1301 Series High-Pressure Regulators

Introduction

The proven reliability and accurate regulation of the 1301 Series regulators (see Figure 1) make them ideal for numerous high-pressure drop applications. They are direct-operated, high-pressure regulators designed for inlet pressures up to 6000 psig / 414 bar. The Type 1301F can handle outlet pressures from 10 to 225 psig / 0.69 to 15.5 bar in three ranges and the Type 1301G can handle outlet pressures from 200 to 500 psig / 13.8 to 34.5 bar in one range.

These multi-purpose regulators can be used as pilot supply or pressure-loaded regulators where high-pressure operating medium must be reduced for use by gas regulator pilots or pressure-loaded regulators. Their rugged design offers versatility for a wide variety of applications including air, gas, water, and other liquids. An optional spring case with a tapped vent and adjusting screw closing cap is available that enables the Type 1301F to be used as a pressure-loaded regulator.

Features

- **Durable Stainless Steel Diaphragm**—For high-outlet pressure applications.
- **Spare Valve Disk Provided**—Extra valve disk through a reversible disk holder assembly.
- **Versatility**—Can control a variety of media including air, gas, water, and other liquids.
- **ANSI Class VI Shutoff**—Soft-seat valve plug disks ensure tight shutoff.
- **Sour Gas Service Capability**—Optional materials are available for applications handling sour gases. These constructions comply with the recommendations of NACE International Standards MR0175 and MR0103.

![Figure 1. Type 1301F Regulator](image)
Specifications

Available Configurations

**Type 1301F:** Direct-operated, high-pressure reducing regulator for inlet pressures to 6000 psig / 414 bar and outlet pressure ranges from 10 to 225 psig / 0.69 to 15.5 bar in three ranges

**Type 1301G:** Direct-operated, high-pressure reducing regulator for inlet pressures to 6000 psig / 414 bar and an outlet pressure range of 200 to 500 psig / 13.8 to 34.5 bar

**Body Size and End Connection Style**

1/4 NPT (one inlet and two outlet connections); CL300 RF, CL600 RF, and CL1500 RF; or PN 25 RF (all flanges are 125 RMS)

**Maximum Inlet Pressure**

**Brass Body:**
- Air and Gas: 6000 psig / 414 bar at or below 200°F / 93°C and 1000 psig / 69.0 bar above 200°F / 93°C
- Liquid: Polytetrafluoroethylene (PTFE) Disk: 1000 psig / 69.0 bar
  - Nylon (PA) Disk: Water: 1000 psig / 69.0 bar
  - Other Liquids: 2000 psig / 138 bar

**Stainless Body:**
- Air and Gas: 6000 psig / 414 bar
- Liquid: Polytetrafluoroethylene (PTFE) Disk: 1000 psig / 69.0 bar
  - Nylon (PA) Disk: Water: 1000 psig / 69.0 bar
  - Other Liquids: 2000 psig / 138 bar

**Maximum Emergency Outlet Pressure**

**Type 1301F:** 250 psig / 17.2 bar

**Type 1301G:** 550 psig / 37.9 bar

**Outlet Pressure Ranges**

See Table 1

**Pressure Registration**

Internal

**Recovery Coefficient**

Kₚᵣᵣ: 0.72

**Flow Capacities**

- Air: See Tables 2, 3, and 4
- Water: See Tables 5 and 6

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1. The pressure/temperature limits in this Bulletin and any applicable standard or code limitation should not be exceeded.

2. Fluorocarbon (FKM) is limited to 180°F / 82°C hot water
Specifications (continued)

Construction Materials

<table>
<thead>
<tr>
<th>Standard Construction</th>
<th>NACE Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body and Spring Case: Forged brass or CF8M Stainless steel</td>
<td>Body and Bottom Cap: CF8M Stainless steel</td>
</tr>
<tr>
<td>Bottom Cap: Brass, 304 Stainless steel, or 316 Stainless steel</td>
<td>Spring Case: CF8M Stainless steel</td>
</tr>
<tr>
<td>Orifice: 303 Stainless steel</td>
<td>Orifice: 316 Stainless steel</td>
</tr>
<tr>
<td>Valve Disks and Holder: Nylon (PA) and Zinc-plated brass, PTFE and Zinc-plated brass, Nylon (PA) and 303 Stainless steel, or PTFE and 303 Stainless steel</td>
<td>Valve Disks and Holder: PTFE and 316 Stainless steel</td>
</tr>
<tr>
<td>Orifice Yoke: Brass or 316 Stainless steel</td>
<td>Orifice Yoke: 316 Stainless steel</td>
</tr>
<tr>
<td>Valve Disk Collar: 304 Stainless steel</td>
<td>Valve Disk Collar: 304 Stainless steel</td>
</tr>
<tr>
<td>Elastomers: Neoprene (CR), Fluorocarbon (FKM), or Ethylenepropylene (EPDM)</td>
<td>Elastomers: Fluorocarbon (FKM)</td>
</tr>
<tr>
<td>Regulator Spring: Zinc-plated steel</td>
<td>Regulator Spring: Zinc-plated steel</td>
</tr>
<tr>
<td>Valve Spring: 302 Stainless steel</td>
<td>Valve Spring: Inconel® X750</td>
</tr>
<tr>
<td>Diaphragm Plate: Zinc-plated steel</td>
<td>Diaphragm Plate: Zinc-plated steel</td>
</tr>
<tr>
<td>Adjusting Screw and Bolt: Double Zinc-plated steel with zinc dichromate overlay</td>
<td>Adjusting Screw and Bolt: Double Zinc-plated steel with zinc dichromate overlay</td>
</tr>
<tr>
<td>Upper Spring Seat: Zinc-plated steel</td>
<td>Upper Spring Seat: Zinc-plated steel</td>
</tr>
<tr>
<td>Diaphragm: 302 Stainless steel</td>
<td>Diaphragm: K500 Monel®</td>
</tr>
</tbody>
</table>

Inconel® and Monel® are marks owned by Special Metals Corporation.

Table 1. Outlet Pressure Ranges

<table>
<thead>
<tr>
<th>TYPE</th>
<th>OUTLET PRESSURE RANGES(1)</th>
<th>SPRING PART NUMBER</th>
<th>SPRING COLOR CODE</th>
<th>SPRING WIRE DIAMETER</th>
<th>SPRING FREE LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>psig</td>
<td>bar</td>
<td>Inch</td>
<td>mm</td>
<td>Inch</td>
</tr>
<tr>
<td>1301F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 to 75</td>
<td>0.69 to 5.2</td>
<td>1D387227022</td>
<td>Blue</td>
<td>0.200</td>
<td>5.08</td>
</tr>
<tr>
<td>50 to 150</td>
<td>3.4 to 10.3</td>
<td>1B788527022</td>
<td>Silver</td>
<td>0.225</td>
<td>5.72</td>
</tr>
<tr>
<td>100 to 225</td>
<td>6.9 to 15.5</td>
<td>1D465127142</td>
<td>Red</td>
<td>0.243</td>
<td>6.17</td>
</tr>
<tr>
<td>1301G</td>
<td>200 to 500</td>
<td>13.8 to 34.5</td>
<td>1K156027142</td>
<td>Silver</td>
<td>0.331</td>
</tr>
</tbody>
</table>

1. All springs can be backed off to 0 psig / 0 bar.

Principle of Operation

The 1301 Series regulators are direct-operated. Downstream pressure is registered internally through the body to the underside of the diaphragm. When downstream pressure is at or above set pressure, the disk is held against the orifice and there is no flow through the regulator. When demand increases, downstream pressure decreases slightly allowing the regulator spring to extend, moving the yoke and disk assembly down and away from the orifice. This allows flow through the body to the downstream system. As the downstream pressure reach its setting, it started to overcome the spring force which is sensed by the diaphragm, moving the yoke and disk assembly up and near its orifice, restricting the flow across the regulator.

Installation

The 1301 Series regulators may be installed in any position. Spring case vents must be protected against the entrance of rain, snow, debris, or any other foreign material that might plug the vent openings. The inlet connection is marked "In" and the three outlet connections are marked “Out”. If a pressure gauge is not installed in one outlet connection, plug the unused connection. See Figure 3 for dimensions.

Overpressure Protection

The 1301 Series regulators have outlet pressure ratings lower than the inlet pressure ratings. Complete downstream overpressure protection is needed if the actual inlet pressure exceeds the outlet pressure rating.

Overpressuring any portion of a regulator or associated equipment may cause leakage, parts damage, or personal injury due to bursting of pressure-containing parts or explosion of accumulated gas. Regulator operation within ratings does not preclude the possibility of damage from external sources or from debris in the pipeline. A regulator should be inspected for damage periodically and after any overpressure condition.

Refer to the relief sizing coefficients in the Specifications and the Capacity Information section to determine the required relief valve capacity.
Capacity Information

Air Capacities

Tables 2 and 3 give regulating capacities at selected pressures and outlet pressure flows in SCFH (at 60°F and 14.7 psia) and Nm³/h (at 0°C and 1.01325 bar) of air. To determine the equivalent capacities for other gases, multiply the table capacities by the following appropriate conversion factors: 1.29 for 0.6 specific gravity natural gas, 0.808 for propane, 0.707 for butane, or 1.018 for nitrogen. For gases of other specific gravities, divide by the square root of the appropriate specific gravity.

To determine wide-open flow capacity for relief valve sizing, use one of the following equations:

For Critical Pressure Drops

Use this equation for critical pressure drops (absolute outlet pressure equal to one-half or less than one-half the absolute inlet pressure).

\[ Q = P_1 \cdot C_g \]

where,
- \( Q \) = gas flow rate, SCFH
- \( C_g \) = gas sizing coefficient
- \( P_1 \) = absolute inlet pressure, psia

For Non-Critical Pressure Drops

Use this equation for pressure drops lower than critical (absolute outlet pressure greater than one-half of absolute inlet pressure).

\[ Q = \sqrt[520]{\frac{3417}{G}} \cdot C_g \cdot P_1 \cdot \sin \left( \frac{\Delta P}{C_1 \cdot \sqrt{P_1}} \right) \cdot \text{DEG} \]

where,
- \( Q \) = liquid flow rate, GPM
- \( \Delta P \) = pressure drop across the regulator, psi
- \( C_r \) = regulating or wide-open flow coefficient
- \( G \) = specific gravity of the liquid

Then, if capacity is desired in normal cubic meters per hour at 0°C and 1.01325 bar, multiply SCFH by 0.0268.

Liquid Capacities

Tables 5 and 6 give regulating capacities in U.S. gallons per minute and liters per minute of water. To determine regulating capacities at pressure settings not given in Tables 5 and 6, or to determine wide-open capacities for relief sizing at any inlet pressure, use the following equation.

\[ Q = C_v \cdot \sqrt{\frac{\Delta P}{G}} \]

where,
- \( Q \) = liquid flow rate, GPM
- \( \Delta P \) = pressure drop across the regulator, psi
- \( C_v \) = regulating or wide-open flow coefficient
- \( G \) = specific gravity of the liquid

Figure 2. Type 1301F Operational Schematic
### Table 2. Type 1301F Regulating Capacities — Air with 100 to 750 psig / 6.9 to 51.7 bar Inlet Pressure

<table>
<thead>
<tr>
<th>Outlet Pressure Range, Spring Part Number, and Color</th>
<th>Outlet Pressure Setting</th>
<th>Capacities in SCFH / Nm³/h of Air</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inlet Pressure, psig / bar</td>
<td>10% Droop</td>
</tr>
<tr>
<td></td>
<td>psig</td>
<td>bar</td>
</tr>
<tr>
<td>10 to 75 psig / 0.69 to 5.2 bar 1D387227022, Blue</td>
<td>25</td>
<td>1.7</td>
</tr>
<tr>
<td>50</td>
<td>3.4</td>
<td>260</td>
</tr>
<tr>
<td>75</td>
<td>5.2</td>
<td>250</td>
</tr>
<tr>
<td>50 to 150 psig / 3.4 to 10.3 bar 1B788527022, Silver</td>
<td>75</td>
<td>5.2</td>
</tr>
<tr>
<td>100 to 225 psig / 6.0 to 15.5 bar 1D465127142, Red</td>
<td>150</td>
<td>10.3</td>
</tr>
</tbody>
</table>

### Table 3. Type 1301F Regulating Capacities — Air with 1000 to 2000 psig / 69.0 to 138 bar Inlet Pressure

<table>
<thead>
<tr>
<th>Outlet Pressure Range, Spring Part Number, and Color</th>
<th>Outlet Pressure Setting</th>
<th>Capacities in SCFH / Nm³/h of Air</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inlet Pressure, psig / bar</td>
<td>10% Droop</td>
</tr>
<tr>
<td></td>
<td>psig</td>
<td>bar</td>
</tr>
<tr>
<td>10 to 75 psig / 0.69 to 5.2 bar 1D387227022, Blue</td>
<td>25</td>
<td>1.7</td>
</tr>
<tr>
<td>50</td>
<td>3.4</td>
<td>900</td>
</tr>
<tr>
<td>75</td>
<td>5.2</td>
<td>1100</td>
</tr>
<tr>
<td>50 to 150 psig / 3.4 to 10.3 bar 1B788527022, Silver</td>
<td>75</td>
<td>5.2</td>
</tr>
<tr>
<td>100 to 225 psig / 6.0 to 15.5 bar 1D465127142, Red</td>
<td>150</td>
<td>10.3</td>
</tr>
</tbody>
</table>

### Table 4. Type 1301G Regulating Capacities — Air

<table>
<thead>
<tr>
<th>Outlet Pressure Range, Spring Part Number, and Color</th>
<th>Outlet Pressure Setting</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inlet Pressure, psig / bar</td>
<td>300 / 20.7</td>
</tr>
<tr>
<td></td>
<td>psig</td>
<td>bar</td>
</tr>
<tr>
<td>200 to 500 psig / 13.8 to 34.5 bar 1K156027142, Silver</td>
<td>500</td>
<td>34.5</td>
</tr>
</tbody>
</table>

### Table 5. Type 1301F Regulating Capacities — Water(1)

<table>
<thead>
<tr>
<th>Outlet Pressure Range, Spring Part Number, and Color</th>
<th>Outlet Pressure Setting</th>
<th>Capacities in Gallons / liters per minute of water based on 20% droop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inlet Pressure, psig / bar</td>
<td>100 / 6.9</td>
</tr>
<tr>
<td></td>
<td>psig</td>
<td>Gallons</td>
</tr>
<tr>
<td>10 to 75 psig / 0.69 to 5.2 bar 1D387227022, Blue</td>
<td>25</td>
<td>1.7</td>
</tr>
<tr>
<td>50</td>
<td>3.4</td>
<td>0.50</td>
</tr>
<tr>
<td>75</td>
<td>5.2</td>
<td>0.46</td>
</tr>
<tr>
<td>50 to 150 psig / 3.4 to 10.3 bar 1B788527022, Silver</td>
<td>75</td>
<td>5.2</td>
</tr>
<tr>
<td>100 to 225 psig / 6.9 to 15.5 bar 1D465127142, Red</td>
<td>150</td>
<td>10.3</td>
</tr>
</tbody>
</table>

1. Inlet pressure greater than 1000 psig / 69.0 bar is not recommended for water service.
Table 6. Type 1301G Regulating Capacities — Water(1)

<table>
<thead>
<tr>
<th>OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR</th>
<th>OUTLET PRESSURE SETTING</th>
<th>CAPACITIES IN GALLONS / liters PER MINUTE OF WATER BASED ON 20% DROOP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>psig</td>
<td>bar</td>
</tr>
<tr>
<td>200 to 500 psig / 13.8 to 34.5 bar</td>
<td>200</td>
<td>13.8</td>
</tr>
<tr>
<td>1K156027142, Silver</td>
<td>500</td>
<td>34.5</td>
</tr>
</tbody>
</table>

1. Inlet pressure greater than 1000 psig / 69.0 bar is not recommended for water service.

Table 7. Type 1301F CV Coefficients(1) — Incompressible Fluid

<table>
<thead>
<tr>
<th>OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR</th>
<th>OUTLET PRESSURE SETTING</th>
<th>TYPE 1301F CV COEFFICIENTS BASED ON 20% DROOP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>psig</td>
<td>bar</td>
</tr>
<tr>
<td>10 to 75 psig / 0.69 to 5.2 bar</td>
<td>25</td>
<td>1.7</td>
</tr>
<tr>
<td>1D387227022, Blue</td>
<td>50</td>
<td>3.4</td>
</tr>
<tr>
<td>75</td>
<td>5.2</td>
<td>0.073</td>
</tr>
<tr>
<td>50 to 150 psig / 3.4 to 10.3 bar</td>
<td>75</td>
<td>5.2</td>
</tr>
<tr>
<td>18788527022, Silver</td>
<td>150</td>
<td>10.3</td>
</tr>
<tr>
<td>100 to 225 psig / 6.9 to 15.5 bar</td>
<td>150</td>
<td>10.3</td>
</tr>
<tr>
<td>1D4651270142, Red</td>
<td>225</td>
<td>15.5</td>
</tr>
</tbody>
</table>

1. Inlet pressure greater than 1000 psig / 69.0 bar is not recommended for water service.

Table 8. Type 1301G CV Coefficients(1) — Incompressible Fluid

<table>
<thead>
<tr>
<th>OUTLET PRESSURE RANGE, SPRING PART NUMBER, AND COLOR</th>
<th>OUTLET PRESSURE SETTING</th>
<th>TYPE 1301G CV COEFFICIENTS BASED ON 20% DROOP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>psig</td>
<td>bar</td>
</tr>
<tr>
<td>200 to 500 psig / 13.8 to 34.5 bar</td>
<td>200</td>
<td>13.8</td>
</tr>
<tr>
<td>1K156027142, Silver</td>
<td>500</td>
<td>34.5</td>
</tr>
</tbody>
</table>

1. Inlet pressure greater than 1000 psig / 69.0 bar is not recommended for water service.

Maximum Allowable Pressure Drop for Liquid

Pressure drops in excess of allowable will result in choked flow and possible cavitation damage. Choked flow is the formation of vapor bubbles in the liquid flowstream causing a condition at the vena contracta which tends to limit flow through the regulator. The vena contracta is the minimum cross-sectional area of the flow stream occurring just downstream of the actual physical restriction. Cavitation and flashing are physical changes in the process fluid. The change is from the liquid state to the vapor state and results from the increase in fluid velocity at or just downstream of the greatest flow restriction, normally the regulator orifice.

To determine the maximum allowable pressure drop for water:

\[ \Delta P \text{ (allow)} = K_v \Delta P_1 \]

where,

- \( \Delta P \) = pressure drop across the regulator, psi
- \( K_v \) = valve recovery coefficient
- \( \Delta P_1 \) = absolute inlet pressure, psia

To determine maximum allowable pressure drop for fluids other than water, use other Fisher® sizing methods or contact your local Sales Office for assistance.

Universal NACE Compliance

Optional materials are available for applications handling sour gases. These constructions comply with the recommendations of NACE International sour service standards.

The manufacturing processes and materials used by Emerson Process Management Regulator Technologies, Inc. assure that all products specified for sour gas service comply with the chemical, physical, and metallurgical requirements of NACE MR0175 and/or NACE MR0103. Customers have the responsibility to specify correct materials. Environmental limitations may apply and shall be determined by the user.

Ordering Information

Use the Specifications section on pages 2 and 3 to complete the Ordering Guide on page 8. Specify the desired selection wherever there is a choice to be made. Provide your Sales Office with this information when ordering the regulator.
Figure 3. 1301 Series Dimensions

Table 9. 1301 Series Dimensions

<table>
<thead>
<tr>
<th>TYPE</th>
<th>BODY MATERIAL</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Inch</td>
</tr>
<tr>
<td>1301F</td>
<td>Brass</td>
<td>3.38</td>
</tr>
<tr>
<td></td>
<td>Stainless steel</td>
<td>3.62</td>
</tr>
<tr>
<td>1301G</td>
<td>Brass</td>
<td>3.38</td>
</tr>
<tr>
<td></td>
<td>Stainless steel</td>
<td>3.62</td>
</tr>
</tbody>
</table>
Ordering Guide

Type (Select One)

1301F
☐ 10 to 75 psig / 0.69 to 5.2 bar***
☐ 50 to 150 psig / 3.4 to 10.3 bar***
☐ 100 to 225 psig / 6.9 to 15.5 bar***

1301G
☐ 200 to 500 psig / 13.8 to 34.5 bar***

Dual Gauge Port Construction (Optional)
☐ Yes

Body and Spring Case Material (Select One)
☐ Brass***
☐ CF8M Stainless steel**

Valve Disk (Select One)
☐ Nylon (PA)***
☐ PTFE**

Gaskets (Select One)
☐ Neoprene (CR)***
☐ Fluorocarbon (FKM)**
☐ Ethylene propylene (EPDM)*
☐ Fluorosilicone (FVMQ)**

Replacement Parts Kit (Optional)
☐ Yes, send one replacement parts kit to match this order.

Regulators Quick Order Guide

*** Standard - Readily Available for Shipment
** Non-Standard - Allow Additional Time for Shipment
* Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.

Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.

Specification Worksheet

Application:
Specific Use _______________________
Line Size _______________________
Fluid Type _______________________
Specific Gravity _______________________
Temperature _______________________

Does the Application Require Overpressure Protection? 
☐ Yes ☐ No

Pressure:
Maximum Inlet Pressure ________
Minimum Inlet Pressure ________
Differential Pressure ________
Set Pressure ________
Maximum Flow ________

Accuracy Requirements:
Less Than or Equal To: 
☐ 5% ☐ 10% ☐ 20% ☐ 40%

Construction Material Requirements (if known):

Industrial Regulators

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