Series TD
Type TDL, Type TDM
Automatic Recirculation Valve for Pump Protection

CIRCOR ENERGY | Schroedahl

5/16 Version 1

Series TD

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

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

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Series TD

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 high quality and an easier solution for clean liquid pump protection - more cost effective than a conventional modulating control valve package.

Figure 1

Sectional Drawing of an Automatic Recirculation Valve Type TDM

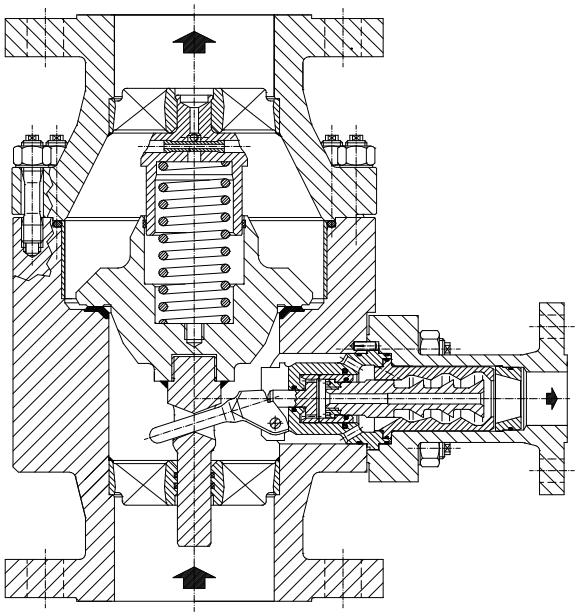
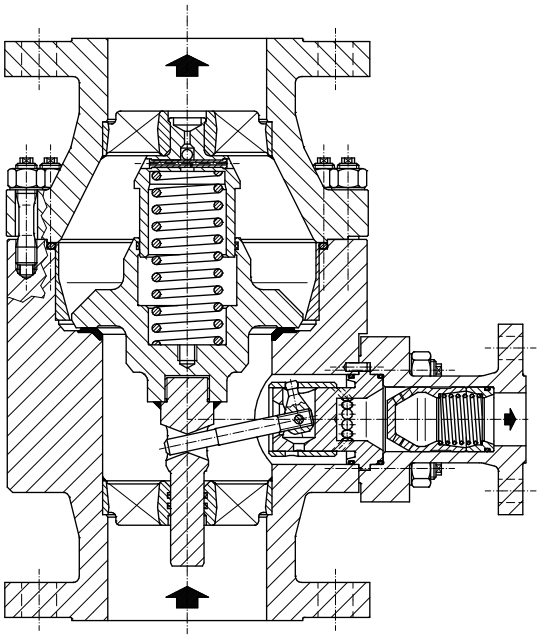


Figure 2

Sectional Drawing of an Automatic Recirculation Valve Type TDL



Operation of the Automatic Recirculation Valves

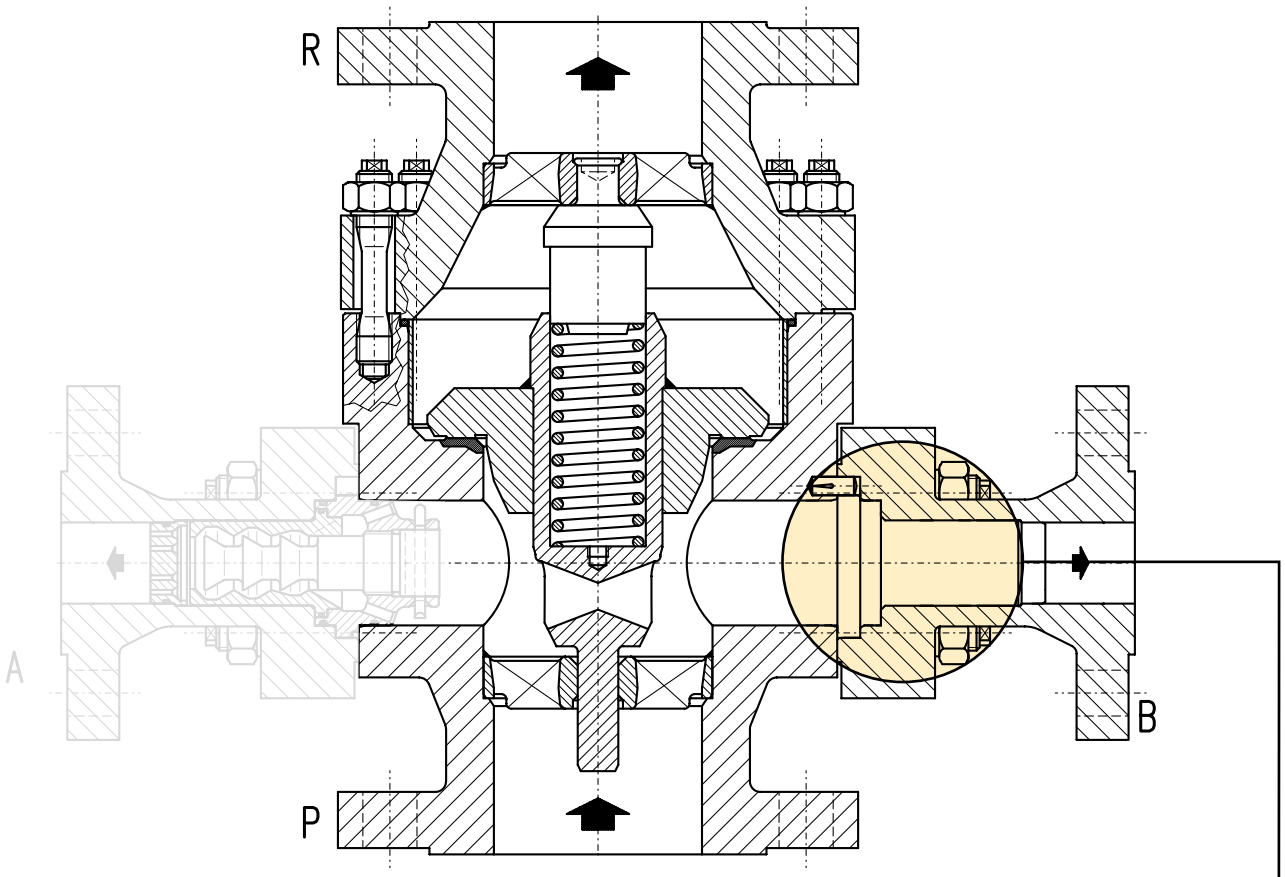


Figure 3

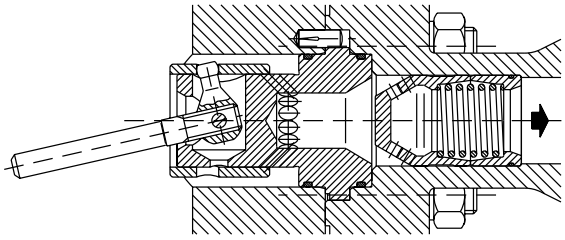


Figure 4: Type TDL

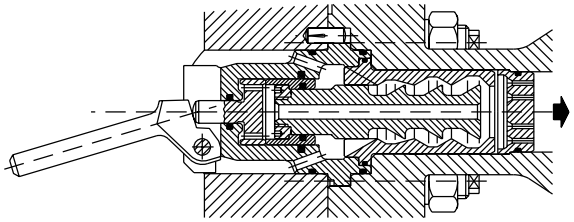


Figure 5: Type TDM

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. 3 and 4) 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

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.

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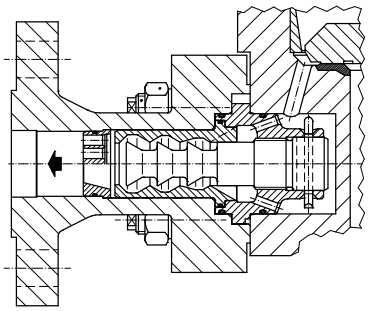
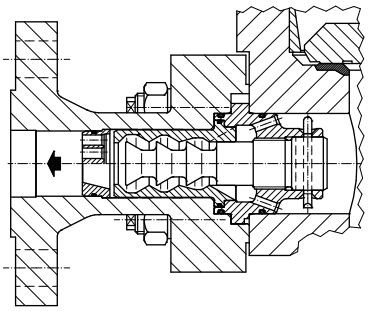
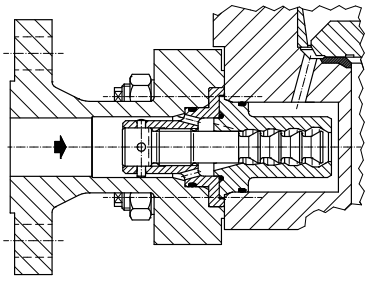
Options A:



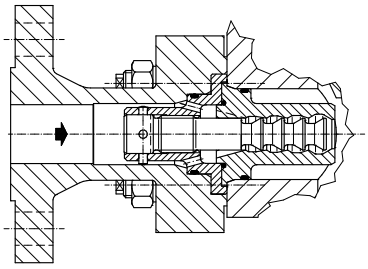
A1



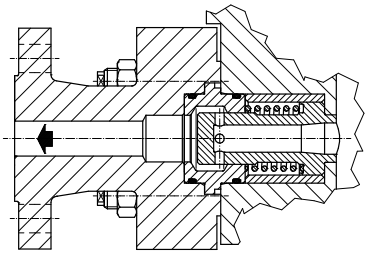
A2



A3



A4



A5

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

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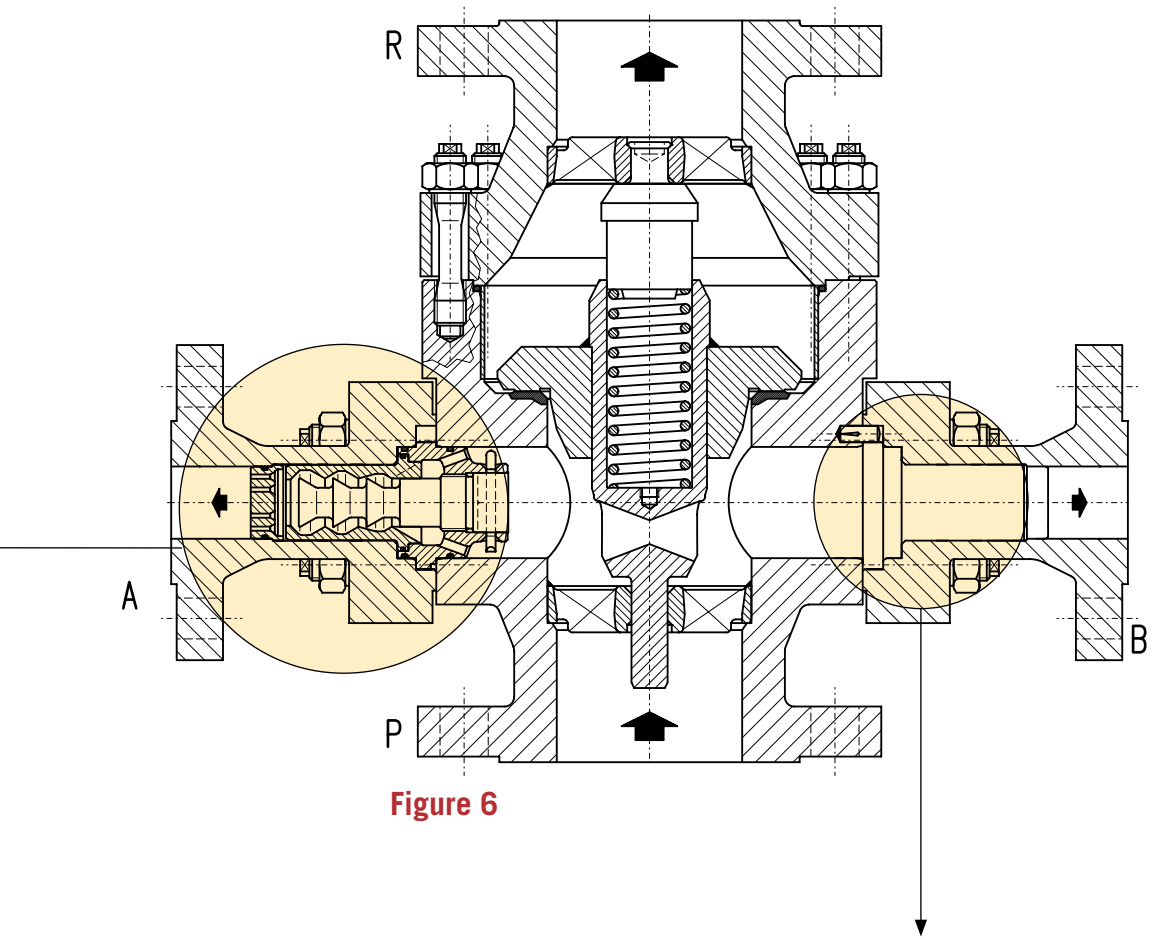
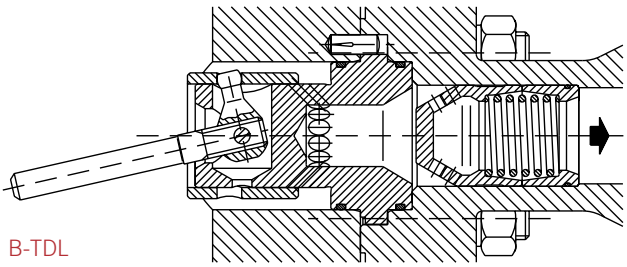
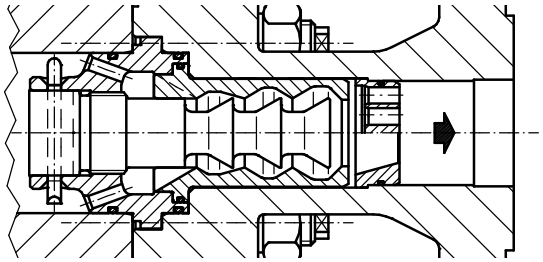


Figure 6

Options B:



B-TDL



B-TDM

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)

Series TD

Valve sizes

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

Pressure Rating

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

Connections

Flanges are standard according to EN 1092-1 or ASME. Flanges according to other standards (EN 1092-1, 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”) 06 = DN 32 (1 1/4”) 07 = DN 40 (1 1/2”) 08 = DN 50 (2”) 09 = DN 65 (2 1/2”) 10 = DN 80 (3”) 11 = DN 100 (4”) 12 = DN 125 (5”) 13 = DN 150 (6”) 15 = DN 200 (8”) 16 = DN 250 (10”) 17 = DN 300 (12”)	1 = PN10 2 = PN 16 3 = PN 25 (Class 150) 4 = PN 40 7 = PN 160 (Class 900) 8 = PN 250 (Class 1500) 9 = PN 320 0 = PN 400 (Class 2500)	F = Flanges acc. to EN 1092-1 U = Flanges acc. to ASME S = Welding Ends (not for bypass) J = Japanese Standard B = British Standard	V = Vertical Installation H = Horizontal Installation A = Manual start-up connection W = Standard oversized bypass CS = Carbon Steel SS = Stainless Steel SD = Duplex Steel

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 via schroedahl@circor.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 valve 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.

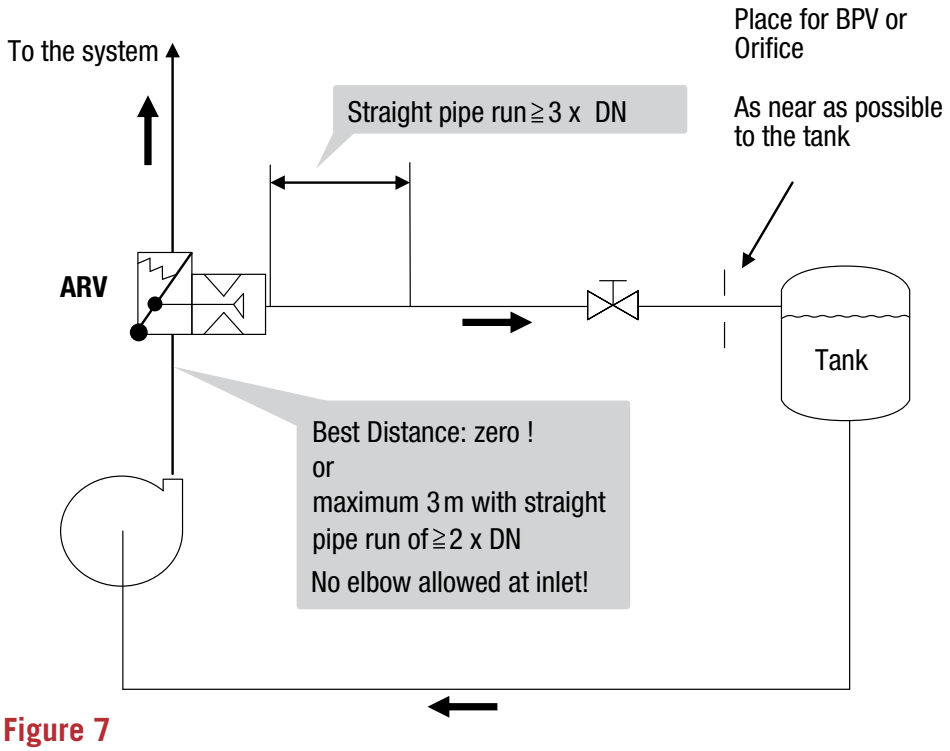
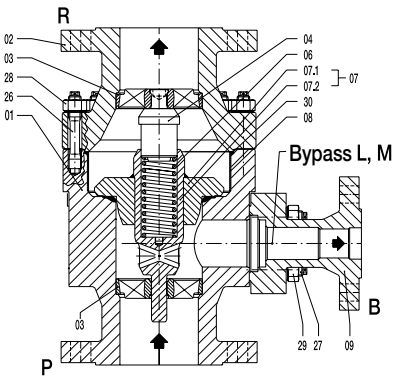


Figure 7

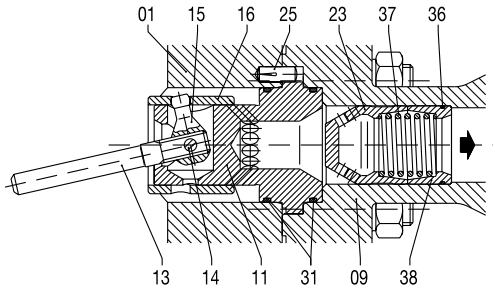
Parts List

Housing



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

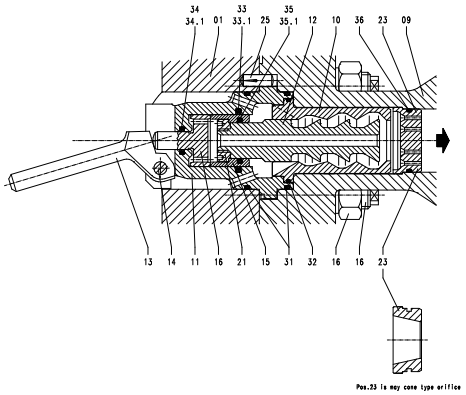
Bypass L



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

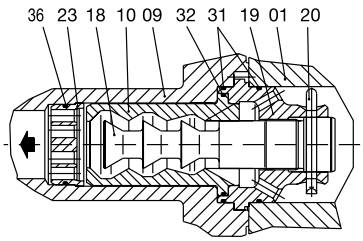
Parts List

Bypass M



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 (Option A1, Example)



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.

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 (m^3/h)		16	26	35	55	100	150	250	400	530	860	1240	1780
Bypass L /M	DN (mm)	25	25	25	25	40	40	50	50	65	80	100	125
see Fig.3/4	DN (inch)	1	1	1	1	1½	1½	2	2	2½	3	4	5
Max. Bypas flow P-B (m^3/h)		18	18	18	18	40	40	65	65	115	180	280	480

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.

Example Valve Selection

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

Qmin = Minimum flow in m^3/h, s.g. specific gravity in kg/dm^3
Δp = Differential pressure in bar over the bypass at minimum flow

Conditions: DN 100 pump, PN 100, main flow is 180 m^3/h, required bypass flow is 40 m^3/h, S.G. is 0.95, Δp is 70 bar at Q_{min}.

Selection: a. The main flow is in the range of a DN 100 valve.
b. The Δp at minimum flow is ≥ 40 bar, this means that we have to select a valve type TDM.
c. Kv = 40 x 0.95 / 70 = 4.8 m^3/h , this means a DN 100 valve with a DN 50 bypass can be used as the maximum K_v is 5.4 m^3/h.

Automatic Recirculation Valve Technical Data

Customer: _____ Data Sheet: _____

Enquiry no.: _____ _____

Prior reference: _____ Quantity: _____

Project: _____ Order no.: _____

Automatic Recirculation Valve type:_____

Valve inlet (in.) DN _____ PN _____ Flange Code: _____

Valve outlet (in.) DN _____ PN _____ Installation: vertical _____ horizontal _____

Bypass outlet (in.) DN _____ PN _____ Paint: _____

Start-up (in.) DN _____ PN _____ Start-up: above _____ below check valve _____

Mat.-/test certificates: _____

Materials: _____

Housing: _____ Internals: _____ Seals: _____

Medium: _____ Operating temp. (°C): _____

S.G. (kg/m³): _____ Design temp. (°C): _____

H_0 = _____m

Q_M = _____m³/h H_M = _____m Suction pr. pv _____barg

Q_{100} = _____m³/h H_{100} = _____m Differential pr. (p_1-p_n) _____bar

Q_{max} = _____m³/h H_{Qmax} = _____m Backpress p_N _____barg

Q_A = _____m³/h H_A = _____m Backpress p_A _____barg

Notes: _____

_____

_____

Revision _____ Date _____ Description_____

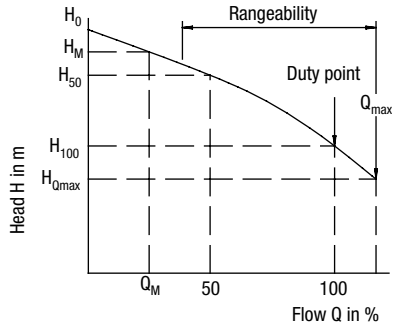
Name _____ Signature _____

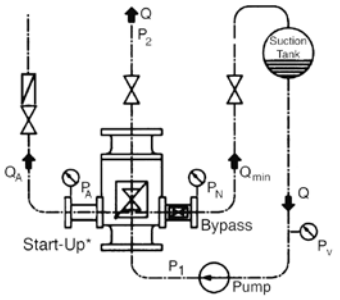
Revision _____ Date _____ Description_____

Name _____ Signature _____

Revision _____ Date _____ Description_____

Name _____ Signature _____





Dimensions

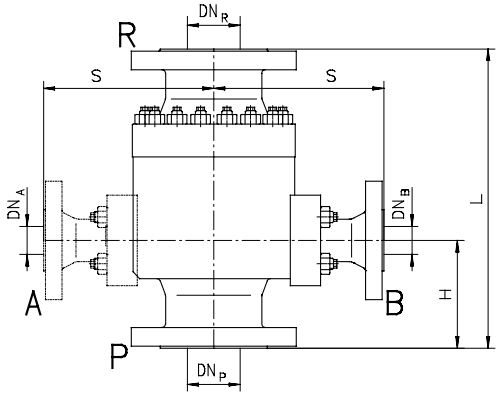
EN

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	182	90	30
066		100		300	182	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	47
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	677
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

Dimensions

ASME

Size	DN_R/DN_P	PN	DN_B	L (mm)	S (mm)	H (mm)	Weight (kg)
073		150		200	155	75	19
075		300		260	190	90	34
076	1½"	600	1"	260	190	90	34
077		900		300	200	110	34
078		1500		310	215	120	47
083		150		230	163	90	26
085		300		300	185	115	40
086	2"	600	1"	300	193	110	56
087		900		340	203	130	56
088		1500		350	233	130	85
093		150		290	174	110	37
095		300		340	199	125	56
096	2½"	600	1½"	340	220	125	83
097		900		380	230	140	83
098		1500		400	250	145	89
103		150		310	191	115	48
105		300		380	220	140	69
106	3"	600	1½"	380	240	140	85
107		900		410	250	150	85
108		1500		450	275	165	125
113		150		350	211	125	72
115		300		430	240	155	105
116	4"	600	2"	430	266	155	150
117		900		450	280	160	150
118		1500		520	300	190	200
123		150		400	266	135	100
125		300		500	290	175	183
126	5"	600	2"	500	300	175	223
127		900		525	310	185	223
128		1500		650	341	235	345
133		150		480	295	165	195
135		300		550	350	190	255
136	6"	600	2½"	550	355	190	270
137		900		585	355	200	275
138		1500		700	405	250	480
153		150		600	395	200	355
155		300		650	405	215	467
156	8"	600	3"	680	430	225	550
157		900		700	430	225	550
158		1500		880	485	310	920
163		150		730	475	240	460
165		300		775	520	260	677
166	10"	600	4"	800	560	270	970
167		900		800	560	270	970
168		1500		980	570	340	1470
173		150		850	530	280	1020
175		300		900	550	300	930
176	12"	600	5"	1050	650	360	1600
177		900		1050	650	360	1600
178		1500		1250	720	440	2100



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

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CIRCOR Energy is a global manufacturer of highly engineered valves, fittings, pipeline and associated products for general, critical and severe service applications in the Oil & Gas, Power Generation and Process Industry markets. CIRCOR Energy continuously develops precision technologies to improve our customers' ability to control the flow of the world's natural resources.

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