

# Axial Flow Valve

High pressure regulator

Series 300/600

Nominal diameter DN 50 to DN 300

## Applications

- Industrial
- Distribution
- Transmission

## Brief information

The unique design incorporates many features vital to an optimum of satisfactory operation and at the same time simple to maintain and more compact than any other equivalent regulator. The "V"-port radial slots in the valve cage provides an equal percentage valve characteristic and a wide and stable control range. A further consequence of this design is that the noise level is considerably reduced compared to conventional units. The preloaded rubber sleeve is the only moving part, expanding around the complete circumference of two tapered stainless steel valve cage sections which are provided with radial slots. The sleeve has the function of the conventional "seat" type regulator. Lifting of the sleeve regulates the gas flow. The Axial Flow Valve can be installed in any position and can be easily bolted between two flanges. The short construction length can result in a smaller pressure reduction station without loss of control accuracy. The Axial Flow Valve can easily be removed from the gas line and comprises only a few components. The entire regulator can be disassembled by removing one bolt. No special tools or techniques are required.

All units are suitable for operation on natural, liquid petroleum and manufactured gases. The units are approved by DVGW according to the pressure equipment directive 97/23/EC (PED) and accordance with EN 334.

Registration Number: CE-0085BN0509

## Technical Data

- Inlet pressure range: 1.5 bar to 100 bar
- Outlet pressure range: 10 mbar to 41 bar

### Body ratings and sizes

| Series | Sizes (DN)                 | Pressure rating |
|--------|----------------------------|-----------------|
| 300    | 50, 80, 100, 150, 200, 300 | 50 bar          |
| 600    | 50, 100, 150, 200          | 100 bar         |

## Ordering example

- Gas pressure regulator AFV
- Valve size DN
- Pressure class ANSI or PN
- Sleeve type and grade, (e. g. HB7)
- Control block inspirator or restrictor
- Pilot system, pilot and optional load limit regulator (e. g. Z / ZSC100)
- Inlet pressure ... to ... bar
- Outlet pressure ... bar or pressure range from ... to ... bar
- Recommended flow rate

### Pressure ranges, accuracy classes

|          | P <sub>0</sub> [bar] | P <sub>d</sub> [bar]        | AC             | SG             |
|----------|----------------------|-----------------------------|----------------|----------------|
| ANSI 600 | 20–100               | 3 – 10<br>8 – 16<br>14 – 42 | 10<br>5<br>2.5 | 10<br>10<br>10 |
| ANSI 300 | 14– 50               | 1 – 3<br>3 – 14<br>14 – 42  | 5<br>5<br>2.5  | 20<br>10<br>10 |
| PN 16    | 1.5– 16              | 0 – 1<br>0 – 1<br>0 – 1     | 20<br>10<br>10 | 30<br>30<br>20 |

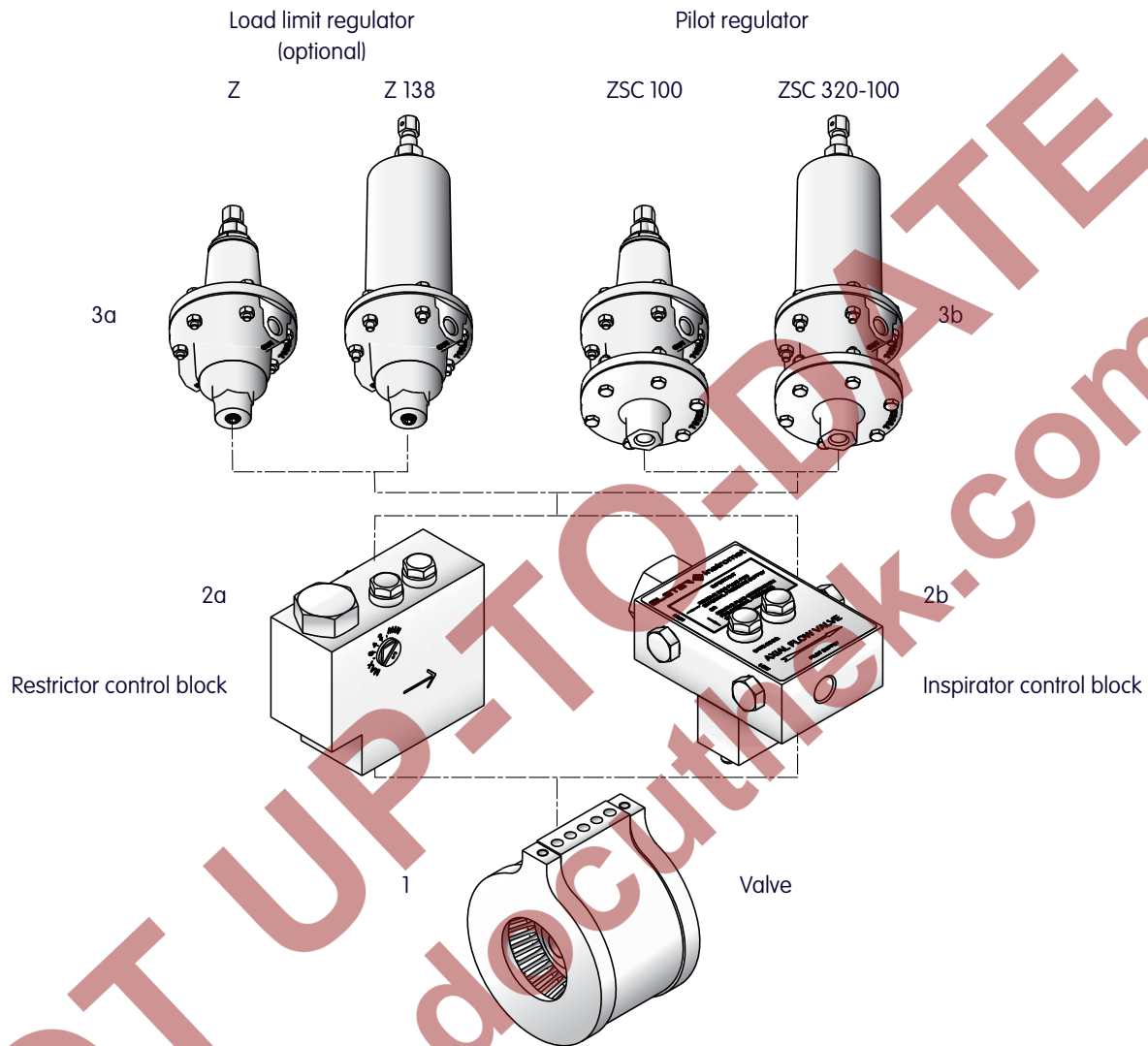
## Main features

- Simple unique design
- Compact size and light weight
- Streamline path for quiet operation
- Sized from DN 50 through DN300
- Pilot operated
- Temperature range -20 °C to +60 °C
- Low noise
- Minimal spares
- Easy to install
- Easy to maintain

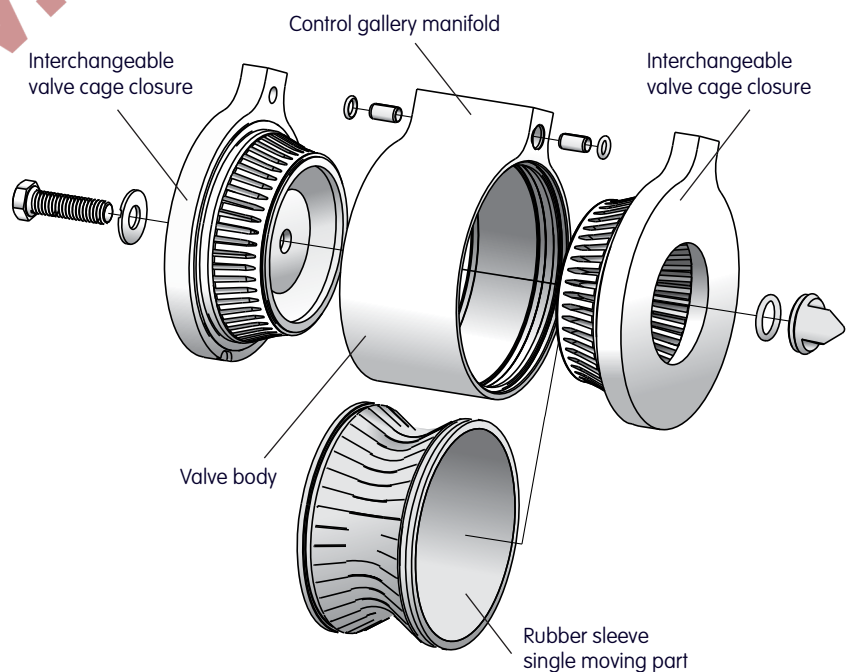
## Options

- Pressure reduction
- Relief valve
- Pressure reduction/ monitor combination
- Two stage pressure reduction with monitor override
- Flow control

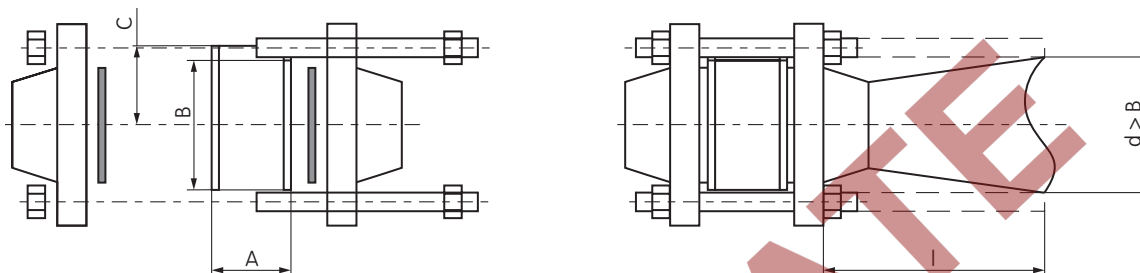
## System components



- 1 Valve consisting of:  
Body assembly  
Cage closure  
Sleeve
- 2a Control block - Composite, with integral restrictor and filter assembly.
- 2b Control block - Inspirator, with integral restrictor and filter assembly. Special nozzle reduces the differential pressure necessary to fully open the Axial Flow Valve.
- 3a Load limit regulator - Series Z used for maintaining the inlet pressure for a control pilot  
Inlet pressures up to 100bar.  
Outlet pressures up to 41 bar.
- 3b Pilot regulator - Series ZSC used for secondary pressure control  
Inlet pressures up to 100bar.  
Outlet pressures up to 41 bar.



## Valve dimensions, weights and bolts



## Series 300

| DN  | Size [mm] |     |     | Weight<br>[kg] | PN 16 |           | ANSI 150 |                | ANSI 300 |                  |
|-----|-----------|-----|-----|----------------|-------|-----------|----------|----------------|----------|------------------|
|     | A         | B   | C   |                | n     | d x l     | n        | d x l          | n        | d x l            |
| 50  | 77        | 105 | 70  | 2.6            | 4     | 5/8" x 7" | 4        | 5/8" x 7"      | 8        | 5/8" x 7"        |
| 80  | 94        | 136 | 84  | 4.1            | 8     | 5/8" x 8" | 4        | 5/8" x 8"      | 8        | 3/4" x 8 1/2"    |
| 100 | 114       | 175 | 105 | 8.6            | -     | -         | 8        | 5/8" x 8 1/2"  | 8        | 3/4" x 10"       |
| 150 | 140       | 222 | 129 | 17.3           | -     | -         | 8        | 3/4" x 10"     | 12       | 3/4" x 11"       |
| 200 | 171       | 279 | 157 | 36.4           | -     | -         | 8        | 3/4" x 11 1/2" | 12       | 7/8" x 12 3/4"   |
| 300 | 240       | 410 | 222 | 80.5           | -     | -         | 12       | 7/8" x 14 3/4" | 16       | 1 1/8" x 16 1/2" |

## Series 600

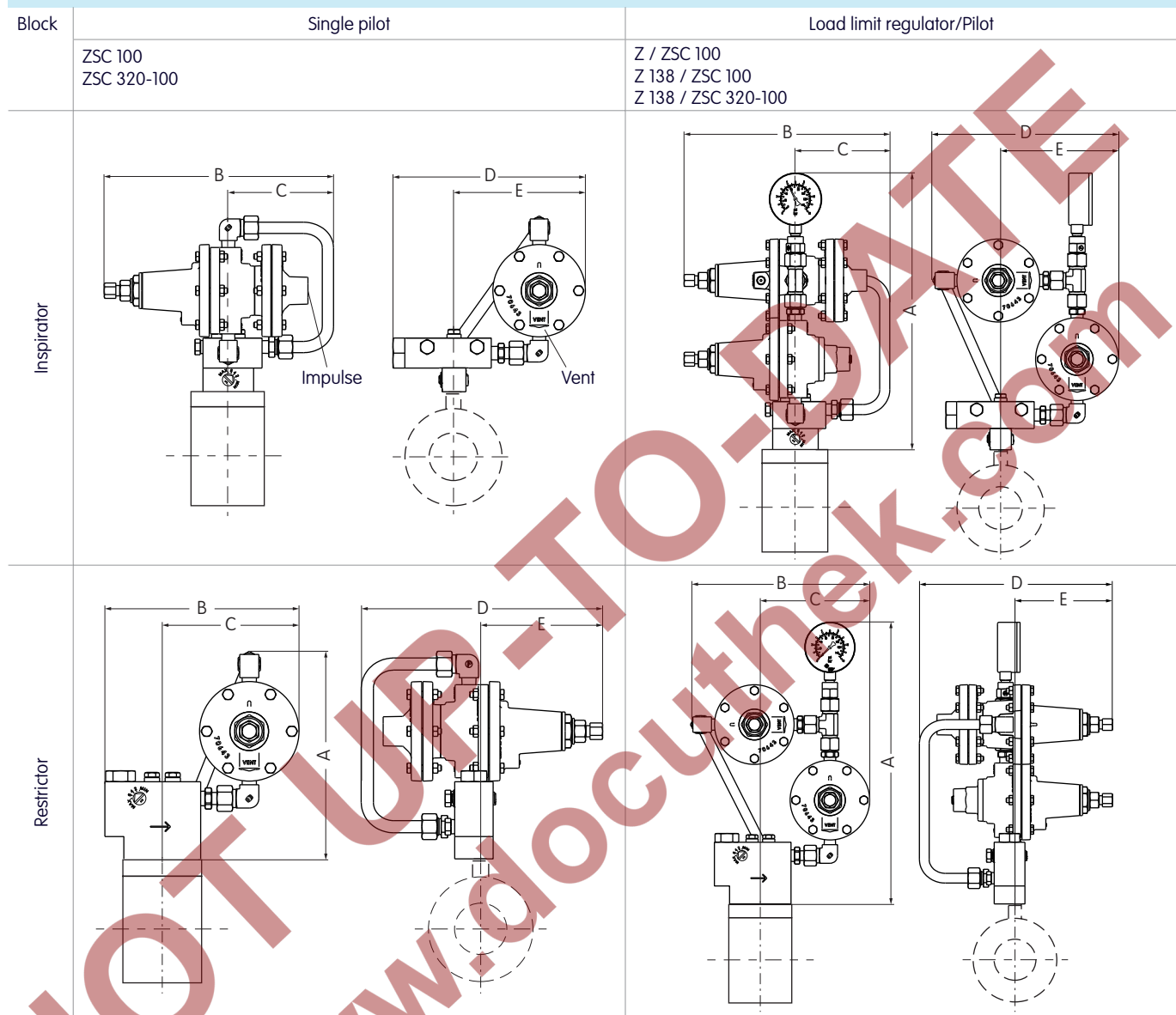
| DN  | Size [mm] |     |     | Weight<br>[kg] | ANSI 600 |                  |
|-----|-----------|-----|-----|----------------|----------|------------------|
|     | A         | B   | C   |                | n        | d x l            |
| 50  | 87        | 111 | 73  | 3.5            | 8        | 5/8" x 8"        |
| 100 | 133       | 194 | 114 | 14.3           | 8        | 7/8" x 11 1/2"   |
| 150 | 175       | 267 | 151 | 33.4           | 12       | 1" x 14 1/4"     |
| 200 | 205       | 321 | 178 | 55.4           | 12       | 1 1/8" x 16 1/2" |

n: Number of bolts, d: thread size (UNC), l: length of bolt

## Material

|                |                              |   |
|----------------|------------------------------|---|
| AFV            | Body                         | Carbon steel S355J2H with ZnNi corrosion protection |
|                | Cage                         | Stainless steel (1.4542)                            |
|                | Sleeve                       | NBR/HNBR  |
| AFV pilot loop | Body                         | Brass (CuZn40Pb2)                                   |
|                | Cover                        | Brass (CuZn40Pb2)                                   |
|                | Orifice                      | Brass (CuZn39Pb3)                                   |
|                | Diaphragms/elastomeric parts | Reinforced NBR/NBR                                  |
|                | Bearings                     | Steel (C35) with Zn corrosion protection            |
|                | Manifold block               | Steel (ST52) with ZnNi corrosion protection         |
|                | Bearings manifold block      | Brass (CuZn39Pb3)/ Stainless steel 1.4305           |

Pilot Loop: Dimensions and weights



| Block      | Pilot               | A   | B   | C   | D   | E   | Weight  |
|------------|---------------------|-----|-----|-----|-----|-----|---------|
| Inspirator | ZSC 100             | 188 | 244 | 112 | 205 | 140 | 6 kg    |
|            | Z / ZSC 100         | 329 | 244 | 112 | 205 | 140 | 8.5 kg  |
|            | ZSC 320-100         | 188 | 329 | 112 | 205 | 140 | 8 kg    |
|            | Z 138 / ZSC 320-100 | 329 | 329 | 112 | 205 | 140 | 12.1 kg |
| Restrictor | ZSC 100             | 205 | 192 | 135 | 239 | 121 | 6 kg    |
|            | Z / ZSC 100         | 348 | 222 | 135 | 239 | 121 | 8.5 kg  |
|            | ZSC 320-100         | 205 | 192 | 135 | 324 | 206 | 8 kg    |
|            | Z 138 / ZSC 320-100 | 348 | 222 | 135 | 324 | 206 | 12.1 kg |

Pilot loop pressure ranges

| Inlet pressure range<br>[bar] | Outlet pressure range<br>[bar] | Minimal differential pressure [bar] |            | Pressure rating | Control system             |             |
|-------------------------------|--------------------------------|-------------------------------------|------------|-----------------|----------------------------|-------------|
|                               |                                | Restrictor                          | Inspirator |                 | Load limiter <sup>1)</sup> | Pilot       |
| 3 – 49                        | 1 – 14                         | 2                                   | 1          | ANSI 300        | -                          | ZSC 100     |
| 3 – 45                        | 1 – 10                         | 2                                   | 2          | ANSI 300        | Z                          | ZSC 100     |
| 11 – 49                       | 7 – 14                         | 6                                   | 6          | ANSI 300        | Z 138                      | ZSC 100     |
| 16 – 50                       | 14 – 41                        | 2                                   | 1          | ANSI 300        | -                          | ZSC 320-100 |
| 20 – 50                       | 14 – 41                        | 6                                   | 6          | ANSI 300        | Z 138                      | ZSC 320-100 |
| 9 – 80                        | 3 – 10                         | 4                                   | 4          | ANSI 600        | Z                          | ZSC 100     |
| 14 – 84                       | 8 – 14                         | 6                                   | 6          | ANSI 600        | Z 138                      | ZSC 100     |
| 20 – 100                      | 14 – 41                        | 6                                   | 6          | ANSI 600        | Z 138                      | ZSC 320-100 |

<sup>1)</sup> Usually the Load limit regulator Z / Z 138 are only required for inlet pressure fluctuations of more than 3 bar

## Operation

To open the regulator it is necessary to reduce the pressure at the back of the sleeve until it is below inlet pressure. The now higher inlet pressure acts on the full inlet surface of the sleeve causing it to expand,

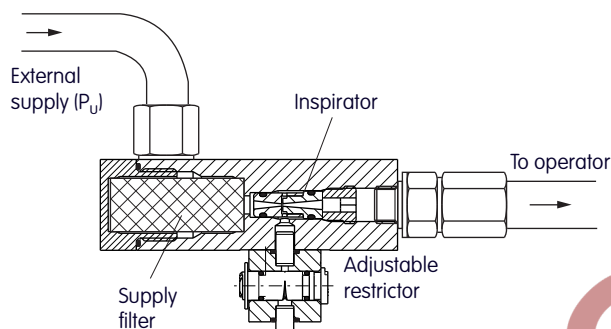
lifting the sleeve from the inlet/outlet cages to allow flow through the valve.

Two control loops are available, which automatically create the sleeve control differ-

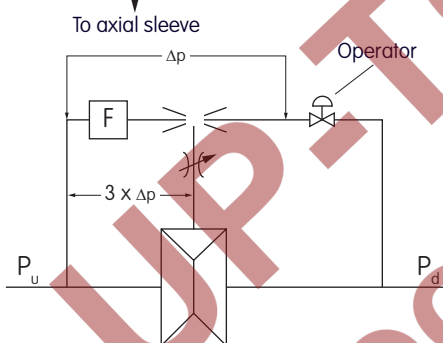
ential proportionate to flow required.

Both loops are provided with external or internal supply facility.

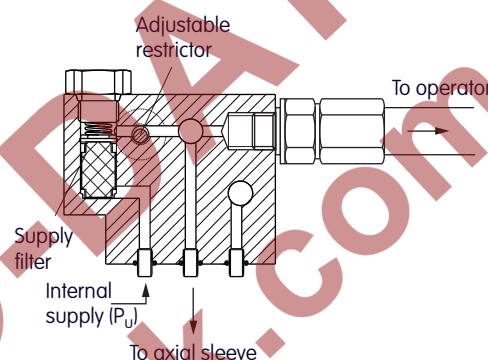
### Inspirator control



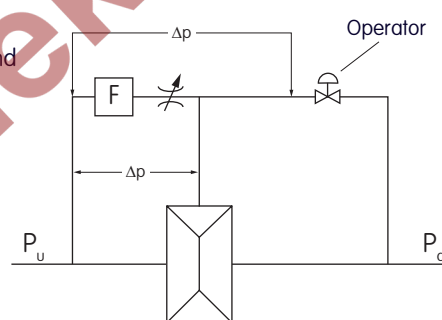
As the operator opens, a flow and hence pressure drop is created across the inspirator. The inspirator boosts the pressure drop to the back of the axial sleeve by approximately 3:1.



### Restrictor control



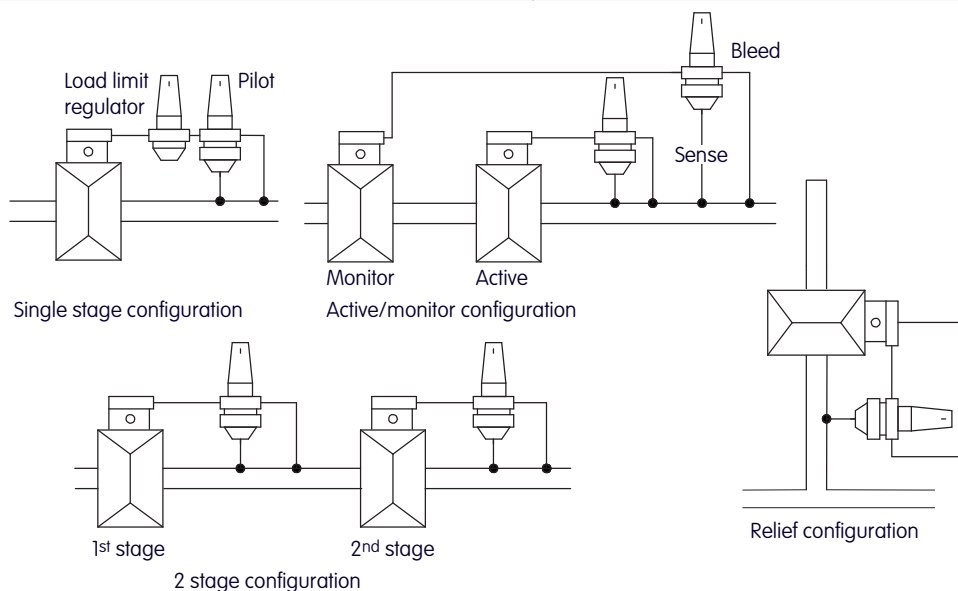
As the operator opens, a flow and hence pressure drop is created across the restrictor. The pressure drop is transferred directly to the back of the axial sleeve.



| Operating differential  | Boosted 3:1   | 1:1  |
|-------------------------|---|--|
| Applications            | General<br>Transmission/distribution<br>Minimal pressure differential<br>Enhanced control | Special applications<br>Fast response<br>Minimal downstream volumes<br>Variable control requirements |
| Low restrictor setting  | Slow to open<br>Slow to close   | Quick to open<br>Slow to close   |
| High restrictor setting | Quick to open<br>Quick to close   | Slow to open<br>Quick to close   |

## Installation

The axial flow valve can be used in a wide range of installation configurations. Shown here are some typical basic examples.



## Pilot operators

(detailed information can be found on the Z/ZSC data sheet)

- Type Z and Z 138 load limit regulator used to maintain the inlet pressure for a control pilot
- Type ZSC 100 and ZSC 320-100 pilot used for secondary pressure control
- Type ZSC 150 and ZSC 320-150 pilot used for back pressure and relief service
- Type Hanoreg pilot used for secondary pressure control – low outlet pressure
- Type 1203/1203EP pilot used for secondary pressure control – low outlet pressure

| Pressure ratings          |  |                       |
|---------------------------|--|-----------------------|
| Type                      | Maximum allowable operating pressure MOP | Outlet pressure range |
| Z and ZSC 100             | 100 bar                                  | 70 mbar to 22.4 bar   |
| Z 138 and ZSC 320-100     | 100 bar                                  | 10.3 bar to 41.4 bar  |
| Hanoreg <sup>1)</sup>     | 16 bar                                   | 15 mbar to 1 bar      |
| 1203/1203EP <sup>1)</sup> | 10 bar                                   | 10 mbar to 250 mbar   |

<sup>1)</sup> See separate data sheet

## Pressure spring ranges

| Load limit regulator Z, pilot regulator ZSC 100 and relief pilot ZSC 150 |             |            |
|--|-------------|------------|
| Spring range   | Colour code | Order No.  |
| 70 – 350 mbar  | Green       | 71411 P010 |
| 0.14 – 0.7 bar   | Brown/blue  | 71411 P043 |
| 0.2 – 2.1 bar  | Yellow      | 71411 P011 |
| 0.7 – 5.2 bar  | Red         | 71411 P012 |
| 1.7 – 10.4 bar   | Blue        | 71411 P014 |
| 6.9 – 15.5 bar   | White       | 71411 P009 |
| 13.8 – 22.4 bar  | White/red   | 71411 P046 |

max. inlet pressure 100 bar

| Load limit regulator Z 138, pilot regulator ZSC 320-100 and relief pilot ZSC 320-150 |             |            |
|--|-------------|------------|
| Spring range   | Colour code | Order No.  |
| 10.3 – 41.4 bar  | -           | 71421 P008 |

max. inlet pressure 100 bar

## Sleeves

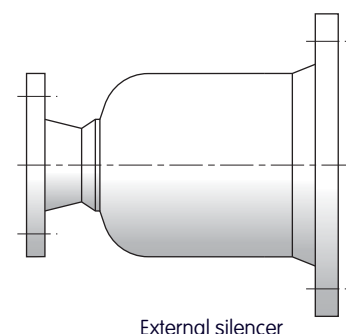
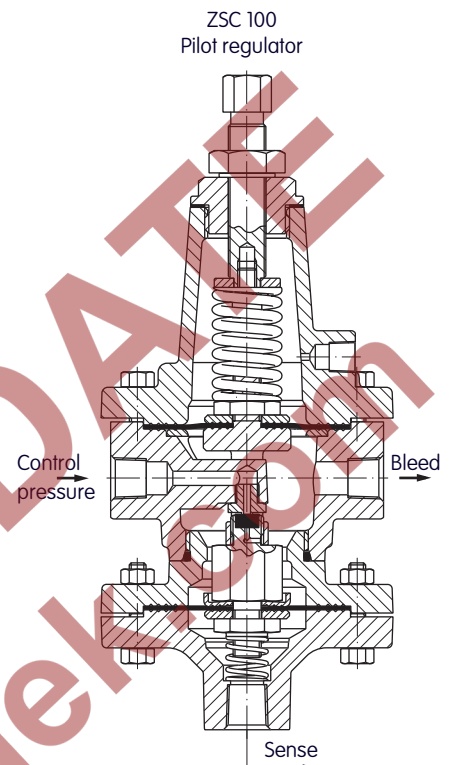
| Sleeve operating differential and ratings |      |             |   |           |            |              |                   |          |
|---|------|-------------|---|-----------|------------|--------------|-------------------|----------|
| AFV series                                | Type | Colour code | Differential pressure p <sub>diff</sub> |           |            |              | Temperature range | Material |
|   |      |             | Minimum <sup>1)</sup>                   |           | Maximum    |              |                   |          |
|   |      |             | Cracking                                | Full open | Continuous | Intermittent |                   |          |
| ANSI300                                   | HB5L | orange      | 0.1 bar                                 | 0.35 bar  | 2 bar      | 3.5 bar      | -35 °C to +60 °C  | HNBR     |
| ANSI300                                   | HB5  | blue        | 0.25 bar                                | 1 bar     | 8 bar      | 12 bar       | -35 °C to +60 °C  | HNBR     |
| ANSI300                                   | HB7  | blue        | 1 bar                                   | 2 bar     | 35 bar     | 50 bar       | -27 °C to +60 °C  | HNBR     |
| ANSI600                                   | B7   | red         | 2 bar                                   | 4 bar     | 70 bar     | 100 bar      | -30 °C to +60 °C  | NBR      |

<sup>1)</sup> By using a Restrictor block

## Noise

Accurate noise prediction estimates can be given for the axial flow valve with or without silencer on request. Or please use our sizing tool.

Where necessary silencers can be provided in complete stations designed to meet required noise restrictions.





| Capacity |    |       |       |       |       |       |       |       |       |       |
|----------|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Size     | DN | 50R10 | 50R25 | 50R50 | 50    | 80    | 100   | 150   | 200   | 300   |
| ANSI 300 | Cv | 6.5   | 15    | 30.7  | 66.5  | 135   | 231   | 325   | 560   | 1165  |
| ANSI 300 | Xt | 0.700 | 0.700 | 0.643 | 0.590 | 0.490 | 0.480 | 0.495 | 0.450 | 0.565 |
| ANSI 300 | KG | 215   | 495   | 975   | 2005  | 3800  | 6400  | 9200  | 15050 | 35000 |
| ANSI 600 | Cv | -     | -     | -     | 67.6  | -     | 248   | 500   | 710   | -     |
| ANSI 600 | Xt | -     | -     | -     | 0.590 | -     | 0.590 | 0.511 | 0.550 | -     |
| ANSI 600 | KG | -     | -     | -     | 2050  | -     | 7600  | 14000 | 21100 | -     |

## Sizing

- Critical flow,  $p_2 \leq 0.5 \cdot p_1$ :

$$Q_n = p_1 \cdot \frac{K_G}{2} ; K_G = \frac{2 \cdot Q_n}{p_1}$$

- Sub critical flow,  $p_2 > 0.5 \cdot p_1$ :

$$Q_n = K_G \cdot \sqrt{p_2 \cdot (p_1 - p_2)} ;$$

$$K_G = \frac{Q_n}{\sqrt{p_2 \cdot (p_1 - p_2)}}$$

$Q_n$  = maximum flow rate in m<sup>3</sup>/h  
natural gas at 15°C and  $p_b = 1.013$  bar

$p_b$  = local static atmospheric pressure in bar (absolute pressure)

$p_1 = p_u + p_b$  inlet pressure absolute (bar absolute)

$p_2 = p_d + p_b$  outlet pressure absolute (bar absolute)

$K_G$  = Flow coefficient in  $\frac{m^3}{h \cdot bar}$

## Correction factor for other gases

The capacities on the previous pages are given in m<sup>3</sup>/h of natural gas 0.61 (Air =1).

For other gases multiply the capacity by K.

$$K = \sqrt{\frac{0.61}{d_{\text{operating gas}}}}$$

$$Q_{n \text{ operating gas}} = Q_{n \text{ natural gas}} \cdot K$$

|             | Standard density<br>$\rho_n$ (kg/m <sup>3</sup> ) | Relative density (Air=1)<br>d | Conversion factor<br>K |
|-------------|---|-------------------------------|------------------------|
| Natural gas | 0.83  | 0.64                          | 1.00                   |
| Town gas    | 0.56  | 0.43                          | 1.22                   |
| Methane     | 0.72  | 0.56                          | 1.07                   |
| Propane     | 2.00  | 1.55                          | 0.64                   |
| Air         | 1.29  | 1.00                          | 0.80                   |
| Nitrogen    | 1.25  | 0.97                          | 0.81                   |
| Hydrogen    | 0.09  | 0.07                          | 3.04                   |

## Example

Given:

- Maximum inlet pressure  $p_{1\max} = 45$  bar absolute
- Minimum inlet pressure  $p_{1\min} = 23$  bar absolute
- Outlet pressure  $p_2 = 3$  bar absolute
- Flow rate  $Q_n = 50000$  m<sup>3</sup>/h (natural gas)

=> critical flow  $p_1 \cdot 0.5 > p_2$

$$K_G = \frac{2 \cdot Q_n}{p_1} = \frac{2 \cdot 50000}{23} = 4348$$

It is recommended to choose a valve size with a  $K_G$  coefficient 20% above the calculated value.

2. Step: Choosing the valve

Chosen: Axial Flow Valve: DN 100 ANSI 300  $K_G = 6400$

3. Step: Choosing the sleeve

Differential pressure: minimum 20 bar, maximum 42 bar

Chosen: HB7 ANSI 300 DN 100

4. Step: Choosing the pilot loop

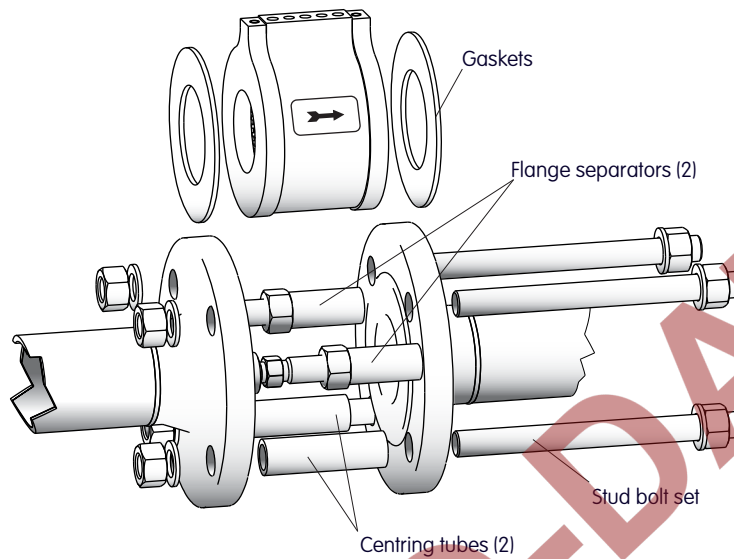
$p_u$  between 23 – 45 bar varying,

$p_d$  between 1.0 – 10 bar,

Chosen: Load limit regulator Z, pilot ZSC 100

For a detailed sizing please ask for our sizing tool

## Accessories

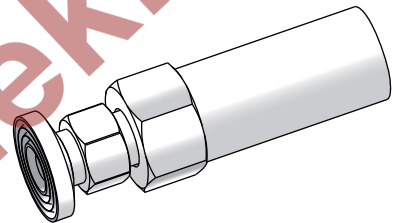


### Flange separator

The flange separator is used to jack the flanges apart and relieve pipe strain to facilitate removal and replacement. (Two required)

#### Flange separator

| Order No. | AFV size       |             |
|-----------|----------------|-------------|
|           | ANSI300        | ANSI600     |
| 73593G001 | DN 50, 80, 100 | DN 50       |
| 73593G002 | DN 150, 200    | DN 100, 150 |
| 73593G003 | DN 300         | DN 200      |



### Centring tube

The Axial Flow Valve is a wafer design which simply bolts between flanges. To ensure exact centring of the valve for full capacity, centring tubes are easily fitted over the existing bolts (series 300 only).

#### Centring tubes ANSI 300

| Order No. | AFV size |
|-----------|----------|
| 73552P001 | DN50     |
| 73552P002 | DN80     |
| 73552P003 | DN100    |
| 73552P004 | DN150    |
| 73552P005 | DN200    |
| 73552P007 | DN300    |

### Spare part set

#### Spare part sets

| Order No.  | Spare part set                      |
|------------|-------------------------------------|
| 73914 K010 | Spare set Z / ZSC                   |
| 73917 K001 | Spare set AFV (O-rings less sleeve) |
| 73 020 166 | Spare set inspirator                |
| 73 020 165 | Spare set restrictor                |

Sleeves see separate data sheet

## Your contacts



Germany  
Elster GmbH  
Steinern Str. 19 - 21  
55252 Mainz-Kastel  
T +49 6134 605 0  
F +49 6134 605 223  
www.elster-instromet.com  
info@elster-instromet.com

Belgium  
Elster NV/SA  
Rijkmakerlaan 9  
2910 Essen  
T +32 3 670 0700  
F +32 3 667 6940  
www.elster-instromet.com  
info@elster-instromet.com

Singapore  
Elster-Instromet Sdn. Bhd. (Singapore Branch)  
29 Tai Seng Avenue  
#06-05A Natural Cool Lifestyle Hub  
Singapore 534119  
T +65 6247 7728  
F +65 6848 9003  
sales@elster-instromet.com.sg

AFV EN02  
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