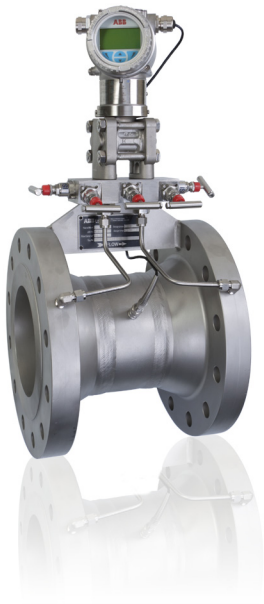
Data sheet DS/FPD570–EN Rev. C

# WedgeMaster FPD570
# Compact wedge flowmeter

## Combining durability with simplicity



### Compact flowmeter with integral transmitter, manifold and temperature element

— for volumetric- or mass-flow metering available for pipe sizes DN25 to DN150 (1 to 6 in.)
— problems caused by impulse piping eliminated by mounting the transmitter and manifold directly on to the meter
— complete with manifold and ABB DP or Multivariable transmitter

### Corrosion and erosion resistant

— V-shaped restriction eliminates damage from the secondary phase
— no critical surface dimensions to wear and affect performance
— durable with excellent long term stability

### Minimum requirements for straight pipe

— flow is conditioned within the meter body without compromising on performance
— 5 pipe diameters upstream and 3 diameters downstream is all that is needed for specified performance, enabling the meter to be used in difficult pipework configurations

### Calibrated for optimum accuracy

— all meters water-calibrated to verify actual meter coefficient, providing a metering accuracy of up to 0.5 % of reading when used within calibrated range

### Factory acceptance report

— supplied with report detailing results of critical inspection checks, plus certification data

EUROTEC
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Power and productivity
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ABB

# WedgeMaster FPD570
# Compact wedge flowmeter

## WedgeMaster – compact wedge flowmeter

WedgeMaster is a wedge-based flowmeter designed to greatly simplify specification, installation and commissioning.

Its one-piece flowmeter assembly features the following:
- Wedgemeter element with a choice of pipe sizes from DN25 to DN150 (1 to 6 in.)
- Integral 3-valve instrument manifold (optional 5-valve manifold available)
- Optional integral temperature element for corrected volume / mass calculations
- Integral DP or multivariable transmitter, factory-fitted to the manifold
- Fully leak tested

### Benefits

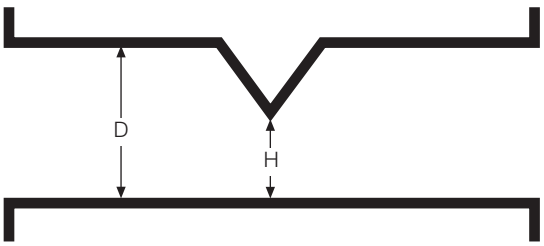
WedgeMaster avoids many of the difficulties involved in the sizing, selection, procurement, installation and commissioning of conventional DP flowmeter installations.

- With all the major components in one assembly, WedgeMaster eliminates the problems of sourcing multiple components. It provides large savings in cost and time due to the simplicity of purchasing, design and installation.
- Integral transmitter and manifold with compact tapping connections eliminates the need to run and connect impulse piping and offers:
  - reduced possibility of impulse line blockage
  - reduced number of potential leakage points
- The assembly is pressure-tested in the factory, ensuring that the connections between the tapping points and the transmitter are completely free of leaks.
- Every flowmeter is flow calibrated, ensuring the performance of the complete flowmeter, not just the flow element.
- The 'Plugged Impulse Line Detection' (PILD) feature generates a warning via HART communication if either or both of the impulse lines become fully or partially obstructed (for example, by foreign material or ice). The meter can also be configured to drive the analog output signal to the 'Alarm current'.




- New 'through-the-glass' (TTG) keypad technology enables configuration without the need to remove the transmitter covers, even in hazardous areas.
- Factory configuration saves the user time during commissioning and ensures that the flowmeter output span truly matches that of the application flowrate.

WedgeMaster utilizes a V-shaped restriction to produce a differential pressure that has a square root relationship to volumetric flow.




WedgeMaster is available with 4 standard wedge ratios to cover a wide range of application flow rates. The wedge ratio is defined as H/D where H is the wedge opening height and D is the nominal pipe diameter. The restriction is V-shaped at an optimum angle to give the best possible characteristics when measuring viscous fluids. The element is suitable for applications where the pipe Reynolds number is as low as 500 (well into the laminar flow zone) and as high as several million.

### Versions

WedgeMaster is available in two versions:

### WedgeMaster V

— compact Wedge flowmeter for measurement of liquids, gases and steam in volumetric units (actual volume). It uses the ABB 266DSH transmitter and provides a flow rate and total display with an output of 4 to 20 mA proportional to the actual volume flowrate.

WedgeMaster V has a stainless steel body and an alloy transmitter case (optionally stainless steel).

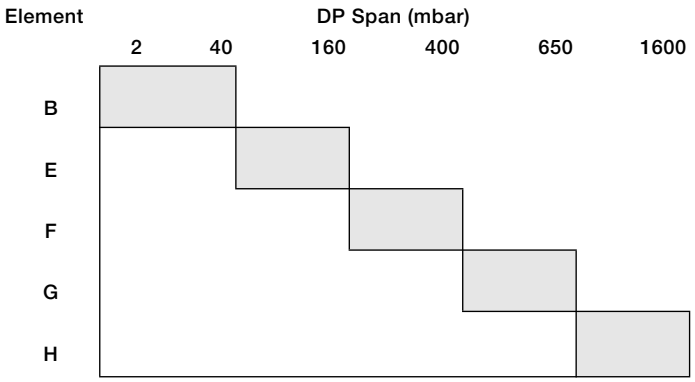
### WedgeMaster M

— compact Wedge flowmeter, providing measurement directly in either mass- or corrected volume-units for liquids and steam. Gas flow measurement is provided directly in reduced volume units. It uses the ABB 267CS or 266CSH multivariable transmitter to measure DP, temperature and pressure, providing a flowrate and total display and transmits a 4 to 20 mA signal proportional to the mass- or corrected volume-flowrate.

WedgeMaster M has a stainless steel body, an alloy transmitter case (optionally stainless steel) and an optional internal temperature element.

### DP Span limits

There are up to 5 DP sensor ranges available. For optimum accuracy, select the sensor where the full scale DP is in the shaded area and is as close as possible to the maximum range of the sensor.




## Performance specifications

### Standard H/D ratios

0.2, 0.3, 0.4, 0.5
(Restrictions apply depending on actual model code)

### Process connection

ANSI Class 300, 600, 900, 1500, 2500 RF and RTJ or Wafer body
(Restrictions apply depending on actual model code)

### Construction materials

### Process wetted parts

— Body: carbon steel, 316 stainless steel
— Restriction: carbon steel, 316 stainless steel

### Mounting hardware

— 3- or 5-valve manifold: 316 stainless steel with PTFE packing
— Impulse lines / fittings: 316 stainless steel

### Accuracy

### Calibrated

±0.5 % of actual flow when operated within the calibrated range

### Bi-directional

As above when Kd2 designated as reverse flow coefficient

### Repeatability

±0.2 %

### Pressure Rating

100 bar (1440 lbf/in$^2$)

# WedgeMaster FPD570
# Compact wedge flowmeter

### Weights

| Size mm (in.) | Flange Rating | Weight kg (lbs) |
|---|---|---|
| 25 (1) | ASME CL300 | 20 (44) |
| | ASME CL600 | 20 (44) |
| | ASME CL900 | 24 (53) |
| | ASME CL1500 | 24 (53) |
| | ASME CL2500 | 26 (57) |
| 40 (1½) | ASME CL300 | 22 (49) |
| | ASME CL600 | 24 (53) |
| | ASME CL900 | 28 (62) |
| | ASME CL1500 | 28 (62) |
| | ASME CL2500 | 38 (84) |
| 50 (2) | ASME CL300 | 24 (53) |
| | ASME CL600 | 26 (57) |
| | ASME CL900 | 38 (84) |
| | ASME CL1500 | 38 (84) |
| | ASME CL2500 | 54 (119) |

| Size mm (in.) | Flange Rating | Weight kg (lbs) |
|---|---|---|
| 80 (3) | ASME CL300 | 30 (66) |
| | ASME CL600 | 36 (79) |
| | ASME CL900 | 44 (97) |
| | ASME CL1500 | 60 (132) |
| | ASME CL2500 | 102 (225) |
| 100 (4) | ASME CL300 | 38 (84) |
| | ASME CL600 | 54 (119) |
| | ASME CL900 | 62 (137) |
| | ASME CL1500 | 82 (181) |
| | ASME CL2500 | 148 (326) |
| 150 (6) | ASME CL300 | 54 (119) |
| | ASME CL600 | 90 (198) |
| | ASME CL900 | 116 (256) |
| | ASME CL1500 | 166 (366) |
| | ASME CL2500 | 360 (794) |

### Maximum process temperature

230 °C (446 °F)

### At the transmitter sensor

**Silicone oil filled sensor F to H:**
–40 and 121 °C (–40 and 250 °F)
**Silicone oil filled sensor B, E:**
–25 and 121 °C (–13 and 250 °F)
**Inert (Galden) filled sensor F to H:**
–20 and 100 °C (–4 and 212 °F)
**Inert (Galden) filled sensor E:**
–10 and 100 °C (14 and 212 °F)
**Inert (Halocarbon) filled sensor F to H:**
–20 and 100 °C (–4 and 212 °F)
**Inert (Halocarbon) filled sensor E:**
–10 and 100 °C (14 and 212 °F)

**IMPORTANT**
For hazardous atmosphere applications see the temperature range specified on the certificate / approval relevant to the type of protection

### Ambient temperature limits

**Note.** LCD display may not be clearly readable below –20 °C (–4 °F) or above 70 °C (158 °F)

**WedgeMaster V**

V2: Sensors A to E incl: –25 and 85 °C (–13 and 185 °F)
Other sensors: –40 and 85 °C (–40 and 185 °F)

**WedgeMaster M**

M2: –40 and 85 °C (–40 and 185 °F)

### Storage limits

–50 to 85 °C (–58 to 185 °F)
LCD integral display:
— –40 to 85 °C (–40 to 185 °F)

### Integral display

#### WedgeMaster V2, M2

— Wide screen LCD, 128 x 64 pixel, 52.5 x 27.2 mm (2.06 x 1.07 in.) dot matrix
— Multilanguage
— 4 keys for flowmeter configuration and management
— Totalized and instantaneous flow indication
— Display may also indicate diagnostic messages and provides configuration facilities

#### WedgeMaster M1

19-segment alphanumeric display (2-line, 6-character ) with additional bar chart display, optionally with back illumination.

### Environmental limits

#### Electromagnetic compatibility (EMC)

Complies with EN 61326 and NAMUR NE-21

#### Surge immunity level (with surge protector)

4 kV (according to IEC 1000-4-5 EN 61000-4-5)

#### Pressure equipment directive (PED)

Complies with 97/23/EEC Category III Module H

#### Humidity

Relative humidity:
— up to 100 %

Condensing, icing:
— admissible

### Vibration resistance

Accelerations up to 2 g at frequency up to 1000 Hz (according to IEC 60068-2-6)

### Shock resistance

Acceleration:
— 50 g

Duration:
— 11 ms (according to IEC 60068-2-27)

### Wet and dust-laden atmospheres

The meter is dust- and sand-tight and protected against immersion effects as defined by EN 60529 (1989) to IP 67 (IP 68 on request) or by NEMA to 4X

### Hazardous atmospheres

With or without integral display

#### Combined ATEX code EW (= E1 + E2 + E3 below)

#### Combined ATEX and FM Approvals code EN (= E1 + E2 + E3 + E4 + E6 below )

Intrinsic safety:
— ATEX Europe (code E1)
— II 1/2 G Ex ia IIC T6/T5/T4; IP67
— II 1 D Ex iaD 20 T85 °C
— II 1/2 D Ex iaD 21 T85 °C; IP67

Explosion proof:
— ATEX Europe (code E2)
— II 1/2 G Ex d IIC T6
— II 1/2 D Ex tD A21 T85 °C (–50 °C • Ta •+75 °C); IP67

Type 'N':
— ATEX Europe (code E3 ) type examination
— II 3 G Ex nL IIC T6/T5/T4
— II 3 D Ex tD A22 T85 °C; IP67

#### FM Approvals US (code E6) and Canada (code E4)

Explosion proof (US):
— Class I, Div. 1, Groups A, B, C, D

Explosion proof (Canada):
— Class I, Div. 1, Groups B, C, D

Dust ignition proof:
— Class II, Div. 1, Groups E, F, G

Suitable for:
— Class II, Div. 2, Groups F, G; Class III, Div.1, 2

Non-incendive:
— Class I, Div. 2, Groups A, B, C, D

Intrinsically safe:
— Class I, II, III, Div. 1, Groups A, B, C, D, E, F,G
— Class I, Zone 0 AEx ia IIC T6/T4, Zone 0 (FM US)
— Class I, Zone 0 Ex ia IIC T6/T4, Zone 0 (FM Canada)

# WedgeMaster FPD570
# Compact wedge flowmeter

**FM Approvals US**
Intrinsically safe (code EA):
— Class I; Division 1; Groups A, B, C, D;
— Class I; Zone 0; Group IIC; AEx ia IIC

Explosionproof (code EB):
— Class I, Division 1, Groups A, B, C, D;
— Class II/III, Division 1, Groups E, F, G

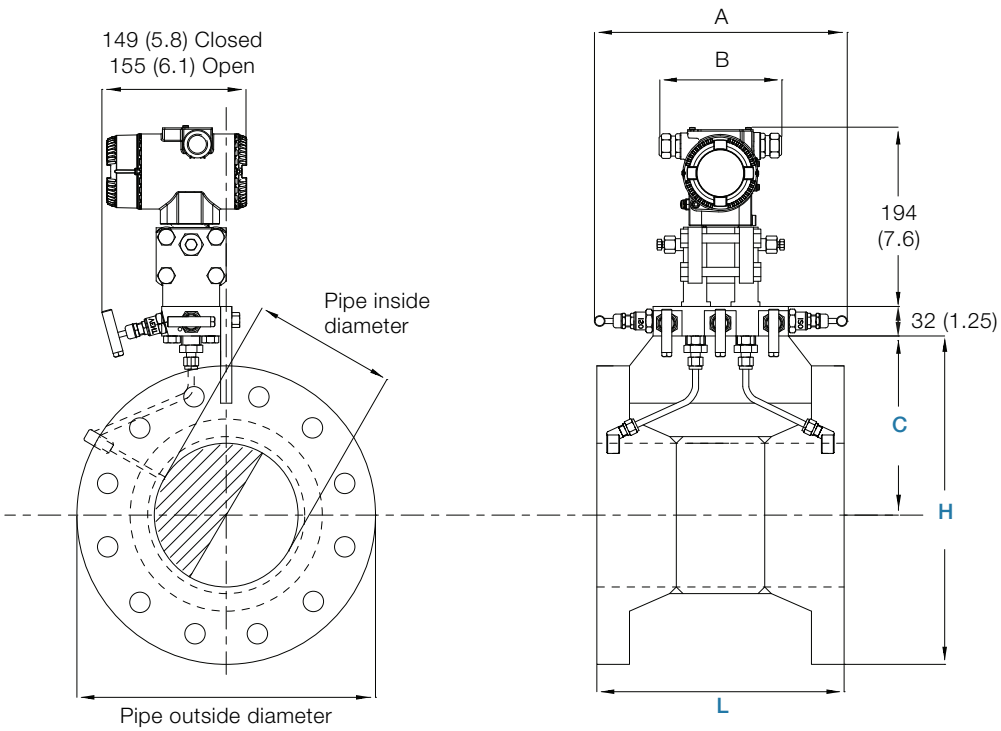
Refer to certificates for ambient temperature ranges (within the limits –50 to 85 °C [–58 to 185 °F]) related to the different temperature classes

**CSA Approvals Canada (code EE):**
Explosion Proof:
— Class I, Division 1, Groups B, C, D;
— Class II/III, Division 1, Groups E, F, G

## Dimensions

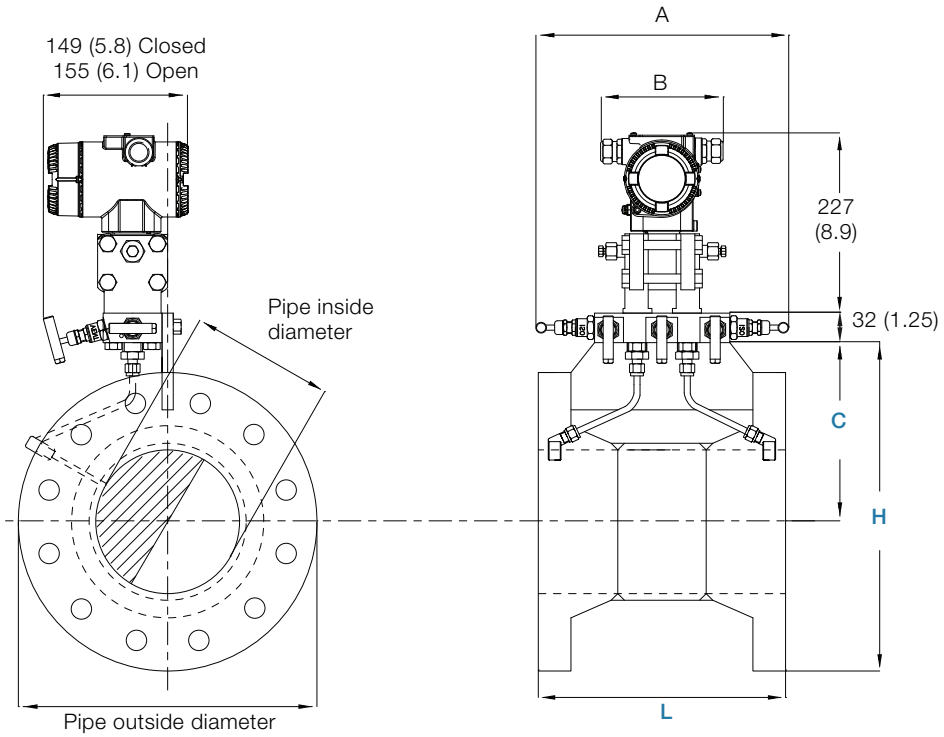
### WedgeMaster M1

Dimensions in mm (in.)



## WedgeMaster V2, M2

Dimensions in mm (in.)




| | | Size | | | | | |
|---|---|---|---|---|---|---|---|
| Dimension | Model | 25 (1) | 40 (1.5) | 50 (2) | 80 (3) | 100 (4) | 150 (6) |
| C | 300LB | 102 (4.02) | 118 (4.65) | 123 (4.84) | 145 (5.71) | 167 (6.57) | 199 (7.83) |
| | 600LB | 102(4.02) | 118 (4.65) | 123 (4.84) | 145 (5.71) | 177 (6.97) | 218 (8.58) |
| | 900LB | 115 (4.53) | 129 (5.08) | 148 (5.83) | 161 (6.34) | 186.5 (7.34) | 230.5 (9.07) |
| | 1500LB | 115 (4.53) | 129 (5.08) | 148 (5.83) | 173.5 (6.83) | 196 (7.72) | 237 (9.33) |
| | 2500LB | 119.5 (4.70) | 142 (5.59) | 157.5 (6.20) | 192.5 (7.58) | 218 (8.58) | 281.5 (11.08) |
| L | 300LB | 121 (4.76) | 134 (5.28) | 137 (5.39) | 181 (7.13) | 219 (8.62) | 320 (12.60) |
| | 600LB | 124 (4.88) | 140 (5.51) | 147 (5.79) | 191 (7.52) | 254 (10.00) | 335 (13.19) |
| | 900LB | 147 (5.79) | 166 (6.54) | 204 (8.03) | 204 (8.03) | 254 (10.00) | 330 (12.99) |
| | 1500LB | 147 (5.79) | 166 (6.54) | 204 (8.03) | 235 (9.25) | 248 (9.76) | 368 (14.49) |
| | 2500LB | 178 (7.01) | 223 (8.78) | 254 (10.00) | 337 (13.27) | 381 (15.00) | 547 (21.54) |
| H | 300LB | 164 (6.46) | 196 (7.72) | 206 (8.11) | 250 (9.84) | 294 (11.57) | 358 (14.09) |
| | 600LB | 164 (6.46) | 196 (7.72) | 206 (8.11) | 250 (9.84) | 314 (12.36) | 396 (15.59) |
| | 900LB | 190 (7.48) | 218 (8.58) | 256 (10.08) | 282 (11.10) | 333 (13.11) | 421 (16.57) |
| | 1500LB | 190 (7.48) | 218 (8.58) | 256 (10.08) | 307 (12.09) | 352 (13.86) | 434 (17.09) |
| | 2500LB | 199 (7.83) | 244 (9.61) | 275 (10.83) | 345 (13.58) | 396 (15.59) | 523 (20.59) |

# WedgeMaster FPD570
# Compact wedge flowmeter

## Ordering information

| | | Main code | | | | | | | | | | | | Optional code |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WedgeMaster compact wedge flowmeter** | **FPD570** | XX | XXX | X | X | XX | XX | XX | X | X | X | X | X | XX | XX XX XX XX XX XX |
| **Model and design level** | | | | | | | | | | | | | | | |
| WedgeMaster V, for volume flow, design level 2 (266DSH) | V2 | | | | | | | | | | | | | | |
| WedgeMaster M, for mass flow, design level 1 (267CS) | M1 | | | | | | | | | | | | | | |
| WedgeMaster M, for mass flow, design level 2 (266CSH) | M2 | | | | | | | | | | | | | | |
| **Meter size** | | | | | | | | | | | | | | | |
| 25 mm (1 in.) | | 025 | | | | | | | | | | | | | |
| 40 mm (1½ in.) | | 040 | | | | | | | | | | | | | |
| 50 mm (2 in.) | | 050 | | | | | | | | | | | | | |
| 80 mm (3 in.) | | 080 | | | | | | | | | | | | | |
| 100 mm (4 in.) | | 100 | | | | | | | | | | | | | |
| 125 mm (5 in.) | | 125 | | | | | | | | | | | | | |
| 150 mm (6 in.) | | 150 | | | | | | | | | | | | | |
| **Fluid** | | | | | | | | | | | | | | | |
| Liquid | | | L | | | | | | | | | | | | |
| Gas | | | G | | | | | | | | | | | | |
| Steam | | | S | | | | | | | | | | | | |
| **H/D ratio** | | | | | | | | | | | | | | | |
| 0.2 | | | | 2 | | | | | | | | | | | |
| 0.3 | | | | 3 | | | | | | | | | | | |
| 0.4 | | | | 4 | | | | | | | | | | | |
| 0.5 | | | | 5 | | | | | | | | | | | |
| **Body material / restriction material** | | | | | | | | | | | | | | | |
| Carbon steel / carbon steel | | | | | A1 | | | | | | | | | | |
| Carbon steel / AISI 316 SST | | | | | A6 | | | | | | | | | | |
| AISI 316 SST / AISI 316 SST | | | | | S6 | | | | | | | | | | |
| **Process connection type** | | | | | | | | | | | | | | | |
| RFWN (raised face weld neck), standard face[1] | | | | | | R1 | | | | | | | | | |
| RFWN (raised face weld neck), smooth face | | | | | | R2 | | | | | | | | | |
| RTJ (ring-type joint) weld neck[2] | | | | | | T2 | | | | | | | | | |
| Wafer[3] | | | | | | W1 | | | | | | | | | |

Continued on next page …

See page 11

[1] Not available with pipe sizes 15 … 80 mm (½ … 3 in.)

[2] Available only with pipe sizes 40 … 200 mm (½ … 8 in.) / pressure rating ASME CL 1500 / CL 2500

[3] Available only with pipe sizes 25 … 100 mm (1 … 4 in.) / maximum pressure rating PN 100 / ASME CL 600

**WedgeMaster compact wedge flowmeter** — **FPD570** — **Main code** — **Optional code**

| Main code | | | | | | | | | | | | | | Optional code |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FPD570 | XX | XXX | X | X | XX | XX | XX | X | X | X | X | X | XX | XX XX XX XX XX XX |
| | See page 8 | | | | | | | | | | | | | See page 11 |

**Pressure rating**

| | |
|---|---|
| ASME CL 300 | A3 |
| ASME CL 600 | A6 |
| ASME CL 900 | A7 |
| ASME CL 1500 | A8 |
| ASME CL 2500 | A9 |

**Pipeline orientation**

| | |
|---|---|
| Horizontal | H |
| Vertical | V |

**Manifold**

| | |
|---|---|
| Integral 3-valve manifold | 3 |
| Integral 5-valve manifold | 5 |

**DP span limits**

| | | |
|---|---|---|
| 0.05 … 1 kPa / 0.5 … 10 mbar / 0.2 … 4 in. $H_2O$ | (all transmitters) | A |
| 0.14 … 4 kPa / 1.4 … 40 mbar / 0.56 … 16 in. $H_2O$ | (only with WedgeMaster V2) | B |
| 0.2 … 6 kPa / 2 … 60 mbar / 0.8 … 24 in. $H_2O$ | (only with WedgeMaster M1) | C |
| 0.27 … 16 kPa / 2.7 … 160 mbar / 1.08 … 64 in. $H_2O$ | (only with WedgeMaster V2 (266DSH)) | E |
| 0.4 … 40 kPa / 4 … 400 mbar / 1.6 … 160 in. $H_2O$ | | F |
| 0.65 … 65 kPa / 6.5 … 650 mbar / 2.6 … 260 in. $H_2O$ | (only with WedgeMaster V2) | G |
| 1.6 … 160 kPa / 16 … 1600 mbar / 6.4 … 642 in. $H_2O$ | (only with WedgeMaster V2) | H |
| 2.5 … 250 kPa / 25 … 2500 mbar / 10 … 1000 in. $H_2O$ | (only with WedgeMaster M1) | L |
| Others | | Z |

**Transmitter seal material**

| | |
|---|---|
| Without seal | 0 |
| Viton | 3 |
| PTFE | 4 |
| EPDM | 5 |
| Perbunan | 6 |

Continued on next page…

# WedgeMaster FPD570
# Compact wedge flowmeter

| WedgeMaster compact wedge flowmeter | | Main code FPD570 XX XXX X X XX XX XX X X X X X X XX | Optional code XX XX XX XX XX XX |
|---|---|---|---|
| | | See page 8 / See page 9 | See next page … |
| **Electronic housing material / electrical connection** | | | |
| Aluminium alloy / ½-14 NPT | | A | |
| Aluminium alloy / M20 x 1.5 | | B | |
| AISI 316L SST / ½-14 NPT | | S | |
| AISI 316L SST / M20 x 1.5 | | T | |
| Others | | Z | |
| **Integrated digital display (LCD)** | | | |
| None (blind) | | 0 | |
| LCD display | | 1 | |
| LCD display (backlit) | (only with WedgeMaster M1 (267CS)) | 2 | |
| TTG (through-the-glass) integral digital LCD display | (only with model/design level V2,M2) | 5 | |
| **Output signal** | | | |
| HART digital communication and 4 … 20 mA | | | H1 |
| HART digital communication and 4 … 20 mA, SIL2 and SIL3 certified to IEC 61508[1] | | | H2 |
| PROFIBUS PA[2] | | | P1 |
| FOUNDATION Fieldbus[2] | | | F1 |
| MODBUS RS 485[3] | | | M1 |
| Wireless HART[1] | | | W1 |

[1] Design level 2 only

[2] Not with WedgeMaster V1 (364DS)

[3] WedgeMaster M only

Option H2 is for model V2 only

Option P1,F1,M1 for model V2 only

| WedgeMaster compact wedge flowmeter | Main code | | | | | | | | | | | | | Optional code | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FPD570 | XX | XXX | X | X | XX | XX | XX | X | X | X | X | X | X | XX | XX | XX | XX | XX | XX |
| | | | See page 8 | | | | | See page 9 | | | | See page 10 | | | | | | | | |
| **Temperature element** | | | | | | | | | | | | | | | | | | | | |
| Integral | | | | | | | | | | | | | | | AT | | | | | |
| Remote (element not included) | | | | | | | | | | | | | | | AR | | | | | |
| **Calibration** | | | | | | | | | | | | | | | | | | | | |
| Bi-directional water calibration | | | | | | | | | | | | | | | | CM | | | | |
| Standard water calibration at reference conditions | | | | | | | | | | | | | | | | CW | | | | |
| **Certificates** | | | | | | | | | | | | | | | | | | | | |
| Material monitoring with inspection certificate 3.1 acc. EN 10204 | | | | | | | | | | | | | | | | | C2 | | | |
| Certificate of conformance | | | | | | | | | | | | | | | | | C4 | | | |
| X-Ray NDE of welds | | | | | | | | | | | | | | | | | C8 | | | |
| Dye penetrant NDE of welds | | | | | | | | | | | | | | | | | C9 | | | |
| Positive Material Identification (PMI) | | | | | | | | | | | | | | | | | CA | | | |
| Hydrostatic pressure test certificate | | | | | | | | | | | | | | | | | CB | | | |
| Material monitoring NACE MR 01-75 with inspection certificate 3.1 acc. EN 10204 | | | | | | | | | | | | | | | | | CN | | | |
| PED certificate (Pressure Equipment Directive 97 / 23 / EC) | | | | | | | | | | | | | | | | | CP | | | |
| Others | | | | | | | | | | | | | | | | | CZ | | | |
| **Explosion protection certification** | | | | | | | | | | | | | | | | | | | | |
| Factory mutual (FM) – intrinsically safe | | | | | | | | | | | | | | | | | | EA | | |
| Factory mutual (FM) - explosion proof | | | | | | | | | | | | | | | | | | EB | | |
| Canadian standard association (CSA) – explosion proof | | | | | | | | | | | | | | | | | | EE | | |
| ATEX + FM + CSA | | | | | | | | | | | | | | | | | | EN | | |
| ATEX II 1/2 GD EEx ia + ATEX II 1/2 GD EEx d + ATEX EEx nL | | | | | | | | | | | | | | | | | | EW | | |
| **Documentation language** | | | | | | | | | | | | | | | | | | | | |
| German | | | | | | | | | | | | | | | | | | | M1 | |
| Italian | | | | | | | | | | | | | | | | | | | M2 | |
| Spanish | | | | | | | | | | | | | | | | | | | M3 | |
| French | | | | | | | | | | | | | | | | | | | M4 | |
| English | | | | | | | | | | | | | | | | | | | M5 | |
| Chinese | | | | | | | | | | | | | | | | | | | M6 | |
| **Special applications** | | | | | | | | | | | | | | | | | | | | |
| Degreased (oil- and grease-free) with inert capsule filling for oxygen applications | | | | | | | | | | | | | | | | | | | | P1 |
| Gold-plated diaphragm (silicone oil-filled) for hydrogen applications | | | | | | | | | | | | | | | | | | | | P2 |

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3KXF511571R1001

DS/FPD570-EN Rev. C 07.2014

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