

SCHROEDAHL

A subsidiary of **CIRCOR** International Inc.

Series TD Type TDL Type TDM

Automatic Recirculation Valve
for pump protection



Series TD

The SCHROEDAHL Automatic Recirculation Valve is used for the pump protection of centrifugal pumps

Preamble

SCHROEDAHL is the largest supplier of Automatic Recirculation Valves in the world. These ARVs, or pump protection systems, are our principal products. During the last 50 years we have supplied more than 50,000 of these valves to satisfied customers all over the world.



Features

- Automatic bypass operation
- Modulating bypass operation
- Low maintenance
- Easy to install
- Damping of system pulsations
- Suitable for wide range of fluids
- Self operated
- Reduces plant investment and operational costs



Application

The SCHROEDAHL Automatic Recirculation Valve is a high quality automatic solution to protect centrifugal pumps against overheating, instability and cavitation, during zero process flow and low load conditions.

If the flow through the system is or falls below a certain level, the bypass system opens automatically and the fluid is recirculated, providing the required minimum flow for the pump.

Special operation requirements, low load cases, complicated commissioning situations and the pressure in the bypass line have an impact on the valve design and therefore are typically part of customers RFQ information - SCHROEDAHL can offer solutions at a very high level.

The SCHROEDAHL automatic recirculation valve is therefore a high quality, cheaper and easier solution for clean liquid pump protection - more cost effective than a conventional modulating control valve package.

Sectional drawing of an Automatic Recirculation Valve type TDM

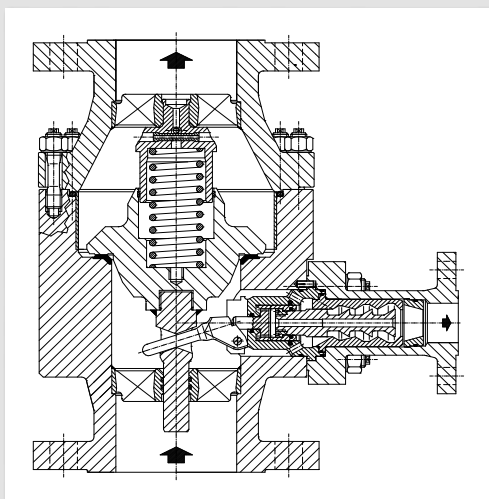


Fig. 1

Sectional drawing of an Automatic Recirculation Valve type TDL

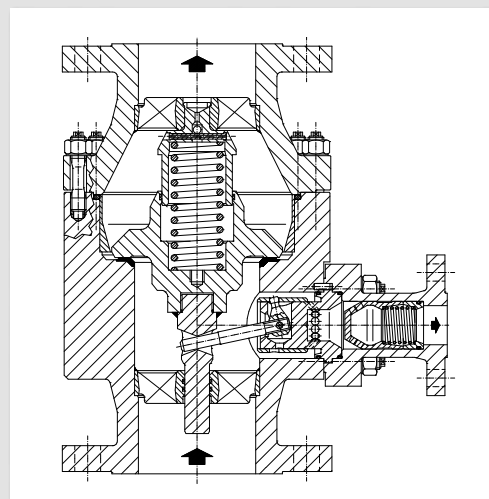


Fig. 2

Operation of the Automatic Recirculation Valves

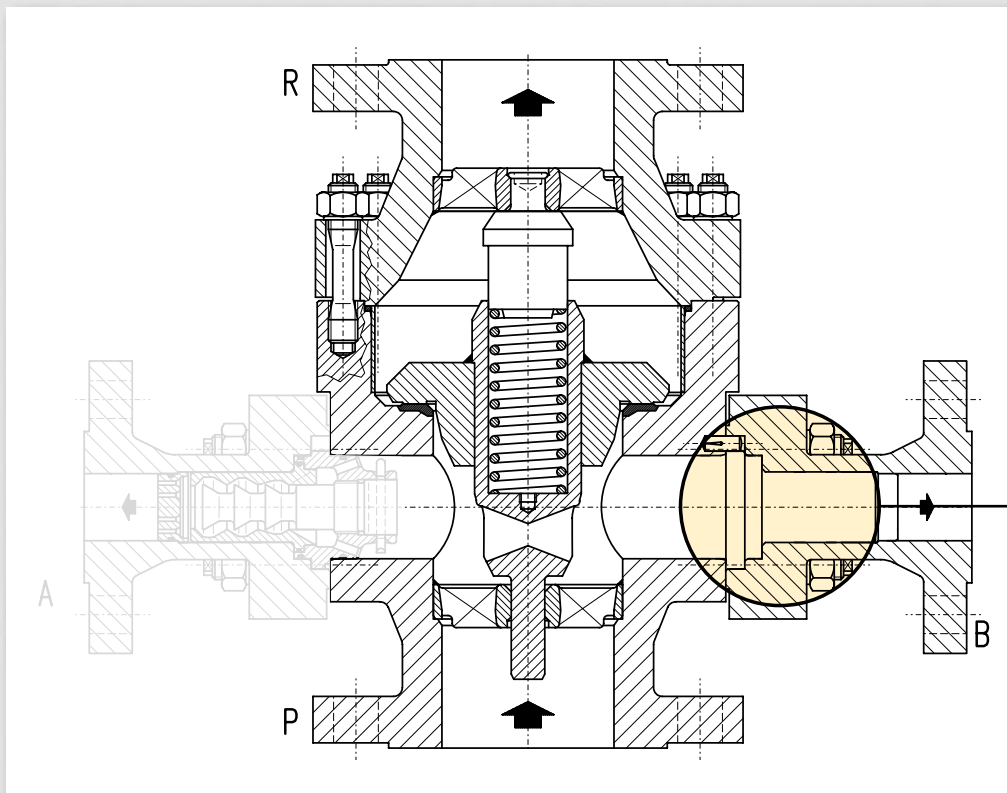


Fig. 3

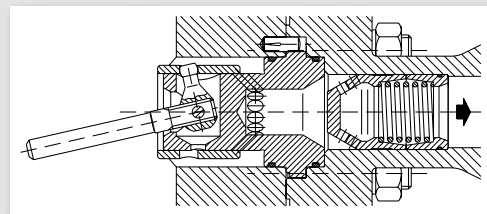


Fig.4: Type TDL

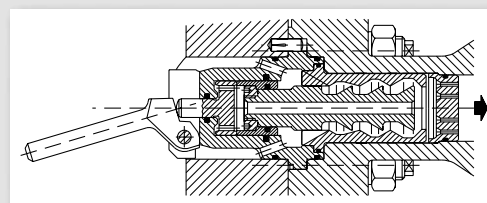


Fig.5: Type TDM

Operation Range Definition

The following two descriptions are typical of the pump protection application:

1. Standard Operation Range Application:

The usual operation of pump protection valves is in the load range from 40% to 100% of the rated process flow. The automatic valve will handle the typical time-limited start-up and shut-down phase with modulating bypass control operation.

TDM valves at high pressure service may also need an adequate bypass back pressure, e.g. an orifice restriction in bypass line, to prevent cavitation during bypass flow condition.

2. Full Operation Range Application:

For high pressure TDM applications that will operate over the full load range from 0 % to 100 % process flow, it will be necessary before placing the order to evaluate special design influences at the valve. Otherwise the application will be classified as a standard range type.

For the high load range, depending on the existing bypass pressure level, it may be necessary to increase the bypass back pressure to prevent cavitation, especially when the bypass is in modulating action. Therefore the installation of a special back pressure valve BPV is recommended, to ensure that the bypass pressure level is always at a suitable pressure level (an orifice plate will not work).

Operation

The outlet main flow controls the check valve and positions it in proportion to the flow. The stem of the check valve transmits the motion via a lever to the bypass. The bypass system regulates the bypass flow in a modulating way and reduces the pressure to the bypass outlet pressure level without cavitation.

The full minimum flow is bypassed when the main check valve is seated. The bypass is fully closed when the check valve is in its upper position, thereby allowing full pump flow to the system.

Flow sensitive modulating bypass control

The check valve moves upwards with increasing main flow and downwards with decreasing flow. The check valve transmits this motion via a lever to the bypass system (Fig. 4 and 5) and therefore controls the bypass flow in a modulating position.

Type TDL

The TDL consists of the check valve section (Fig. 3) with bypass configuration type L (Fig. 4). The lever controls the position of the bushing, which in turn opens or closes the holes in the control head. The minimum flow is thereby bypassed in a modulating way. Applicable for differential pressures up to 40 bar. Standard with non-return function.

Type TDM

The TDM consists of the check valve section (Fig. 3) with bypass configuration type M (Fig. 5). The movement of the lever is transmitted via a piston to the multi-stage vortex plug. The minimum flow is then bypassed in a modulating way over several pressure reduction stages.

Applicable for differential pressures from 20 bar to 230 bar. The standard TDM design has a built-in bypass non-return function (~2 bar dp level required).

Manual Bypass Options for type TD Automatic Recirculation Valves

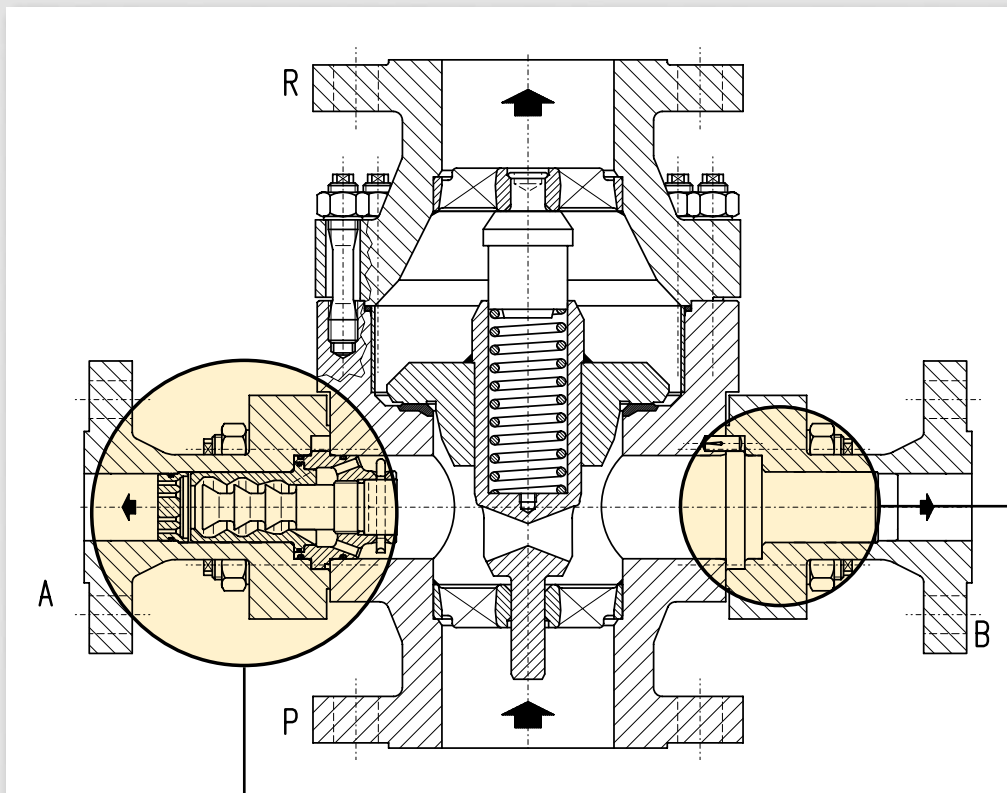
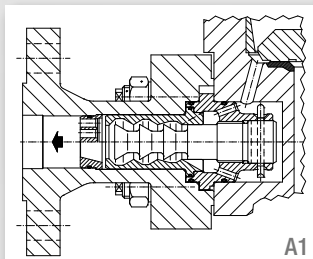
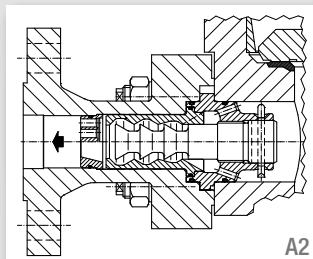


Fig. 6

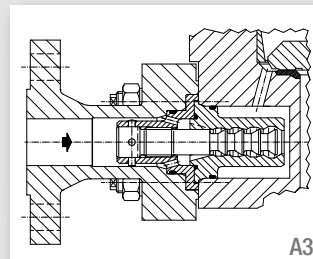
Options A:



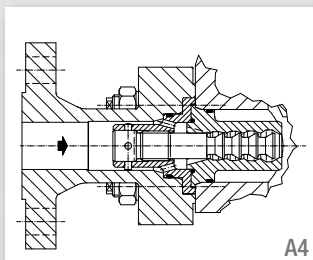
A1



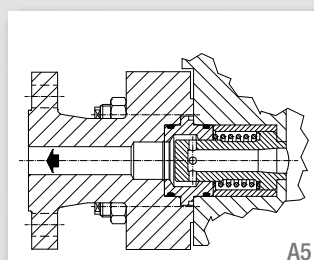
A2



A3



A4



A5

Options Information

Depending on the plant design or additional requirements, different options for the start-up/warm-up side (A), or for the bypass trim side (B) can be selected.

Options A: A typical option is the start-up connection acc. (Fig. A1), to run low pressure flow to the process/boiler for the start-up process, or to warm-up the neighboring pump/system.

Options B: Depending on the plant commissioning condition (dirt, spec. load case, ...), a special commissioning bypass trim set can be selected. The valve will then be shipped with the option bypass set and also attached with the original bypass trim set (to be installed after commissioning).

Please contact SCHROEDAHL for additional information.

Options A:

Additional connection options (on request):

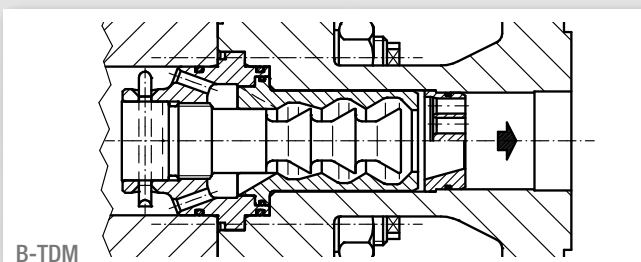
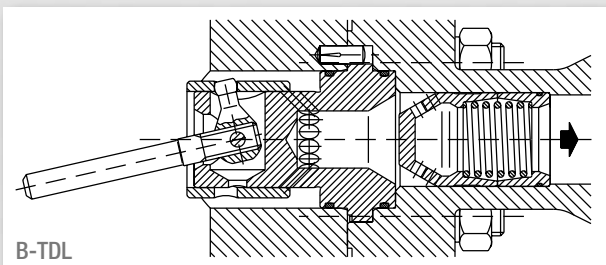
- A1: Start-up/warm-up above check valve
- A2: Start-up/warm-up below check valve.
- A3: Warm-up above check valve.
- A4: Warm-up below check valve.
- A5: Degassing Nozzle

Options B:

Commissioning options for the bypass side (on request):

- B-TDL: Commissioning bypass internals for TDL valve (bigger clearances, modulating)
- B-TDM: Commissioning bypass internals for TDM valve (continuous open, fixed flow coefficient, non-modulating, without moving parts)

Options B:



Valve sizes

Standard size from DN 25 (1") to DN 300 (12").

Pressure rating

Pressure rating from PN 10 to PN 400 (class 150 to class 2500). Other ratings upon request.

Connections

Flanges are standard according to EN 1092-1 or ASME. Flanges according to other standards (ISO, BS, JIS, NF) are available upon request. The inlet and outlet connections can also be supplied with welding ends. The bypass connection is always flanged (for inspection purposes). Manual start-up upon request. Draining or warm-up connections are available, too.

Materials

Standard housing materials:

ASTM A105 (Carbon Steel), EN 1.0460

ASTM 316L (Stainless Steel), EN 1.4404

The standard internals of the TD valves are manufactured from stainless steel with a minimum chrome content of 13%. Other forged materials for housing and internals are available upon request. Selection of the seal material is done according to medium and temperature conditions. The housing material is selected according to medium, pressure temperature conditions and customer requirements.

| Size Code | Pressure Class Code | Connection Code | Configuration Code |
|---------------------|-------------------------|-----------------------------------|--------------------------------|
| 05 = DN 25 (1") | 1 = PN 10 | F = Flanges acc. to EN 1092-1 | V = Vertical Installation |
| 06 = DN 32 (1 1/4") | 2 = PN 16 | U = Flanges acc. to ASME | H = Horizontal Installation |
| 07 = DN 40 (1 1/2") | 3 = PN 25 (Class 150) | S = Welding Ends (not for bypass) | A = Manual start-up connection |
| 08 = DN 50 (2") | 4 = PN 40 | J = Japanese Standard | W = Standard oversized bypass |
| 09 = DN 65 (2 1/2") | 5 = PN 64 (Class 300) | B = British Standard | CS = Carbon Steel |
| 10 = DN 80 (3") | 6 = PN 100 (Class 600) | | SS = Stainless Steel |
| 11 = DN 100 (4") | 7 = PN 160 (Class 900) | | SD = Duplex Steel |
| 12 = DN 125 (5") | 8 = PN 250 (Class 1500) | | |
| 13 = DN 150 (6") | 9 = PN 320 | | |
| 15 = DN 200 (8") | 0 = PN 400 (Class 2500) | | |
| 16 = DN 250 (10") | | | |
| 17 = DN 300 (12") | | | |

Example

TDM116UVW-CS: valve type TDM; 4", class 600, ASME-Flanges, vertical installation, housing material in carbon steel

Installation Information

The Automatic Recirculation Valve should be installed as close as possible to the centrifugal pump discharge, preferably directly on the outlet of the pump.

To prevent low frequency shocks caused by pulsation of the medium, the distance between pump outlet and valve inlet should not exceed 5 m with straight pipe run at the inlet. Exceptions have to be reviewed by SCHROEDAHL.

Vertical installation is preferred, but horizontal installation is also possible on request. The TDL and TDM valves operate at a low noise level and ensure a high reliability due to their sturdy design.

The recommended filter at the pump inlet should have a maximum mesh size of 0.3 to 0.5 mm. For commissioning, we recommend a smaller filter mesh size (e.g. 0,1 mm).

Maintenance, Spares and Test

Maintenance instructions are available upon request or at www.schroedahl.com. Typically we recommend an inspection after commissioning (a gasket set is then needed), and for two-year operation, we recommend a bypass set (one complete bypass unit) for your stock.

A complete valve performance test run is recommended to be done together with the original pump. The bypass Kv/Cv value test can be certified at our test facility.

Please contact SCHROEDAHL for additional information.

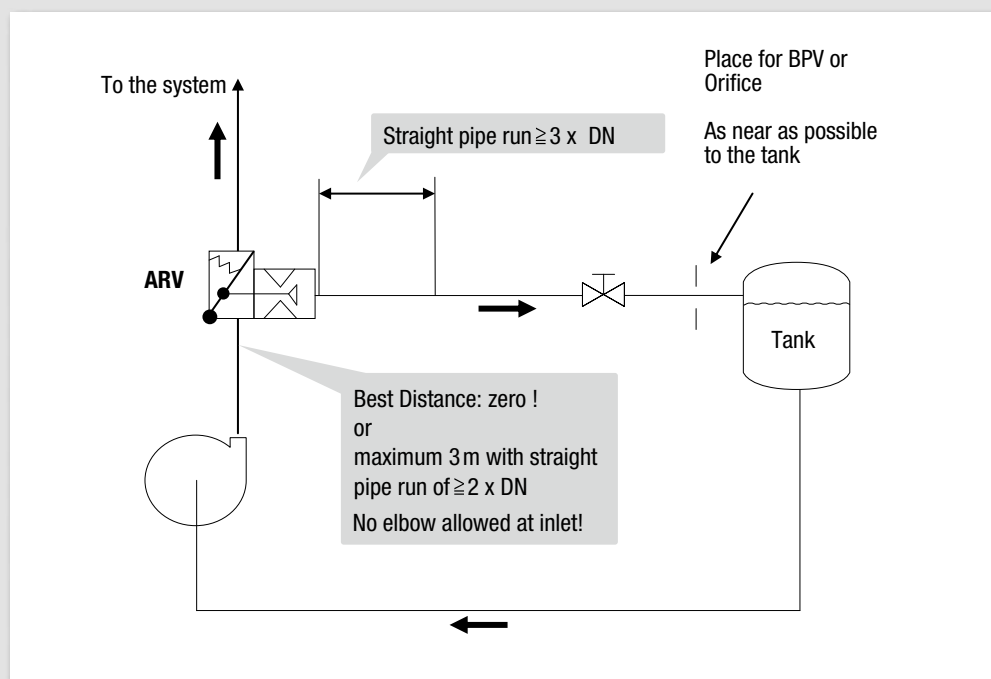
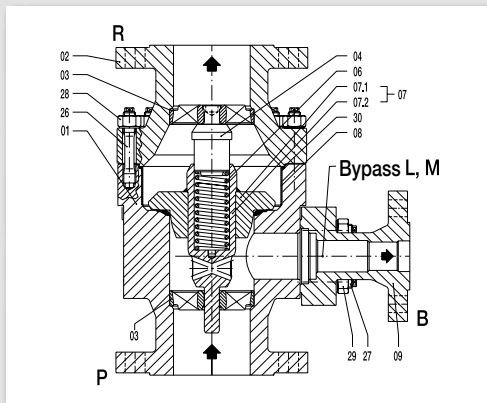


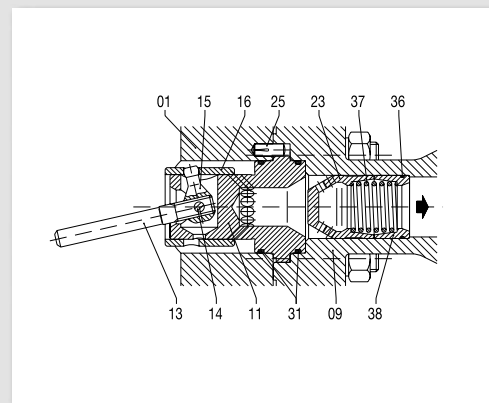
Fig. 7

Parts list

Housing



Bypass L



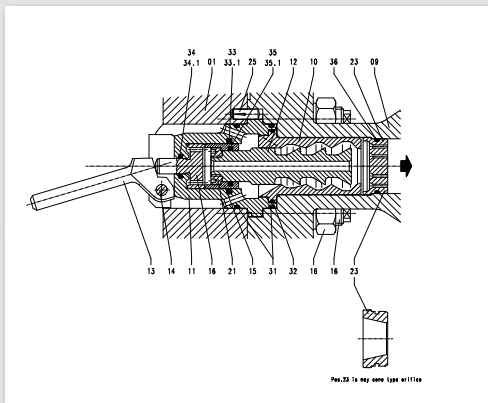
Housing assembly

| Item | Description |
|------|-----------------------|
| 01 | Lower Body |
| 02 | Upper Body |
| 03 | Stem Guide |
| 04 | Guide Bolt |
| 06 | Spring |
| 07 | Check Valve cpl. |
| 07.1 | Check Valve |
| 07.2 | Stem |
| 08 | Liner or Venturi-Ring |
| 09 | Bypass Branch |
| 25 | Guide Pin |
| 26 | Bolt |
| 27 | Bolt |
| 28 | Hexagon Nut |
| 29 | Hexagon Nut |
| 30 | O-Ring |

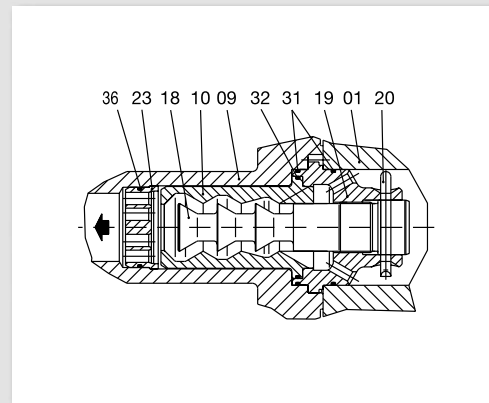
Bypass L

| Item | Description |
|------|-----------------|
| 11 | Control Head |
| 13 | Lever |
| 14 | Pivot Pin |
| 15 | Crank Arm |
| 16 | Control Bushing |
| 23 | Orifice Bushing |
| 31 | O-Ring |
| 36 | O-Ring |
| 37 | Spring |
| 38 | Bottom Ring |

Bypass M



Manual Start-up (Option A1, example)



Bypass M

| Item | Description |
|------|-----------------------|
| 10 | Vortex Bushing |
| 11 | Control Head |
| 12 | Vortex Plug |
| 13 | Lever |
| 14 | Pivot Pin |
| 15 | Relief Bushing |
| 16 | Relief Piston |
| 21 | Threaded Ring |
| 23 | Bypass Orifice / Cone |
| 31 | O-Ring |
| 32 | O-Ring |
| 33 | O-Ring |
| 33.1 | Glyd-Ring |
| 34 | O-Ring |
| 34.1 | Glyd-Ring |
| 35 | O-Ring |
| 35.1 | Glyd-Ring |
| 36 | O-Ring |

Manual Start-up

| Item | Description |
|------|----------------|
| 10 | Vortex Bushing |
| 18 | Vortex Plug |
| 19 | Holder |
| 20 | Pin |
| 23 | Orifice Plate |
| 31 | O-Ring |
| 32 | O-Ring |
| 36 | O-Ring |

Sizing and selection

Nominal size and pressure class of the Automatic Recirculation Valve should preferably be the same as the outlet of the pump.

Notes

The following table is only to be used as an indication. Other bypass sizes available upon request. For final valve selection please contact our office.

| Size Code | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 15 | 16 | 17 |
|---|----|----|----|----|-----|-----|-----|-----|-----|-----|------|------|
| DN P, R (mm) | 25 | 32 | 40 | 50 | 65 | 80 | 100 | 125 | 150 | 200 | 250 | 300 |
| DN P, R (inch) | 1 | 1¼ | 1½ | 2 | 2½ | 3 | 4 | 5 | 6 | 8 | 10 | 12 |
| Max. flow P,R for TDL and TDM valves (m³/h) | 12 | 18 | 35 | 55 | 105 | 175 | 270 | 400 | 530 | 880 | 1100 | 1500 |
| Bypass L /M DN (mm) | 25 | 25 | 25 | 25 | 40 | 40 | 50 | 50 | 65 | 80 | 100 | 125 |
| see Fig.4/5 DN (inch) | 1 | 1 | 1 | 1 | 1½ | 1½ | 2 | 2 | 2½ | 3 | 4 | 5 |
| Max. Bypass flow P-B (m³/h) | 18 | 18 | 18 | 18 | 40 | 40 | 65 | 65 | 115 | 180 | 280 | 480 |

Example valve selection

$$K_v = Q_{\min} \times \sqrt{\frac{\text{S.G.}}{\Delta p}}$$

Q_{\min} = Minimum flow in m³/h, s.g. specific gravity in kg/dm³

Δp = Differential pressure in bar over the bypass at minimum flow

Conditions: Pump DN 100, PN 100, main flow is 180 m³/h, required bypass flow is 40 m³/h, S.G. is 0.95, Δp is 70 bar at Q_{\min} .

- Selection:
- The main flow is in the range of a valve DN 100.
 - The Δp at minimum flow is ≥ 40 bar, this means that we have to select a valve type TDM.
 - $K_v = 40 \times \sqrt{0.95 / 70} = 4.8 \text{ m}^3/\text{h}$, this means a valve DN 100 with a bypass DN 50 can be used as the maximum K_v is 5.4 m³/h.



SCHROEDAHL
we protect your business

Automatic Recirculation Valve Technical Data

Customer:

Enquiry no.:

Prior reference:

Order no.:

Project:

Data sheet:

Quantity:

Automatic Recirculation Valve type:

| | | | | | |
|---------------|----|----------------------|----|----------------------|---|
| Valve inlet | DN | <input type="text"/> | PN | <input type="text"/> | Fl.Code.: <input type="text"/> |
| Valve outlet | DN | <input type="text"/> | PN | <input type="text"/> | Installation: <input type="checkbox"/> vertical <input type="checkbox"/> horizontal |
| Bypass outlet | DN | <input type="text"/> | PN | <input type="text"/> | Paint: <input type="text"/> |
| Start-up | DN | <input type="text"/> | PN | <input type="text"/> | Start-up <input type="checkbox"/> above <input type="checkbox"/> below check valve |

Mat.-/test certificates:

Materials:

Housing: Internals: Seals:

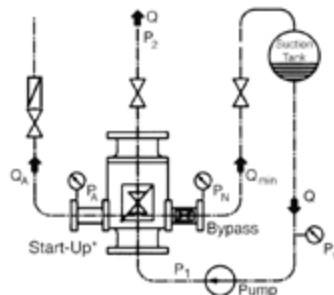
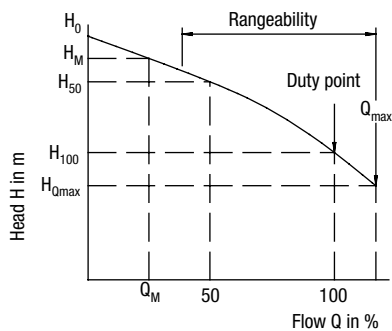
Medium: Operating temp. [°C]:

S.G. [kg/m³]: Design temp. [°C]:

| | | | |
|---------------------------------------|-------------------------------------|--|--------------------------|
| $Q_M =$ <input type="text"/> m³/h | $H_0 =$ <input type="text"/> m | Suction pr. pv | <input type="text"/> bar |
| $Q_{100} =$ <input type="text"/> m³/h | $H_M =$ <input type="text"/> m | Differential pr. (p ₁ -p _r) | <input type="text"/> bar |
| $Q_{max} =$ <input type="text"/> m³/h | $H_{Qmax} =$ <input type="text"/> m | Back pressure p _N | <input type="text"/> bar |
| $Q_A =$ <input type="text"/> m³/h | $H_A =$ <input type="text"/> m | Back pressure p _A | <input type="text"/> bar |

Notes:

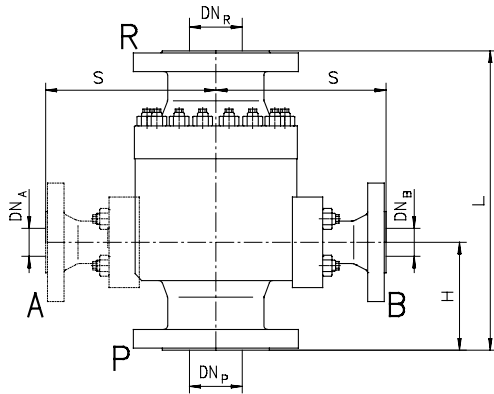
| Revision | Date | Description | Name | Signature |
|----------|------|-------------|------|-----------|
| | | | | |
| | | | | |
| | | | | |



Dimensions

EN

| Size | DN _R /DN _P | PN | DN _B | L (mm) | S (mm) | H (mm) | Weight (kg) |
|-----------------|----------------------------------|-------------|-----------------|--------|--------|--------|-------------|
| 051-052-053-054 | 25 | 10-16-25-40 | 25 | 190 | 153 | 73 | 15 |
| 055 | | 63 | | 250 | 182 | 90 | 32 |
| 056 | | 100 | | 250 | 182 | 90 | 32 |
| 061-062-063-064 | 32 | 10-16-25-40 | 25 | 190 | 153 | 73 | 17 |
| 065 | | 63 | | 250 | 190 | 90 | 30 |
| 066 | | 100 | | 250 | 190 | 90 | 30 |
| 071-072-073-074 | 40 | 10-16-25-40 | 25 | 200 | 155 | 75 | 19 |
| 075-076-077 | | 63-100-160 | | 260 | 190 | 90 | 34 |
| 078 | | 250 | | 300 | 215 | 120 | 47 |
| 081-082-083-084 | 50 | 10-16-25-40 | 25 | 230 | 163 | 90 | 26 |
| 085 | | 63 | | 300 | 185 | 115 | 48 |
| 086-087 | | 100-160 | | 300 | 193 | 110 | 56 |
| 088 | | 250 | | 350 | 223 | 130 | 85 |
| 091-092-093-094 | 65 | 10-16-25-40 | 40 | 290 | 184 | 110 | 37 |
| 095 | | 63 | | 340 | 219 | 125 | 56 |
| 096-097 | | 100-160 | | 340 | 227 | 125 | 83 |
| 098 | | 250 | | 400 | 260 | 145 | 89 |
| 101-102-103-104 | 80 | 10-16-25-40 | 40 | 310 | 191 | 115 | 48 |
| 105 | | 63 | | 380 | 233 | 140 | 69 |
| 106-107 | | 100-160 | | 380 | 240 | 140 | 85 |
| 108 | | 250 | | 450 | 265 | 165 | 125 |
| 111-112-113-114 | 100 | 10-16-25-40 | 50 | 350 | 221 | 125 | 72 |
| 115 | | 63 | | 430 | 258 | 155 | 105 |
| 116-117 | | 100-160 | | 430 | 266 | 155 | 150 |
| 118 | | 250 | | 520 | 300 | 190 | 200 |
| 121-122-123-124 | 125 | 10-16-25-40 | 50 | 400 | 266 | 135 | 100 |
| 125 | | 63 | | 500 | 280 | 175 | 183 |
| 126-127 | | 100-160 | | 500 | 291 | 175 | 223 |
| 128 | | 250 | | 600 | 321 | 215 | 345 |
| 131-132-133-134 | 150 | 10-16-25-40 | 65 | 480 | 295 | 165 | 195 |
| 135 | | 63 | | 550 | 350 | 190 | 255 |
| 136 | | 100 | | 550 | 355 | 190 | 270 |
| 137 | | 160 | | 585 | 355 | 200 | 275 |
| 138 | | 250 | | 700 | 405 | 250 | 480 |
| 151-152-153-154 | 200 | 10-16-25-40 | 80 | 600 | 395 | 200 | 355 |
| 155 | | 63 | | 650 | 405 | 215 | 467 |
| 156-157 | | 100-160 | | 680 | 430 | 225 | 550 |
| 158 | | 250 | | 830 | 485 | 290 | 920 |
| 161-162-163-164 | 250 | 10-16-25-40 | 100 | 730 | 475 | 240 | 460 |
| 165 | | 63 | | 775 | 520 | 260 | 680 |
| 166-167 | | 100-160 | | 800 | 560 | 270 | 970 |
| 168 | | 250 | | 900 | 560 | 310 | 1470 |
| 171-172-173-174 | 300 | 10-16-25-40 | 125 | 850 | 530 | 280 | 1020 |
| 175 | | 63 | | 900 | 550 | 300 | 930 |
| 176-177 | | 100-160 | | 1050 | 650 | 360 | 1600 |
| 178 | | 250 | | 1200 | 720 | 420 | 2100 |



P = Pump outlet
 R = Pipeline/ process
 B = Bypass connection
 (A = Start-up connection as option)

ASME

| Size | DN _R /DN _P | PN | DN _B | L (mm) | S (mm) | H (mm) | Weight (kg) |
|------|----------------------------------|------|-----------------|--------|--------|--------|-------------|
| 073 | 1½" | 150 | 1" | 200 | 155 | 75 | 19 |
| 075 | | 300 | | 260 | 190 | 90 | 34 |
| 076 | | 600 | | 260 | 190 | 90 | 34 |
| 077 | | 900 | | 300 | 200 | 110 | 34 |
| 078 | | 1500 | | 310 | 215 | 120 | 47 |
| 083 | 2" | 150 | 1" | 230 | 163 | 90 | 26 |
| 085 | | 300 | | 300 | 185 | 115 | 48 |
| 086 | | 600 | | 300 | 193 | 110 | 56 |
| 087 | | 900 | | 340 | 203 | 130 | 56 |
| 088 | | 1500 | | 350 | 233 | 130 | 85 |
| 093 | 2½" | 150 | 1½" | 290 | 174 | 110 | 37 |
| 095 | | 300 | | 340 | 199 | 125 | 56 |
| 096 | | 600 | | 340 | 220 | 125 | 83 |
| 097 | | 900 | | 380 | 230 | 140 | 83 |
| 098 | | 1500 | | 400 | 250 | 145 | 89 |
| 103 | 3" | 150 | 1½" | 310 | 191 | 115 | 48 |
| 105 | | 300 | | 380 | 220 | 140 | 69 |
| 106 | | 600 | | 380 | 240 | 140 | 85 |
| 107 | | 900 | | 410 | 250 | 150 | 85 |
| 108 | | 1500 | | 450 | 275 | 165 | 125 |
| 113 | 4" | 150 | 2" | 350 | 211 | 125 | 72 |
| 115 | | 300 | | 430 | 240 | 155 | 105 |
| 116 | | 600 | | 430 | 266 | 155 | 150 |
| 117 | | 900 | | 450 | 280 | 160 | 150 |
| 118 | | 1500 | | 520 | 300 | 190 | 200 |
| 123 | 5" | 150 | 2" | 400 | 266 | 135 | 100 |
| 125 | | 300 | | 500 | 290 | 175 | 183 |
| 126 | | 600 | | 500 | 300 | 175 | 223 |
| 127 | | 900 | | 525 | 310 | 185 | 223 |
| 128 | | 1500 | | 650 | 341 | 235 | 345 |
| 133 | 6" | 150 | 2½" | 480 | 295 | 165 | 195 |
| 135 | | 300 | | 550 | 350 | 190 | 255 |
| 136 | | 600 | | 550 | 355 | 190 | 270 |
| 137 | | 900 | | 585 | 355 | 200 | 275 |
| 138 | | 1500 | | 700 | 405 | 250 | 480 |
| 153 | 8" | 150 | 3" | 600 | 395 | 200 | 355 |
| 155 | | 300 | | 650 | 405 | 215 | 467 |
| 156 | | 600 | | 680 | 430 | 225 | 550 |
| 157 | | 900 | | 700 | 430 | 225 | 550 |
| 158 | | 1500 | | 880 | 485 | 310 | 920 |
| 163 | 10" | 150 | 4" | 730 | 475 | 240 | 460 |
| 165 | | 300 | | 775 | 520 | 260 | 677 |
| 166 | | 600 | | 800 | 560 | 270 | 970 |
| 167 | | 900 | | 800 | 560 | 270 | 970 |
| 168 | | 1500 | | 980 | 570 | 340 | 1470 |
| 173 | 12" | 150 | 5" | 850 | 530 | 280 | 1020 |
| 175 | | 300 | | 900 | 550 | 300 | 930 |
| 176 | | 600 | | 1050 | 650 | 360 | 1600 |
| 177 | | 900 | | 1050 | 650 | 360 | 1600 |
| 178 | | 1500 | | 1250 | 720 | 440 | 2100 |



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