Vortex Flow Measuring System

PROline prowirl 73

Two-Wire Saturated Steam Mass Flowmeter.

Application
For measuring the volume or mass flow of saturated steam and liquids. The instrument calculates steam mass flow using data according to the international standard IAPWS-IF97 (ASME).
If the pressure is constant, the instrument is able to put out the mass flow of superheated steam or the mass and volume flow of other gases.
With devices with a PROFIBUS-PA or FOUNDATION Fieldbus interface the possibility exits, to read the operating pressure as an input value.
For utility and process applications in the chemical, petrochemical, power and district heating industries and in many other industries.

Your benefits
• Proven robust, capacitive sensor (installed base > 100,000)
• Immune to:
  – Vibration (over 1 g in all axes)
  – Temperature shock (> 150 K/s)
  – Dirty media
  – Water hammer
• Process temperature range: -330° to +750°F (-200° to +400°C)
• Connection to all common systems:
  – HART
  – PROFIBUS-PA
  – FOUNDATION Fieldbus
• Galvanically isolated frequency output available (for flow, alarm, limit value etc.).
• Permanent self-monitoring and diagnosis of electronics and sensor.
• Correction of diameter mismatch.
• No maintenance, no moving parts, no zero-point drift.

Endress + Hauser
The Power of Know How
Function and system design

Measuring principle

Vortex shedding flowmeters work on the principle of the Karman vortex street. When a fluid flows past a bluff body, vortices are alternately formed and shed on both sides with opposite senses of rotation. These vortices each generate a local low pressure. The pressure fluctuations are recorded by the sensor and converted to electrical pulses. The vortices develop very regularly within the application limits of the device. Therefore, the frequency of vortex shedding is directly proportional to the volume flow.

The K-factor is used as the proportional constant:

\[
\text{K-Factor} = \frac{\text{pulses}}{\text{unit volume [gal]}} \quad \text{OR} \quad \text{K-Factor} = \frac{\text{pulses}}{\text{unit volume [dm}^3\text{]}}
\]

Within the application limits of the device, the K-factor only depends on the geometry of the device. It is independent of the fluid velocity and its properties viscosity and density. In this way, the K-factor is also independent of the type of fluid to be measured, regardless of whether this is steam, a gas or a liquid.

The primary measuring signal is already digital (frequency signal) and a linear function of the flow. After manufacturing the meter, the K-factor is determined once-off in the factory by means of calibration and is not subjected to any long term drift or zero point shift.

The device does not contain any moving parts and requires no maintenance.

The capacitive sensor

The sensor of a vortex flowmeter has a major influence on the performance, robustness and reliability of the whole measuring system.

The robust DSC sensor with integrated thermometer (Pt 1000) offers all the advantages of the Prowirl DSC sensors already known. The DSC sensor is burst-tested up to over 5800 psi (400 bar) and vibration and temperature shock tested (temperature shocks of 150 K/s).

Prowirl 73 uses Endress + Hauser’s proven and patented capacitive measuring technology, with to date more than 100,000 Vortex measuring points installed world wide.

Due to its internal mechanical balance, the DSC sensor (Differential Switched Capacitance), reads only the pressure pulses caused by the vortices and stays immune to any influence from mechanical pipe line vibrations.

The DSC sensor measures low flow rates at low fluid density even when pipe line vibrations are present.

Therefore, Prowirl 73 keeps its wide turndown ratio even under rough operating conditions. Vibrations of at least 1g at frequencies up to 500 Hz in all axes (X, Y, Z) do not affect the flow measurement.

Thanks to its mechanical design, the capacitive sensor is also especially resistant to temperature shocks and water hammer in steam lines.
Temperature meter

Temperature meter
In addition to the volume flow the instrument measures the temperature. This measurement is performed by a resistance thermometer Pt 1000 located close to the process in the DSC sensor’s paddle (see figure, Pt 1000, bottom of Page 2).

Flow computer

The electronics of the measuring device is equipped with a flow computer. By means of this computer using the primary measurands (volume flow and temperature) a variety of other process variables can be calculated, e.g:
• the mass and heat flow of saturated steam and water
• the mass and heat flow of superheated steam (at constant pressure)
• the mass and corrected volume flow of other gases (at constant pressure)
• the mass flow of any liquid

Diagnostics

The device offers optionally a wide variety of diagnostics, e.g. tracking of the temperature of media and ambient, extreme flow events etc.

Measuring system

The measuring system consist of a sensor and a transmitter.
Two versions are available:
• Compact version: sensor and transmitter form a mechanical unit.
• Remote version: sensor is mounted separate from the transmitter.

Sensor
• Prowirl F (Flange version)
• Prowirl W (Wafer version)

Transmitter
• Prowirl 73

Input

Measured variable

• Volumetric flow (volume flow) → is proportional to the frequency of vortex shedding after the bluff body.
• Temperature → can be directly put out and is used for the calculation of e.g. mass flow.

The measured process variables volume flow and temperature or the calculated process variables mass flow, heat flow or corrected volume flow can be output as the output variables.

Measuring range

The measuring range depends on the fluid and the nominal diameter.

Start of measuring range

Depends on the density and the Reynolds number (Re_{min} = 4000, Re_{linear} = 20,000). The Reynolds number is dimensionless and indicates the ratio of a fluid’s inertial forces to its viscous forces. It is used to characterise the flow. The Reynolds number is calculated as follows:

\[
Re = \frac{4 \cdot Q \cdot [\text{ft}^3/\text{s}] \cdot \rho \ [\text{lb/ft}^3]}{\pi \cdot d_i \ [\text{ft}] \cdot \mu \ [\text{cP}]}
\]

\[
Re = \frac{4 \cdot Q \cdot [\text{m}^3/\text{s}] \cdot \rho \ [\text{kg/m}^3]}{\pi \cdot d_i \ [\text{m}] \cdot \mu \ [\text{Pa} \cdot \text{s}]}
\]

Re = Reynolds number; Q = Flow; di = Internal diameter; \mu = Dynamic viscosity; \rho = Density


\[
1/2" \text{ to } 1" \rightarrow v_{min} = \frac{4.92}{\sqrt{\rho \ [\text{lb/ft}^3]}} \ [\text{ft/s}]
\]

\[
1-1/2" \text{ to } 6" \rightarrow v_{min} = \frac{5.74}{\sqrt{\rho \ [\text{lb/ft}^3]}} \ [\text{ft/s}]
\]

\[
\text{DN 15 to 25} \rightarrow v_{min} = \frac{6}{\sqrt{\rho \ [\text{kg/m}^3]}} \ [\text{m/s}]
\]

\[
\text{DN 40 to 300} \rightarrow v_{min} = \frac{7}{\sqrt{\rho \ [\text{kg/m}^3]}} \ [\text{m/s}]
\]
Full scale value

- Gas/steam: $v_{max} = 248\text{ ft/s (75 m/s)}$, for $1/2^\circ v_{max} = 152\text{ ft/s (DN 15: } v_{max} = 46\text{ m/s)}$
- Liquids: $v_{max} = 30\text{ ft/s (9 m/s)}$

Note!

By using the selection and sizing software “Applicator”, you can determine the exact values for the fluid you use. You can obtain Applicator from your Endress+Hauser sales center or on the Internet at www.endress.com.

Measuring range for gases lb/ft³ or SCF [m³/h or Nm³/h]

In the case of gases, the start of the measuring range depends on the density. With ideal gases, the density [$\rho$] or corrected density $\rho_s$ ($\rho_r$) can be calculated using the following formulas:

$$\rho = \frac{\rho_s \cdot T}{P} \cdot \frac{273.15}{T} \cdot 1.013 \cdot \frac{T}{\text{psia}} \cdot 530$$

$$\rho_s = \frac{\rho \cdot T}{P} \cdot \frac{273.15}{T} \cdot 1.013 \cdot \frac{T}{\text{psia}} \cdot 530$$

The following formula can be used to calculate the volume $[Q]$ or corrected volume $Q_s$ ($Q_r$) in the case of ideal gases:

$$Q = \frac{Q_s \cdot T}{P} \cdot \frac{273.15}{T} \cdot 1.013 \cdot \frac{T}{\text{psia}} \cdot 530$$

Output

Outputs, general

The following measured variables can generally be output via the outputs:

<table>
<thead>
<tr>
<th>Volume flow</th>
<th>Temperature</th>
<th>Mass flow</th>
<th>Standard volume flow</th>
<th>Heat flow (power)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>if available</td>
<td>if available</td>
<td>if available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current output</th>
<th>Frequency output</th>
<th>Impulse output</th>
<th>Status output</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Limit value*</td>
</tr>
</tbody>
</table>

In addition, the calculated measured variables density, specific enthalpy, saturation steam pressure (for saturated steam), Z-factor and flow velocity can be displayed if available via the local display.

Output signal

- Current output: 4 to 20 mA with HART, Start value, Full scale value and time constant (0 to 100 s) can be set, Temperature coefficient: typically 0.003% o.r./°F (0.005% o.r./°C) (o.r. = of reading)
- Frequency output: Open collector, passive, Galvanically isolated, Nonhazardous, Explosion proof: $U_{max} = 36\text{ V}$, with 15 mA current limit, $R_s = 500\ \Omega$
- Intrinsically safe: $U_{max} = 30\text{ V}$, with 15 mA current limit, $R_s = 500\ \Omega$

Can be configured as:

- Frequency output: Full scale frequency 0 to 1000 Hz ($f_{max} = 1250\text{ Hz}$)
- Pulse output: Pulse value and polarity can be selected,
  - Pulse width can be selected (0.01 to 10 s) Pulse frequency max. 100 Hz
- Status output: Can be configured for error messages or flow, temperature limit values
- Vortex frequency: Direct output of unscaled vortex pulses 0.5 to 2850 Hz
- PFM signal (pulse-frequency modulation): by external connecting with flow computer RMC or RMC 621

**PROFIBUS-PA interface:**
- PROFIBUS-PA in accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
- Current consumption = 16 mA
- FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: Supported baudrate = 31.25 kBit/s
- Signal encoding = Manchester II
- Function blocks: 4 x Analog Input, 2 x Totalizer
- Output data: Volume flow, Mass flow, Corrected volume flow, Heat flow, Temperature, Density, Specific Enthalpy, Saturated steam pressure, Z-Factor, Vortex frequency, Electronic temperature, Reynoldsnumber, Flow velocity, Totalizer
- Input data: Pressure, Empty pipe detection (ON/OFF), Control totalizer, Display value
- Bus address adjustable via DIP-switches at the measuring device

**FOUNDATION Fieldbus interface:**
- FOUNDATION Fieldbus H1, IEC 61158-2, galvanically isolated
- Current consumption = 16 mA
- Signal encoding = Manchester II
- FDE (Fault Disconnection Electronic) = 0 mA
- Data transmission rate: Supported baudrate = 31.25 kBit/s
- Function blocks: 6 x Analog Input, 1 x Discrete Output, 1 x Analog Output
- Output data: Volume flow, Mass flow, Corrected volume flow, Heat flow, Temperature, Density, Specific Enthalpy, Saturated steam pressure, Z-Factor, Vortex frequency, Electronic temperature, Reynoldsnumber, Flow velocity, Totalizer 1 + 2
- Input data: Pressure, Empty pipe detection (ON/OFF), Reset totalizer
- Link Master (LM) functionality is supported

**Signal on alarm**
- Current output: error response can be selected (e.g. in accordance with NAMUR Recommendation NE 43)
- Frequency output: error response can be selected
- Status output: "not conducting" in event of fault

**Load**

The grey shaded area indicates the permissible load (for HART: min. 250 Ω)

The load can be calculated as follows:

\[
R_B = \frac{(U_s - U_{\text{in}})}{(I_{\text{max}} - 10^{-3})} = \frac{(U_s - U_U)}{0.022}
\]

- \(U_s\) Supply voltage: Nonhazardous = 12 to 36 V DC; Ex proof = 15 to 36 V DC; Intrins safe = 12 to 30 V DC
- \(U_U\) Terminal voltage: Nonhazardous = min. 12 V DC; Ex proof = min. 15 V DC; Intrins safe = min. 12 V DC
- \(I_{\text{max}}\) Output current (22.6 mA)

**Low flow cut off**
Switch points for low flow cut off can be selected as required

**Galvanic isolation**
The electrical connections are galvanically isolated from one another.
**Power supply**

**Electrical connection**

![Diagram of Prowirl 73 electrical connection]

- **HART:** Power supply, current output
- **PROFIBUS-PA:** 1 = PA+, 2 = PA–
- **FOUNDATION Fieldbus:** 1 = FF+, 2 = FF–

**b** Optional frequency output, can also be operated:
- as pulse or status output (except PROFIBUS-PA and FOUNDATION Fieldbus)
- together with the flow computer RMC or RMS 621 as PFM output (pulse-frequency modulation)

**c** Ground terminal (relevant for remote version)

**Supply voltage**

- **Nonhazardous:** 12 to 36 V DC (with HART 18 to 36 V DC)
- **Intrinsically safe:** 12 to 30 V DC (with HART 18 to 30 V DC)
- **Explosion proof:** 15 to 36 V DC (with HART 21 to 36 V DC)

- **PROFIBUS-PA and FOUNDATION Fieldbus**
  - **Nonhazardous and Explosion proof:** 9 to 32 V DC
  - **Intrinsically safe:** 9 to 24 V DC

**Current consumption**

- **PROFIBUS-PA:** 16 mA
- **FOUNDATION Fieldbus:** 16 mA

**Cable entry**

- Power supply and signal cables (outputs):
  - Cable entry M20 x 1.5 (8 to 11.5 mm)
  - Thread for cable entry: ½" NPT, G ½" (not for remote version)
  - Fieldbus connector

**Power supply failure**

- Totalizer stops at the last value determined (can be configured)
- All settings are kept in the EEPROM
- Error messages (incl. value of operated hours counter) are stored

**Performance characteristics**

**Reference operating conditions**

- Error limits following ISO/DIN 11631:
  - 60 to 86°F (20 to 30°C), 30 to 60 psi (2 to 4 bar), Calibration rig traceable to national standards
  - Calibration with the corresponding process connection of the respective norms

**Maximum measured error**

- **Liquid (volume flow):**
  - < 0.75% o.r. for Re > 20,000; < 0.75% o.f.s for Re between 4000 to 20,000

- **Gas/Steam (volume flow):**
  - < 1% o.r. for Re > 20,000; < 1% o.f.s for Re between 4000 to 20,000

- **Temperature:**
  - < 2°F (1°C), (T > 212°F / 100°C, saturated steam);
  - rise time 50% (stirred under water, following IEC 60751): 8 s
• Mass flow (saturated steam):
  – for flow velocity \( v \) 65 to 164 ft/s (20 to 50 m/s, \( T > 300°F /150°C \), (423 K)
    < 1.7% o.r. (2% o.r. for remote version) for \( \text{Re} > 20,000 \)
    < 1.7% o.f.s (2% o.f.s for remote version) for \( \text{Re} \) between 4000 to 20,000
  – for flow velocity \( v \) 33 ft/s to 230 ft/s (10 to 70 m/s, \( T > 285°F /140°C \), (413 K)
    < 2% o.r. (2.3% o.r. for remote version) for \( \text{Re} > 20,000 \)
    < 2% o.f.s (2.3% o.f.s for remote version) for \( \text{Re} \) between 4000 to 20,000

• Mass flow (other fluids):
  Depends on the quality of the pressure value specified in the device functions.
  An individual error observation must be carried out.
  
  o.r. = Of reading, o.f.s = Of full scale, \( \text{Re} \) = Reynolds number

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**Repeatability**

±0.25% o.r. (of reading)

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**Operating conditions: installation**

**Installation instructions**

Vortex meters require a fully developed flow profile as a prerequisite for correct volume flow measurement. For this reason, please note the following points when installing the device:

**Orientation**

The device can generally be installed in any position in the piping. In the case of liquids, upward flow is preferred in vertical pipes to avoid partial pipe filling (see orientation A). In the case of hot fluids (e.g. steam or fluid temperature \( \geq 390°F / 200°C \)), select orientation C or D so that the permitted ambient temperature of the electronics is not exceeded.

Orientations B and D are recommended for very cold fluid (e.g. liquid nitrogen). Orientations B, C and D are possible with horizontal installation.

The arrow indicated on the device must always point in the direction of flow in all mounting orientations.

Caution!

• If fluid temperature is \( \geq 390°F (200°C) \), orientation B is not permitted for the wafer version (Prowirl 73 W) with a nominal diameter of 4” and 6” (DN 100 and DN 150).

• In case of vertical orientation and downward flowing liquid, the piping has to always be completely filled.

![Possible orientations of the device](image)

**Minimum spacing and cable length**

We recommend you observe the following dimensions to guarantee problem-free access to the device for service purposes:

• Min. spacing in all directions, \( A = 3.94" \) (100 mm)

• Necessary cable length \( L + 6" \) (150 mm)
Rotating the electronics housing and the display

The electronics housing can be rotated continuously 360° on the housing support. The display unit can be rotated in 45° steps, allowing viewing the display regardless of mounting position.

Piping insulation

When insulating, please ensure that a sufficiently large area of the housing support is exposed. The uncovered part serves as a radiator and protects the electronics from overheating (or undercooling).

The maximum insulation height permitted is illustrated in the diagrams. These apply equally to both the compact version and the sensor in the remote version.

Wafer version mounting set

The centering rings supplied with the wafer style meters are used to mount and center the instrument.

A mounting set consisting of tie rods, seals, nuts and washers can be ordered separately.

Mounting wafer version

1 = Nut
2 = Washer
3 = Tie rod
4 = Centering rings (supplied with unit)
5 = Seal
Inlet and outlet run

As a minimum, the inlet and outlet runs shown below must be observed to achieve the specified accuracy of the device. The longest inlet run shown must be observed if two or more flow disturbances are present. $D =$ Pipe diameter.

Minimum inlet and outlet runs with various flow obstructions

A = Inlet run, B = Outlet run
1 = Reduction
2 = Expansion
3 = 90° elbow or T-piece
4 = 2 x 90° elbow, 3-dimensional
5 = 2 x 90° elbow
6 = Control valve

Note!
A specially designed perforated plate flow conditioner can be installed if it is not possible to observe the inlet runs required (see Page 9).

Perforated plate flow conditioner

A specially designed perforated plate flow conditioner, available from Endress+Hauser, can be installed if it is not possible to observe the inlet runs required. The flow conditioner is fitted between two piping flanges and centered with mounting bolts. Generally, this reduces the inlet run required to $10 \times D$ with complete accuracy.

Flow conditioner

The pressure loss for flow conditioners is calculated as follows:

$\Delta p \ [\text{psi}] = 0.000183 \times \rho \ [\text{lb/ft}^3] \times v^2 \ [\text{ft/s}]$

Examples of pressure loss for flow conditioner

- Example with steam
  $p = 145 \text{ psi}$
  $t = 464^\circ \text{ F} \rightarrow \rho = 0.27 \text{ lb/ft}^3$
  $v = 131 \text{ ft/s}$
  $\Delta p = 0.000183 \times 0.27 \times 131^2 = 0.86 \text{ psi}$

- Example with H$_2$O condensate (176°F)
  $\rho = 60 \text{ lb/ft}^3$
  $v = 8.2 \text{ ft/s}$
  $\Delta p = 0.000183 \times 60 \times 8.2^2 = 0.74 \text{ psi}$
Operating conditions: environment

Ambient temperature range
- Compact version: -40 to +158°F (-40 to +70°C)
  (EEx-d version: -40 to +140°F (-40 to +60°C); ATEX II 1/2 GD-version/dust ignition-proof:
  -4 to +131°F (-20 to +55°C)
  Display can be read between -4 to +158°F (-20 to +70°C)
- Remote version:
  Sensor: -40 to +185°F (-40 to +85°C)
  (ATEX II 1/2 GD-version/dust ignition-proof: -4 to +131°F (-20 to +55°C)
  Transmitter -40 to +176°F (-40 to +80°C)
  (EEx-d version: -40 to +140°F (-40 to +60°C); ATEX II 1/2 GD-version/dust ignition-proof:
  -4 to +131°F (-20 to +55°C)
  Display can be read between -4 to +158°F (-20 to +70°C)

When mounting outside, protect from direct sunlight with a protective cover (order number 543199), especially in warmer climates with high ambient temperatures.

Storage temperature
-40 to +176°F (-40 to +80°C (ATEX II 1/2 GD-version/dust ignition-proof: -4 to +131°F (-20 to +55°C)

Degree of protection
NEMA 4X (IP67) according to EN 60529

Vibration resistance
Acceleration up to 1 g, 10 to 500 Hz, following IEC 60068-2-6

Electromagnetic compatibility (EMC)
According to EN 61326/A1 and NAMUR Recommendation NE 21.

Operating conditions: process

Medium temperature range
- DSC sensor (differential switched capacitor) capacitive sensor: -330 to +750°F
  (-200 to +400°C)
- Seal:
  - Graphite: -330 to +750°F (-200 to +400°C)
  - Kalrez: -4 to +525°F (-20 to +275°C)
  - Viton: 5 to 345°F (-15 to +175°C)
  - Gylon (PTFE): -330 to +500°F (-200 to +260°C)

Medium pressure
Pressure-temperature curve according to ANSI B16.5, stainless steel
ANSI B 16.5 → Class 150 to 300

Pressure loss
The pressure loss can be determined with the aid of the Applicator, a software for selection and sizing of flowmeters. The software is available both via Internet (www.applicator.com) and on a CD-ROM for local PC installation.
Measuring ranges

The Prowirl 73 flowmeter determines the volumetric flow under operating conditions (ACFM), i.e. the effective volume at a particular operating pressure (e.g. 100 psig). Gas volumes are highly dependent on pressure and temperature. Gas quantities are, therefore, usually given at standard temperature and pressure (SCFM at 14.7 psia and 60°F), and steam quantities in pounds.

The following tables are given as a guideline for measuring ranges for a typical gas (air at 76°F and 14.7 psig) and a typical liquid (water at 70°F). Normally, the flowmeter is linear up to the maximum flow. Values down to the minimum are not always linear. Endress+Hauser will be pleased to help you select and dimension a flowmeter for your specific application.

### Measuring Ranges for Prowirl 73 Water Meters

<table>
<thead>
<tr>
<th>Dia. (in)</th>
<th>psig</th>
<th>0.5</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>6</th>
<th>8</th>
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<tbody>
<tr>
<td>0.5</td>
<td>52</td>
<td>112</td>
<td>38</td>
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<td>156</td>
<td>230</td>
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<tr>
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<td>70</td>
<td>132</td>
<td>200</td>
<td>300</td>
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<td>708</td>
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<tr>
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<td>90</td>
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### Measuring Ranges for Prowirl 73 Meter Sizes

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</tr>
</tbody>
</table>

Saturated steam flow minimum and maximum rates by meter size are shown below. The diagram serves as a guideline for quick estimation of measuring ranges.

**NOTE:** min./max. ranges below are in lbs/hr

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**PROline Prowirl 73 F, W**

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## Measuring Ranges for Prowirl 73 F Water Version

<table>
<thead>
<tr>
<th>Size</th>
<th>SCFM Air at 14.7 psia / 60°F</th>
<th>GPM Water at 70°F</th>
<th>K-Factor Pulses/dm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.36 20.6 520 - 2600</td>
<td>0.84 30.8 10 - 520</td>
<td>245 280</td>
</tr>
<tr>
<td>1.5</td>
<td>18.2 221 140 - 1650</td>
<td>4.8 198 4.6 - 200</td>
<td>14 - 17</td>
</tr>
<tr>
<td>2</td>
<td>29.4 359 100 - 1200</td>
<td>7.93 321 3.3 - 150</td>
<td>6.8</td>
</tr>
<tr>
<td>3</td>
<td>65.9 806 75 - 850</td>
<td>17.6 722 2.2 - 110</td>
<td>3.9 - 2.4</td>
</tr>
<tr>
<td>4</td>
<td>112 1371 70 - 800</td>
<td>30.4 1228 2 - 100</td>
<td>1.1 - 1.4</td>
</tr>
<tr>
<td>5</td>
<td>252 3066 38 - 450</td>
<td>67.8 2752 1.2 - 55</td>
<td>0.27 - 0.32</td>
</tr>
</tbody>
</table>

## Measuring Ranges for Prowirl 73 F Flanged Version

<table>
<thead>
<tr>
<th>Size</th>
<th>SCFM Air at 14.7 psia / 60°F</th>
<th>GPM Water at 70°F</th>
<th>K-Factor Pulses/dm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1.77 14.1 380 - 2850</td>
<td>0.70 22 14 - 600</td>
<td>390 - 450</td>
</tr>
<tr>
<td>1</td>
<td>3.50 73.6 200 - 2700</td>
<td>1.41 66 6.5 - 340</td>
<td>70 - 85</td>
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<tr>
<td>1.5</td>
<td>4.17 147.0 150 - 1750</td>
<td>3.96 163 4.5 - 220</td>
<td>150 - 228</td>
</tr>
<tr>
<td>2</td>
<td>2.47 300 120 - 1560</td>
<td>6.27 273 3.7 - 170</td>
<td>8 - 11</td>
</tr>
<tr>
<td>3</td>
<td>5.59 677 80 - 900</td>
<td>15.0 616 2.5 - 115</td>
<td>2.5 - 3.2</td>
</tr>
<tr>
<td>4</td>
<td>9.71 1177 65 - 700</td>
<td>26.4 1026 1.9 - 86</td>
<td>1.1 - 1.4</td>
</tr>
<tr>
<td>5</td>
<td>159 2672 40 - 460</td>
<td>57.0 2742 1.2 - 57</td>
<td>0.3 - 0.4</td>
</tr>
<tr>
<td>6</td>
<td>420 5126 27 - 322</td>
<td>114 4623 1.0 - 39</td>
<td>0.1266 - 0.1400</td>
</tr>
</tbody>
</table>

---

Endress + Hauser
Mechanical construction

Design, dimensions

Dimensions of transmitter, remote version

* The following dimensions differ depending on the version:
– The dimension 9.13 in (232 mm) changes to 8.90 in (226 mm) in the blind version (without local operation).
– The dimension 5.90 in (150 mm) changes to 6.42 in (163 mm) in the Explosion proof version.
– The dimension 13.6 in (345 mm) changes to 14.5 in (368 mm) in the Explosion proof version.

Dimensions of Prowirl 73 W
Wafer version for flanges according to:
• ANSI B16.5. Class 150 to 300
• DIN and JIS standards available, consult factory

Dimensions:
A = Standard and Intrinsically safe version
B = Remote version
C = Explosion proof version (transmitter)

* The following dimensions change as follows in the blind version (without local operation):
– Standard and Intrinsically safe version: the dimension 5.87 in (149 mm) changes to 5.59 in (142 mm) in the blind version.
– Explosion proof version: the dimension 5.94 in (151 mm) changes to 5.67 in (144 mm) in the blind version.

** The dimension depends on the cable gland used.
Dimensions of Prowirl 73 F

Flanged version according to:
- ANSI B16.5, Class 150 to 300, $R_s = 125$ to $250 \mu \text{in}$
- DIN and JIS standards available, consult factory

**The following dimensions change as follows in the blind version (without local operation):**
- Standard and Intrinsically safe version: the dimension $5.87$ in ($149$ mm) changes to $5.59$ in ($142$ mm) in the blind version.
- Explosion proof version: the dimension $5.94$ in ($151$ mm) changes to $5.67$ in ($144$ mm) in the blind version.

**The dimension depends on the cable gland used.**
Dimensions of flow conditioner according to ANSI

Flow conditioner according to ANSI, material 316L

Weight

- Weight of ProWirl 73 W → see dimension tables on Page 12
- Weight of ProWirl 73 F → see dimension tables on Page 13 and top of this page
- Weight of flow conditioner according to ANSI → see dimension table above

Material

- Transmitter housing:
  Powder-coated die-cast aluminum
- Sensor:
  - Flanged version
    316L Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR 0175
  - Wafer version
    316L Stainless steel, A351-CF3M (1.4404), in conformity with NACE MR 0175
- Flanges:
  - ANSI → 316L Stainless steel, A351-CF3M, in conformity with NACE MR 0175
  \(^{1/2} \text{ to } 6", \text{ DN 15 to 150}: \) as of 2004 changeover from fully cast construction to construction with weld-on flanges in 316/316L, in conformity with NACE MR 0175
- DSC sensor (differential switched capacitor; capacitive sensor):
  - Wetted parts (marked as “wet” on the DSC sensor flange),
    316L Stainless steel (1.4435), in conformity with NACE MR 0175
  - Non-wetted parts:
    - 304 Stainless steel, 1.4301 (CF3)
    - Support:
      - 304L Stainless steel, 1.4308 (CF8)
• Seal:
  – Graphite (Grafoil)
  – Viton
  – Kalrez 6375
  – Gylon (PTFE) 3504

Human interface

**Display elements**

- Liquid crystal display, double-spaced, plain text display, 16 characters per line
- Display can be configured individually, e.g. for measured variables and status values, totalizers

**Operating elements (HART)**

- Local operation with three keys (O, S, F)
- Quick Setup for quick commissioning
- Operating elements accessible also in Ex-zones

**Remote operation**

- Remote operation possible via:
  - HART
  - PROFIBUS-PA
  - FOUNDATION Fieldbus
  - Endress+Hauser Service Protocol

Certificates and approvals

**CE mark**

The device is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing the CE mark.

**Ex-approval**

- Intrinsically safe:
  - ATEX/CENELEC
    - II1/2G, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS-PA and FOUNDATION Fieldbus)
    - II1/2GD, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS-PA and FOUNDATION Fieldbus)
    - II1G, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS-PA and FOUNDATION Fieldbus)
    - II2G, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS-PA and FOUNDATION Fieldbus)
    - II3G, EEx na IIC T1 to T6 X (T1 to T4 X for PROFIBUS-PA and FOUNDATION Fieldbus)
  - FM
    - Class I/II/III Div. 1/2, Group A to G, Class I Zone 0, Group IIC
    - CSA
    - Class I/II/III Div. 1/2, Group A to G, Class I Zone 0, Group IIC
    - Class II Div. 1, Group E to G
    - Class III

- Explosion proof:
  - ATEX/CENELEC
    - II1/2G, EEx d [ia] IIC T1 to T6 (T1 to T4 for PROFIBUS-PA and FOUNDATION Fieldbus)
    - II1/2GD, EEx ia IIC T1 to T6 (T1 to T4 for PROFIBUS-PA and FOUNDATION Fieldbus)
    - II2G, EEx d [ia] IIC T1 to T6 (T1 to T4 for PROFIBUS-PA and FOUNDATION Fieldbus)
  - FM
    - Class I/II/III Div. 1, Groups A to G
    - CSA
    - Class I/II/III Div. 1,2 Groups A to G
    - Class II Div. 1, Groups E to G
    - Class III

More information on the Ex-approvals can be found in the separate Ex-documentation.
<table>
<thead>
<tr>
<th><strong>Pressure measuring device approval</strong></th>
<th>Devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3 (3) of the EC Directive 97/23/EC (Pressure Equipment Directive). For larger nominal diameters, certified flowmeters to Category III are optionally also available if necessary (depends on fluid and operating pressure). All devices are applicable for all fluids and instable gases on principle and have been designed and manufactured in accordance to sound engineering practice.</th>
</tr>
</thead>
</table>
| **Certification FOUNDATION Fieldbus** | The flowmeter has successfully passed all test procedures and is certified and registered by the Fieldbus FOUNDATION. The device thus meets all the requirements of the specifications following:  
  - Certified according to FOUNDATION Fieldbus Specification  
  - The device meets all the specifications of the FOUNDATION Fieldbus-H1  
  - Interoperability Test Kit (ITK), revision status 4.5 (device certification no. available on request):  
    The device can also be operated with certified devices of other manufacturers  
  - Physical Layer Conformance Test of the Fieldbus FOUNDATION |
| **Certification PROFIBUS-PA** | The flowmeter has successfully passed all test procedures and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the requirements of the specifications following:  
  - Certified according to PROFIBUS-PA profile version 3.0 (device certification number available on request)  
  - The device can also be operated with certified devices of other manufacturers (interoperability) |
| **Other standards and guidelines** |  
  - EN 60529: Degrees of protection by housing (IP code).  
  - EN 61010: Protection measures for electrical equipment for measurement, control, regulation and laboratory procedures.  
  - EN 61326/A1: Electromagnetic compatibility (EMC requirements).  
  - NAMUR NE 21: Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.  
  - NAMUR NE 43: Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.  
  - ANSI/ISA-S82.01: Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements. Pollution degree 2, Installation Category II  
  - The International Association for the Properties of Water and Steam - Release on the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam  
  - ASME International Steam Tables for Industrial Use (2000) |

**Accessories**

- Spare parts as per separate price list
- Replacement transmitter Prowirl 73
- Flow conditioner
- Universal flow and energy computer RMC 621
- HART Communicator DXR 275 handheld terminal
- HART Communicator DXR 375 handheld terminal
- Active barrier preline RN 221 N
- Pressure transducer Cerabar S (PROFIBUS-PA, FOUNDATION Fieldbus)
- Process display RIA 250, RIA 251
- Field display RIA 261 resp. RID 261 (PROFIBUS-PA)
- Applicator
- ToF Tool - FieldTool Package
- Fieldgate FXA 520
Additional ordering information for Prowirl 73

You can order Prowirl 73 with pre-programming of the most important parameters. For this purpose the following information is required when ordering the device:

- Fluid (saturated steam, superheated steam, water or compressed air)
- Average operating pressure in bar abs. (not required for the fluid saturated steam)
- 4 mA value = measured value (e.g. 50 kg/h) that shall result in a current of 4 mA, incl. unit
- 20 mA value = measured value (e.g. 1000 kg/h) that shall result in a current of 20 mA, incl. unit
- Pulse value (if the device is ordered with a pulse output), incl. unit

You can reset the device to this ordered state later on.

Ordering information

PROline Prowirl 73 F (Flanged version)

1 Nominal diameters / measuring range
1S 10" / Gas: 14.1 to 141 ft/min, Liquid: 1.41 to 14 gpm
2S 1.5" / Gas: 36 to 81 ft/min, Liquid: 1.41 to 14 gpm
3S 2" / Gas: 69 to 162 ft/min, Liquid: 3.96 to 45 gpm
4S 2.5" / Gas: 105 to 243 ft/min, Liquid: 10.1 to 121 gpm
5S 3" / Gas: 141 to 330 ft/min, Liquid: 17.8 to 211 gpm
6S 4" / Gas: 214 to 495 ft/min, Liquid: 29.6 to 347 gpm
7S 6" / Gas: 420 to 981 ft/min, Liquid: 57 to 711 gpm
8S 8" / Gas: 633 to 1562 ft/min, Liquid: 89.3 to 1097 gpm
9S 10" / Gas: 1056 to 2540 ft/min, Liquid: 131.5 to 1599 gpm
10S 12" / Gas: 1479 to 3470 ft/min, Liquid: 164.3 to 1939 gpm
11S 14" / Gas: 2000 to 4760 ft/min, Liquid: 214.3 to 2607 gpm

2 Sensor material
S 316L SS, -330° to +750°F

3 Process connections
K Class 150, Schedule 40, ANSI B16.5, RF
L Class 150, Schedule 80, ANSI B16.5, RF
M Class 300, Schedule 40, ANSI B16.5, RF
N Class 300, Schedule 80, ANSI B16.5, RF

NOTE: DIN and JIS flanges available, contact factory

4 DSC sensor
4 316L with thermometer, -330° to +750°F

5 DSC sensor seal
A Gritol (graphite), -330° to +750°F
B Viton, +5° to +345°F
C Kalrez, -5° to +527°F
D Oil/fat/water-free, Gritol (graphite), -330° to +750°F
E Oil/fat/water-free, Viton, +5° to +345°F
F Gylon (PTFE), -330° to +500°F
G Oil/fat/water-free, Gylon (PTFE), -330° to +500°F (not for 8" to 12" sensors)

6 Calibration
A 3-point calibration, standard
C 5-point calibration, standard
D SCS/A2LA 3-point calibration (ISO/IEC 17025), with certificate traceable to ISO 9000

7 Certificates
1 Standard version without certificate
3 2.3 pressure test certificate (1.5 x PN, 3 minutes)
4 3.1B material and 2.3 pressure test certificate
5 CRN approval (for ANSI flanges only)
8 CRN approval, 3.1B and 2.3 pressure test (for ANSI flanges only)
P Approval according to PED Cat. III (not for 1/2", 1"
R Approval according to PED Cat. III, 3.1B material certificate included (not for 1/2", 1"

8 Approvals
A Standard, nonhazardous areas
N FM intrinsically safe, CL I, II, III, Div. 1, 2; Grps. A-G
CSA Class I, II, III, Div. 1, 2; Grps. A-G; Class II, Div. 1, Grps. E-G; Class III
P FM Explosion proof, Class I, II, III, Div. 1, Grps. A-G
CSA Class I, II, III, Div. 1, 2; Grps. A-G; Class II, Div. 1, Grps. E-G; Class III

NOTE: ATEX approvals available, consult factory
PROline Prowirl 73 F (con’t)

9 Protection type / version
A NEMA 4X (IP 67) / compact, aluminum field housing
E NEMA 4X (IP 67) / remote, aluminum field housing, 30 ft cable
F NEMA 4X (IP 67) / remote, aluminum field housing, 90 ft cable

10 Cable entries
B 1/2” NPT
L Fieldbus connector and 1/2” NPT thread (not for protection type A; J; not for approvals N or P)

11 Display / operation
0 Without display, remote configuration only
4 With display, push-button operation (not for output/input H, K)
6 With display, remote configuration only (not for output/input W, A)
K Without display, remote configuration, enhanced climate resistance (not for output/input H, K)

12 Software
A Standard software

13 Outputs / Inputs
W 4 to 20 mA HART
A 4 to 20 mA HART, frequency
H PROFIBUS-PA
K FOUNDATION Fieldbus

Ordering information

PROline Prowirl 73 W (Wafer version)

1 2 3 4 5 6 7 8 (order codes 9-13, refer to page 19)

73W -

1 Nominal diameters / measuring range
15 1/2” / Gas: 2.35 to 20.6 ft/min, Liquid: 0.84 to 30.8 gpm
25 1” / Gas: 6.47 to 94.2 ft/min, Liquid: 1.76 to 83.7 gpm
40 1-1/2” / Gas: 18.2 to 221 ft/min, Liquid: 4.8 to 198 gpm
50 2” / Gas: 29.4 to 355 ft/min, Liquid: 7.93 to 321 gpm
80 3” / Gas: 65.9 to 806 ft/min, Liquid: 17.6 to 722 gpm
1H 4” / Gas: 112 to 1371 ft/min, Liquid: 30.4 to 1228 gpm
1F 6” / Gas: 252 to 3066 ft/min, Liquid: 67.8 to 2752 gpm

2 Sensor material
S 316L SS

3 Process connections
K Class 150, Schedule 40, ANSI B16.5, RF
M Class 300, Schedule 40, ANSI B16.5, RF
NOTE: DIN and JIS flanges available, contact factory

4 DSC sensor
4 316L with thermometer, -330° to +750°F

5 DSC sensor seal
A Grafoil (graphite), -330° to +750°F
B Viton, -5° to +345°F
C Kalrez, -5° to +527°F
D Oil/latex/water-free, Grafoil (graphite), -330° to +750°F
E Oil/latex/water-free, Viton, -5° to +345°F
F Glyon (PTFE), -330° to +500°F
G Oil/latex/water-free, Glyon (PTFE), -330° to +500°F (not for 8” to 12” sensors)

6 Calibration
A 3-point calibration, standard
C 5-point calibration, standard
D SCS/A2LA 3-point calibration (ISO/IEC 17025), with certificate traceable to ISO 9000

7 Certificates
1 Standard version without certificate
3 2.3 pressure test certificate (1.5 x PN, 3 minutes)
4 3.1B material and 2.3 pressure test certificate
5 CRN approval (for ANSI flanges only)
8 CRN approval, 3.1B and 2.3 pressure test (for ANSI flanges only)
P Approval according to PED Cat. III (not for 1/2”, 1”)
R Approval according to PED Cat. III, 3.1B material certificate included (not for 1/2”, 1”)

8 Approvals
A Standard, nonhazardous areas
N FM Intrinsically safe, Class I, II, III; Div. 1; Grps. A-G
CSA Class I, II, III; Div. 1, 2; Grps. A-G; Class II, Div. 1, Grps. E-G; Class III
P FM Explosion proof, Class I, II, III; Div. 1, 2; Grps. A-G; Class II, Div. 1, Grps. A-G
CSA Class I, II, III; Div. 1, 2; Grps. A-G; Class II, Div. 1, Grps. E-G; Class III
NOTE: ATEX approvals available, consult factory
### PROline Prowirl 73 F, W (con’t)

<table>
<thead>
<tr>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection type / version</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>NEMA 4X (IP 67) / compact, aluminum field housing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>NEMA 4X (IP 67) / remote, aluminum field housing, 30 ft cable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>NEMA 4X (IP 67) / remote, aluminum field housing, 90 ft cable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable entries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>1/2” NPT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Fieldbus connector and 1/2” NPT thread (not for protection type A, J not for approvals N or P)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display / operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Without display, remote configuration only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>With display, push-button operation (not for output/input H, K)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>With display, remote configuration only (not for output/input W, A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Without display, remote configuration, enhanced climate resistance (not for output/input H, K)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Standard software, steam, water and compressed air data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Advanced diagnostics, steam, water and compressed air data</td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>Advanced diagnostics, steam, water, natural gas NX-19 and compressed air data</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Outputs / Inputs</td>
<td></td>
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</tr>
<tr>
<td>W</td>
<td>4 to 20 mA HART</td>
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<tr>
<td>A</td>
<td>4 to 20 mA HART, frequency</td>
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<td></td>
</tr>
<tr>
<td>H</td>
<td>PROFIBUS-PA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>FOUNDATION Fieldbus</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

DKW Mounting set for Prowirl 72/73 Wafer version.
Kit includes mounting hardware - centering rings, threaded bolts, nuts, washers and a pair of flange gaskets.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal diameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>1/2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>1&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>1-1/2&quot;</td>
<td></td>
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</tr>
<tr>
<td>50</td>
<td>2&quot;</td>
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<tr>
<td>80</td>
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<td>1H</td>
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</tr>
<tr>
<td>1F</td>
<td>6&quot;</td>
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<tr>
<td>Process connections</td>
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</tr>
<tr>
<td>K</td>
<td>Class 150, ANSI B16.5</td>
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</tr>
<tr>
<td>M</td>
<td>Class 300, ANSI B16.5</td>
<td></td>
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<tr>
<td>NOTE: DIN and JIS flanges available, contact factory</td>
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<tr>
<td>Mounting hardware material</td>
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<tr>
<td>0</td>
<td>Galvanized steel, T &gt; -60°F</td>
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<tr>
<td>1</td>
<td>A2-70 bolts and nuts</td>
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<tr>
<td>2</td>
<td>A2-70 bolts and nuts, 3.1B (not for ANSI or JIS)</td>
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<tr>
<td>Seal material</td>
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<tr>
<td>0</td>
<td>Graphite, -330°F to +750°F</td>
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</tr>
<tr>
<td>1</td>
<td>Fat-free graphite, -330°F to +750°F</td>
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</tr>
<tr>
<td>2</td>
<td>Viton gaskets, fat-free, +5°F to +345°F</td>
<td></td>
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<tr>
<td>3</td>
<td>Viton gaskets, +5°F to +345°F</td>
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</table>
DKST Stainless steel flow conditioner
for Prowirl 72/73, -330° to +750°F

<table>
<thead>
<tr>
<th>Nominal diameters</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>15</td>
<td>1/2&quot;</td>
<td></td>
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</tr>
<tr>
<td>25</td>
<td>1&quot;</td>
<td></td>
<td></td>
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<tr>
<td>40</td>
<td>1-1/2&quot;</td>
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<td></td>
</tr>
<tr>
<td>50</td>
<td>2&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>3&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1H</td>
<td>4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1F</td>
<td>6&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2H</td>
<td>8&quot;</td>
<td></td>
<td></td>
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<tr>
<td>2F</td>
<td>10&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3H</td>
<td>12&quot;</td>
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<tr>
<th>Process connections</th>
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<tbody>
<tr>
<td>K Class 150, ANSI B16.5</td>
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<tr>
<td>M Class 300, ANSI B16.5</td>
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NOTE: DIN and JIS flanges available, contact factory

<table>
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<tr>
<th>Material</th>
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<tr>
<td>0</td>
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<tr>
<td>1</td>
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</table>

For application and selection assistance,
in the U.S. call 888-ENDRESS

For total support of your installed base, 24 hours
a day, in the U.S. call 800-642-8737

Visit us on our web site, www.us.endress.com

<table>
<thead>
<tr>
<th>United States</th>
<th>Canada</th>
<th>Mexico</th>
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<tbody>
<tr>
<td>Endress+Hauser, Inc.</td>
<td>Endress+Hauser Canada Ltd.</td>
<td>Endress+Hauser</td>
</tr>
<tr>
<td>2350 Endress Place</td>
<td>1440 Graham's Lane</td>
<td>Paseo del Pedregal No. 610</td>
</tr>
<tr>
<td>Greenwood, IN 46143</td>
<td>Unit 1, Burlington</td>
<td>Col. Jardines del Pedregal</td>
</tr>
<tr>
<td>Phone: (317) 535-7138</td>
<td>ON, L7S 1W3</td>
<td>01900, Mexico D.F.</td>
</tr>
<tr>
<td>888-ENDRESS</td>
<td>Phone: (905) 681-9292</td>
<td>Mexico</td>
</tr>
<tr>
<td>FAX: (317) 535-8496</td>
<td>800-668-3199</td>
<td>Phone: (525) 568-2405</td>
</tr>
<tr>
<td></td>
<td>FAX: (905) 681-9444</td>
<td>FAX: (525) 568-7459</td>
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