with integral temperature assembly, it is recommended that the meter be insulated when the difference between process and ambient temperature is greater than 30 °F (16.6 °C).

- For line sizes ½-in. (15 mm) to 4-in. (100 mm), we recommend having 4-in. (100 mm) of insulation of at least a 4.35 R-factor.
- For line sizes 6-in. (150 mm) to 12-in. (300 mm), we recommend having 5-in. (125 mm) of insulation of at least a 4.35 R-factor.

The full thickness stated above may not be necessary for the entire flow meter, but is required for the temperature sensor area at a minimum. Insulation is needed to ensure meeting our specified temperature measurement accuracy. Only place insulation up to the neck; do not cover the transmitter.

Figure 3-1: Rosemount 405 installation

- A. Rosemount 405⁽²⁾
- B. Alignment ring
- C. Existing pipe assembly with flange
- D. Nut
- E. Gasket⁽³⁾
- F. Stud
- G. Transmitter

⁽²⁾ This installation drawing applies to the Rosemount 405C, 405P, and 405A.

⁽³⁾ The installation drawing applies when using the Rosemount 3051S, Rosemount 3051S MultiVariable, Rosemount 3051, and Rosemount 2051 transmitters. See the following documents for quick installation instructions for the transmitter: [Rosemount 3051S and 3051SF Flow Meter MultiVariable™ Transmitters](#), [Rosemount 3051S Pressure Transmitter and Rosemount 3051SF Flow Meter with HART® Protocol](#), [Rosemount 3051 Pressure Transmitter and 3051CF Flow Meter with 4-20 mA HART and 1-5 Vdc Low Power Protocol](#), or [Rosemount 2051 Pressure Transmitter with PROFIBUS® PA Protocol](#).

4 Product certifications

4.1 Approved manufacturing locations

Rosemount, Inc.: Shakopee, Minnesota USA

Rosemount DP Flow Design and Operations: Boulder, Colorado USA

Emerson Process Management GmbH & Co. OHG: Wessling, Germany

Emerson Asia Pacific Private Limited: Singapore

Emerson Beijing Instrument Co., Ltd: Beijing, China

4.2 European Directive information

The EU Declaration of Conformity for all applicable European directives for this product can be found on the website at [Rosemount Primary Elements Declaration of Conformity](#).

Contact your local sales office to obtain a hard copy.

European Pressure Equipment Directive (PED) (97/23/EC)

Rosemount 405 Compact Primary Element — Sound Engineering Practice (SEP)



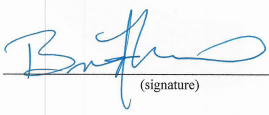
Pressure Transmitter — See appropriate Pressure Transmitter QSG.

4.3 Hazardous locations certifications

For information regarding the electronics product certification, see the appropriate transmitter Quick Start Guide:

- Rosemount 3051SMV: [Rosemount 3051S and 3051SF Series Flow Meter MultiVariable™ Transmitters Quick Start Guide](#)
- Rosemount 3051S: [Rosemount 3051S Series Pressure Transmitter and Rosemount 3051SF Series Flow Meter with HART® Protocol Quick Start Guide](#)
- Rosemount 3051: [Rosemount 3051 Pressure Transmitter and 3051CF Series Flow Meter with 4-20 mA HART and 1-5 Vdc Low Power Protocol Quick Start Guide](#)
- Rosemount 2051: [Rosemount 2051 Differential Flow Transmitter Product Detail Page](#)

Figure 4-1: Rosemount Primary Elements Declaration of Conformity

 EU Declaration of Conformity 	
No: DSI 1000 Rev. V	
<p>We, Rosemount / Dieterich Standard, Inc. 5601 North 71st Street Boulder CO 80301 USA</p>	
<p>declare under our sole responsibility that the products,</p> <p style="text-align: center;">Rosemount Primary Elements: 405, 485, 585, 1195, 1495, 1595, 9295 Rosemount DP Flowmeters: 2051CFx, 3051CFx, 3051SFx</p>	
<p>to which this declaration relates, is in conformity with the provisions of the European Union pressure equipment directive 2014/68/EU as shown in the attached schedule.</p>	
<p>Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Union notified body certification, as shown below and in the attached schedule. The object of the declaration described above is in conformity with the relevant Union harmonization legislation.</p>	
<p>Design Standard/Technical standard applied: ASME B31.3 Harmonized Standards applied: EN10204, EN 15614-1, LVD-2014/25/EU Module of conformity assessment applied: Module H</p>	
Serial Number(s):	
Year Manufactured:	
 _____ (signature)	_____ General Manager (function)
_____ Brian Fieser (name)	_____ April 1st, 2020 (date of issue)
<p>Pressure Equipment Directive Notified Body: Bureau Veritas Services SAS 8 Cours du Triangle, 92800 PUTEAUX – LA DEFENSE, FRANCE</p>	
<p>Certificate of Quality System approval– CE-0062-PED-H-RMT 001-20-USA</p>	
<p><small>Page 1 of 4</small></p>	
<p><small>April 1st, 2020</small></p>	



EU Declaration of Conformity

No: DSI 1000 Rev. V



PED Directive (2014/68/EU) This directive is valid from 19 July 2016

Model/Range	Hazard Classification	
	Gas	Liquid
585S (Flanged): CL150/PN16 to CL900/PN160 (Sensor 11, 22 & 44)	SEP	SEP
585S (Flanged): CL1500/PN250 to CL2500/PN400 (Sensor 11 & 22)	CAT I*	SEP
585S (Flanged): CL1500/PN250 & CL2500/PN400 (Sensor 44)	CAT III	SEP
405A, 405C, 405P Compact Primary Element (x051xFC)	SEP	SEP
1195, x051xFP: 1/2" & 1" (All types & Ratings)	SEP	SEP
1195, x051xFP: CL150/PN16 1-1/2"	CAT I*	SEP
1195, x051xFP: CL300/PN40 1-1/2"	CAT II*	SEP
1195, x051xFP: CL600/PN100 to CL900/PN160 1-1/2"	CAT II*	CAT II
1195, x051xFP: 1-1/2" Threaded & Welded	CAT II*	CAT II
1495 Orifice Plate	SEP	SEP
1496 Orifice Flange Union	SEP	SEP
1595 Conditioning Orifice Plate	SEP	SEP
Pak-Lok – 485/x051xFa: All (CL600/PN100 Rating) All Lines	SEP	SEP
Flanged – 485/x051xFa: CL150/PN16 to CL900/PN160 All Lines	SEP	SEP
Flanged – 485/x051xFa: CL1500/PN250 & CL2500/PN400 All Lines	CAT I*	SEP
Flange-Lok – 485/x051xFa: CL150/PN16 to CL600/PN100 All Lines	SEP	SEP
Flo-Tap – 485/x051xFa: Sensor Size 1 CL150/PN16 to CL600/PN100 2" to 8" Line	SEP	SEP
Flo-Tap – 485/x051xFa : Sensor Size 2 CL150/PN16 6" to 24" Line	CAT I*	SEP
Flo-Tap – 485/x051xFa : Sensor Size 2 CL150/PN16 30" to 36" Line	CAT II*	SEP
Flo-Tap – 485/x051xFa : Sensor Size 2 CL300/PN40 6" to 36" Line	CAT II*	SEP
Flo-Tap – 485/x051xFa : Sensor Size 2 CL600/PN100 6" to 14" Line	CAT II*	SEP
Flo-Tap – 485/x051xFa : Sensor Size 2 CL600/PN100 16" to 36" Line	CAT III	CAT II
Flo-Tap – 485/x051xFa : Sensor Size 3 CL150/PN16 12" to 36" Line	CAT II*	SEP
Flo-Tap – 485/x051xFa : Sensor Size 3 CL150/PN16 42" to 72" Line	CAT III	CAT II
Flo-Tap – 485/x051xFa : Sensor Size 3 CL300/PN40 12" to 36" Line	CAT III	CAT II
Flo-Tap – 485/x051xFa : Sensor Size 3 CL600/PN100 12" to 36" Line	CAT III	CAT II
Flo-Tap – 485/x051xFa : Sensor Size 3 CL600/PN100 42" to 72" Line	N/A	CAT II
Flo-Tap – 585: Sensor Size 44 CL150/PN16 (Line Size Code <= 420)	SEP	SEP
Flo-Tap – 585: Sensor Size 44 CL150/PN16 (Line Size Code > 420, <=720)	CAT I*	SEP
Flo-Tap – 585: Sensor Size 44 CL300/PN40 (Line Size Code <= 420)	SEP	SEP
Flo-Tap – 585: Sensor Size 44 CL300/PN40 (Line Size Code > 420, <=720)	CAT II*	SEP
Flo-Tap – 585: Sensor Size 44 CL600/PN100 (Line Size Code <= 420)	SEP	SEP
Flo-Tap – 585: Sensor Size 44 CL600/PN100 (Line Size Code > 420, <=720)	CAT II*	SEP
585M: Sensor Size 44	CAT III*	SEP
9295, CL150/PN16, 2"	CAT I*	SEP
9295, CL150/PN16, 3" & 4"	CAT II*	SEP
9295, CL150/PN16, 6"	CAT II*	CAT II
9295, CL300/PN40 to CL900/PN160, 2"	CAT II*	SEP
9295, CL300/PN40 to CL900/PN160, 3" & 4"	CAT II*	CAT II
9295, CL300/PN40 to CL900/PN160, 6"	CAT III	CAT II

*When fluid is an unstable gas, these items are Cat III




EU Declaration of Conformity




No: DSI 1000 Rev. V

PED Directive (2014/68/EU) This directive is valid from 19 July 2016

Summary of Classifications – Group 2 All Other Fluids		
Model/Range	Hazard Classification	
	Gas	Liquid
585S (Flanged): CL150/PN16 to CL2500/PN400 (Sensor 11, 22, &44)	SEP	SEP
405A, 405C, 405P Compact Primary Element (x051xFC)	SEP	SEP
1195, x051xFP: 1/2" & 1" (All Versions)	SEP	SEP
1195, x051xFP: CL150/PN16 1-1/2"	SEP	SEP
1195, x051xFP: CL300/PN40 - CL900/PN160 1-1/2"	I	SEP
1195, x051xFP: 1-1/2" Threaded & Welded	I	SEP
1495 Orifice Plate	SEP	SEP
1496 Orifice Flange Union	SEP	SEP
Pak-Lok – 485/x051xF: All (CL600/PN100 Rating) All Lines	SEP	SEP
Flanged – 485/x051xF: CL150/PN16 to CL900/PN160 All Lines	SEP	SEP
Flanged – 485/x051xF: CL1500/PN250 & CL2500/PN400 All Lines	SEP	SEP
Flange-Lok – 485/x051xF: CL150/PN16 to CL600/PN100 All Lines	SEP	SEP
Flo-Tap – 485/x051xF: Sensor Size 1 CL150/PN16 to CL600/PN100 2" to 8" Line	SEP	SEP
Flo-Tap – 485/x051xF: Sensor Size 2 CL150/PN16 6" to 24" Line	SEP	SEP
Flo-Tap – 485/x051xF: Sensor Size 2 CL150/PN16 30" to 36" Line	CAT I	SEP
Flo-Tap – 485/x051xF: Sensor Size 2 CL300/PN40 6" to 36" Line	CAT I	SEP
Flo-Tap – 485/x051xF: Sensor Size 2 CL600/PN100 6" to 14" Line	CAT I	SEP
Flo-Tap – 485/x051xF: Sensor Size 2 CL600/PN100 16" to 36" Line	CAT II	SEP
Flo-Tap – 485/x051xF: Sensor Size 3 CL150/PN16 12" to 36" Line	CAT I	SEP
Flo-Tap – 485/x051xF: Sensor Size 3 CL150/PN16 42" to 72" Line	CAT II	SEP
Flo-Tap – 485/x051xF: Sensor Size 3 CL300/PN40 12" to 72" Line	CAT II	SEP
Flo-Tap – 485/x051xF: Sensor Size 3 CL600/PN100 12" to 36" Line	CAT III	SEP
Flo-Tap – 485/x051xF: Sensor Size 3 CL600/PN100 42" to 72" Line	CAT III	SEP
Flo-Tap – 585: Sensor Size 44 CL150/PN16 (Line Size Code <= 420)	SEP	SEP
Flo-Tap – 585: Sensor Size 44 CL150/PN16 (Line Size Code > 420, <=720)	SEP	SEP
Flo-Tap – 585: Sensor Size 44 CL300/PN40 (Line Size Code <= 420)	SEP	SEP
Flo-Tap – 585: Sensor Size 44 CL300/PN40 (Line Size Code > 420, <=720)	CAT I	SEP
Flo-Tap – 585: Sensor Size 44 CL600/PN100 (Line Size Code <= 420)	SEP	SEP
Flo-Tap – 585: Sensor Size 44 CL600/PN100 (Line Size Code > 420, <=720)	CAT I	SEP
585M: Sensor Size 44	SEP	SEP
9295, CL150/PN16, 2"	SEP	SEP
9295, CL150/PN16, 3" to 6"	I	SEP
9295, CL300/PN40 to CL900/PN160, 2" to 4"	I	SEP
9295, CL300/PN40 to CL900/PN160, 6"	II	SEP



EU Declaration of Conformity



No: DSI 1000 Rev. V

RoHS Directive (2011/65/EU)

Models 3051CFx, 2051CFx
Harmonized standard: EN 50581:2012

Only applies to the following models:

- 3051CFx with 4-20 mA HART output code A
- 3051CFx with FOUNDATION Fieldbus output code F
- 3051CFx with Profibus PA output code W
- 2051CFx with 4-20 mA HART output code A

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April 1st, 2020

4.4 China RoHS

有害物质成分表

罗斯蒙特产品型号 405
7/1/2016

含有China RoHS管控物质超过最大浓度限值的部件型号列表 405
List of 405 Parts with China RoHS Concentration above MCVs

部件名称 Part Name	有害物质 / Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr +6)	多溴联苯 Polybrominated biphenyls (PBB)	多溴联苯醚 Polybrominated diphenyl ethers 多溴联苯醚 (PBDE)
铝制温度传感器外壳组件 Aluminum RTD Housing Assembly	○	○	○	X	○	○

本表格系依照SJ/T11364的规定而制作。

This table is proposed in accordance with the provision of SJ/T11364

○: 意为该部件的所有均质材料中该有害物质的含量均低于GB/T 26572所规定的限量要求。

○: Indicate that said hazardous substance in all of the homogeneous materials for this part is below the limit

requirement of GB/T 26572.

X: 意为在该部件所使用的均质材料里, 至少有一类均质材料中该有害物质的含量高于GB/T 26572所规定的限量要求。

X: Indicate that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.

部件名称 Part Name	组装备件说明 Spare Parts Descriptions for Assemblies
壳体组件Housing Assembly	电子外壳 Electrical Housing

上述申明仅适用于选择铝制外壳组件的产品。其他所有差压流量一次元件的组件所含有的China RoHS 管控物质浓度均低于GB/T 26572所规定的限量要求。关于差压流量计变送器组件的管控物质浓度的申明, 请参看变送器的快速安装指南。

The disclosure above applies to units supplied with aluminum connection heads. No other components supplied with DP Flow primary elements contain any restricted substances. Please consult the transmitter Quick Start Guide (QIG) for disclosure information on transmitter components.



Quick Start Guide
00825-0100-4810, Rev. HC
March 2023

For more information: [Emerson.com](https://www.emerson.com)

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