INNO-ARV® - Automated Recirculation Valves

Pump Protection System

6D-1409

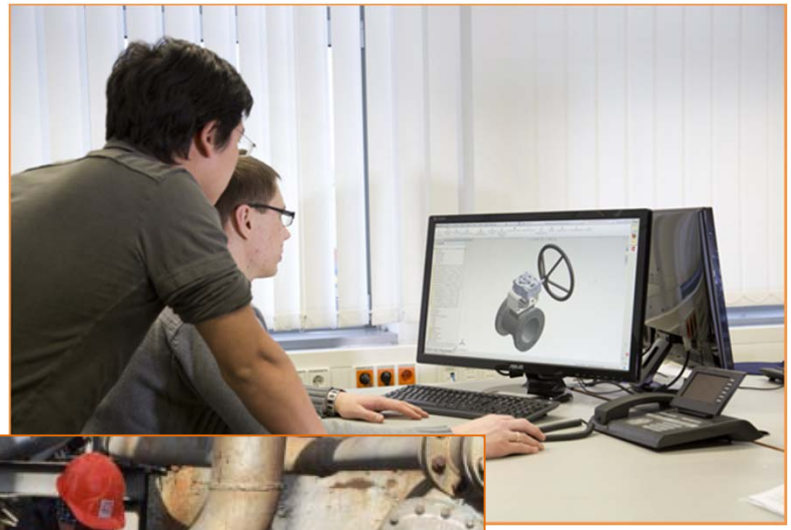
MIAM – Company

- Privately owned company for manufacturing of industrial valves
- Operating in Historic Magdeburg where valves have been manufactured for over 170 years
- Specialized in innovative and custom made valve designs
- Current key business are
  - own patented design of a metal-to-metal seated butterfly valve (INNO-ECC®),
  - a metal-to-metal seated lift plug valve (INNO-CON®) with a patented lifttorque operator,
  - API6D piggable swing check valves,
  - high pressure valves, as well as
  - custom made valve solutions like line blinds or pump protection systems

MIAM – Company

- Qualified personnel with the common background of having worked in the high end valve manufacturing industry for developing and manufacturing high quality valves for special applications for many years

- MIAM and its employees are dedicated to satisfy the highest expectations of its customers with our substantial experience in designing and manufacturing valves for the refinery, chemical and power market



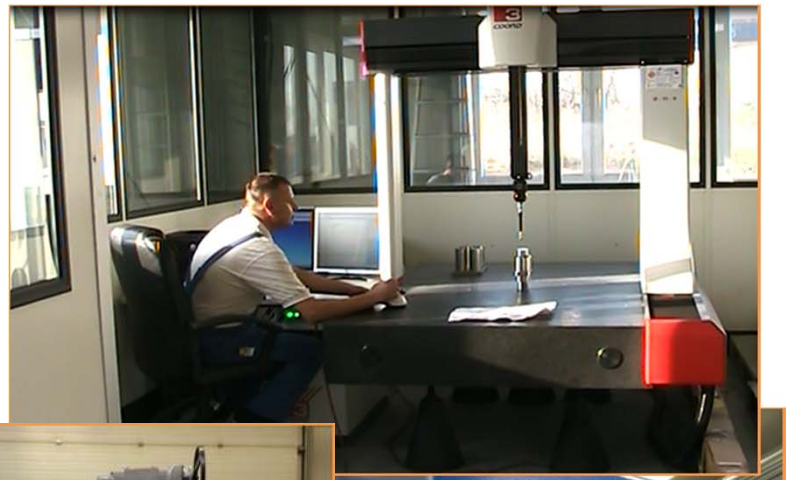
- MIAM is certified ISO 9001-2008 and PED2014/68/EC for developing and manufacturing industrial valves. MIAM is a 6D MONOGRAM holder of the API – American Petroleum Institute for gate, check and metal seated plug valves. Additionally we are GOST certified.

- Design Standards for valve designs include AD2000, ASME B16.34, API6D, API609, API600, EN13445

- Conventional as well as modern 5-axes CNC machines for accurate machining of our valve parts
- In house welding processes especially for seat hardfacing

MIAM – Company / Shop Floor

- Quality assurance of critical parts via high precision 3D measuring device
- Final inspection and testing on our test benches



MIAM – Company / QA

performing under pressure

INNO-ECC
Metal Seated
Butterfly Valves

INNO-CHK
Piggable Swing
Check Valves

INNO-CON
Metal Seated
Liftplug Valves

INNO-BLIND
Blinding Device

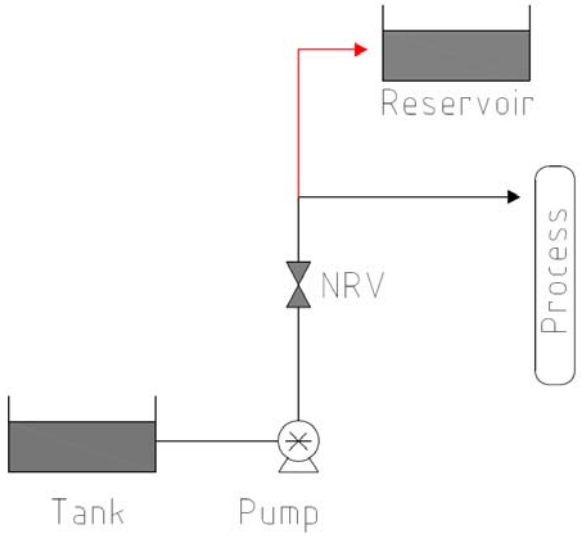
MIAM – Company / Product Range

Pump Protection Systems

- Centrifugal pumps can overheat and see cavitation if they run dry. This can lead to serious damages of the pump.
- To avoid such scenarios it is imperative ensure a minimum flow through the pump at all times
- Such pumps also have no backflow prevention that also needs to be taken into consideration
- Different Solutions are utilized for protection:

Non Return Valve

a. A non return valve is placed on the outlet of the pump along with a reservoir that is used when there is no flow required to the process
b. A reservoir is required
c. There is no flow back to the tank supplying the pump with flow

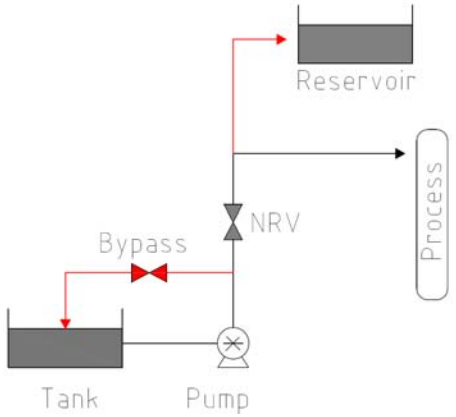


MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems

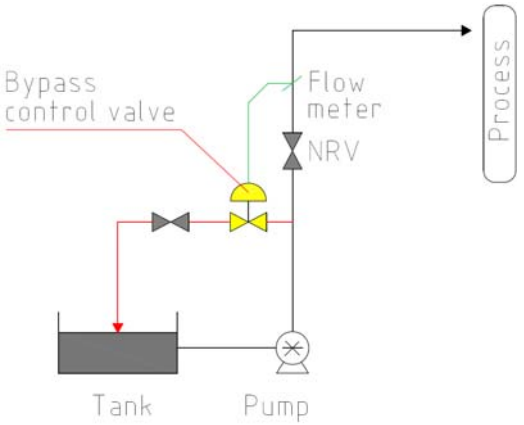
Constant Flow Back

a. Additional to the non return valve placed on the outlet of the pump along with a reservoir that is used when there is no flow required to the process a manual bypass acting as a leakage path back to the tank
b. Constant operation of the flow back to the tank is inefficient and presents a higher operating cost



Control Valve on Bypass

a. A control valve system is placed in the bypass line
b. The control valve is connected to a flow meter that is placed in the main outlet pipe of the pump
c. When the main flow reduces the flow the control valve opens up the bypass line to allow more flow back to the tank to maintain the minimum flow required by the pump
d. Very efficient solution but requires capital investment in different components (control valve with positioner, non return valve, flow metering equipment
e. Eliminates the requirement for a reservoir
f. May require more constant maintenance to ensure correct settings

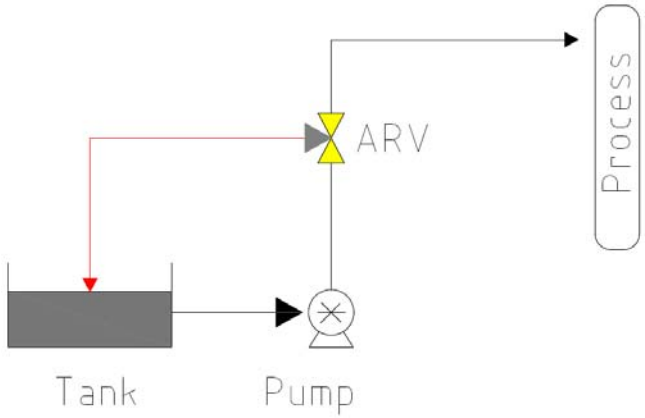


MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems

Automated Recirculation Valve

a. Installed directly into the main outlet pipe of the pump
b. Combines the control valve, the non return valve and the flow metering
c. Automated control of flow between main line and bypass line depending on the flow rate of the pump
d. Safe and reliable system to protect the pump from running dry

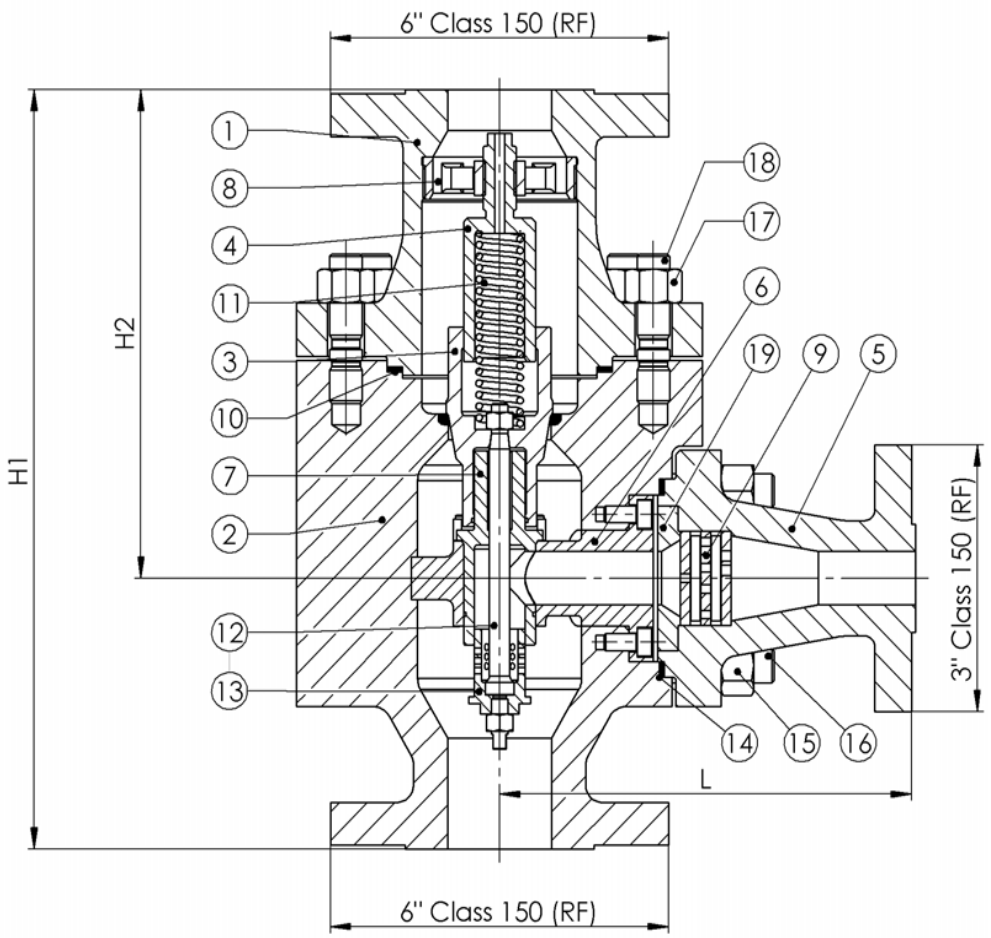


MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems

Parts

Item	Description
1	Body Outlet Flange
2	Body
	Body Seat
3	Plug
4	Adjustable Spring Guide
5	Bypass Outlet Flange
6	Bushing
7	Stem & Plug Guide
8	Guide Plate
9	Throttle Plate
10	Gasket
11	Spring
12	Stem
13	Bypass Plug
14	Gasket
15	Hex. Nut
16	Stud Bolt
17	Hex. Nut
18	Stud Bolt
19	Expansion Plate

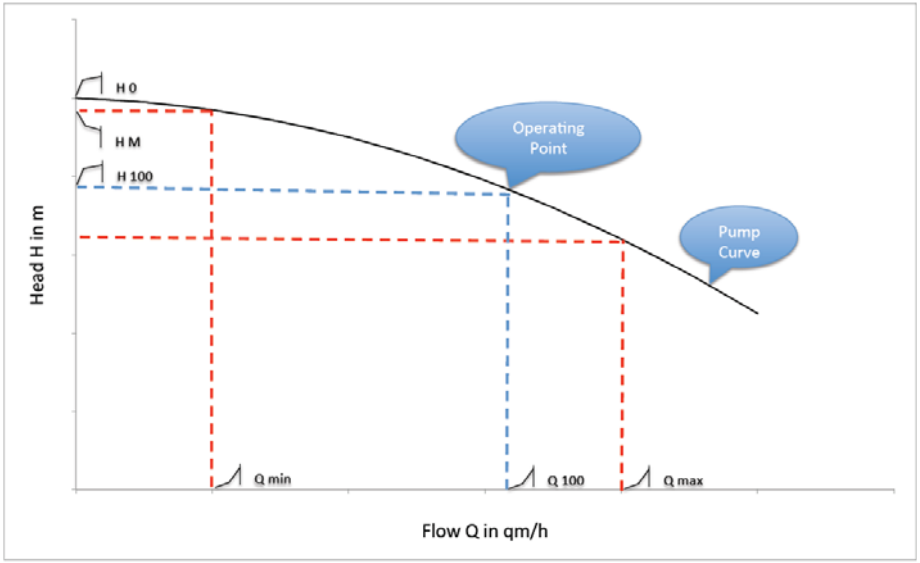


MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems

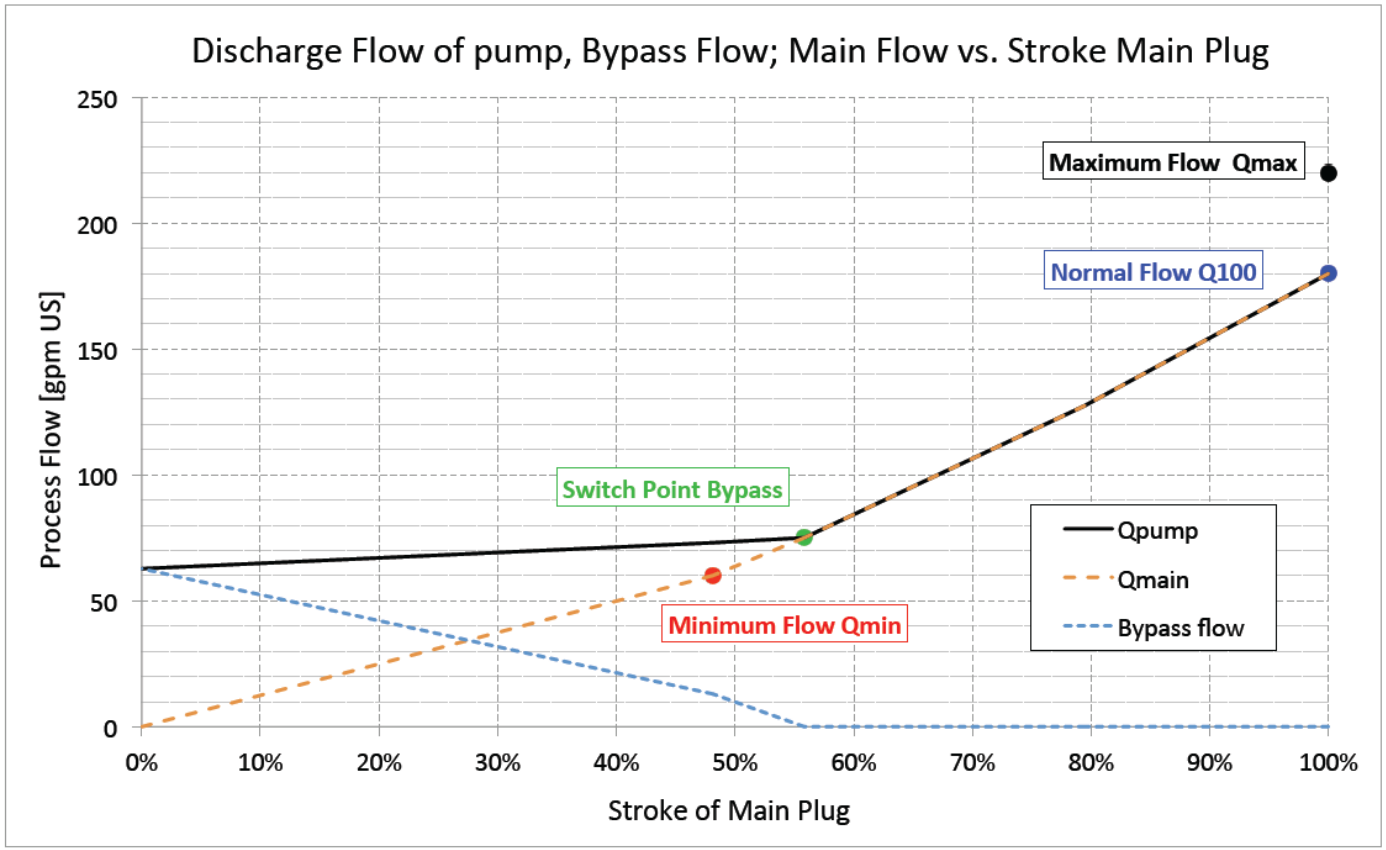
3 Stages of Operation of an Automated Recirculation Valve

1. Main Flow
   - under normal pump operating conditions the ARV main line is fully open and the bypass is fully closed
2. Mixed Flow
   - When the flow is reduced as required by the process the main line check valve inside the ARV starts to reduce the main flow and allows minimal flow through the bypass
3. Bypass Flow
   - When the flow is reduced further as no product is required by the process the check valve inside the ARV closes the main flow and fully opens the bypass flow
   - With bypass flow only the minimum required flow of the pump is maintained and the pump cannot run dry



MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems



MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems

Testing

- Each valve is tested on our in-house testing field
- The shut off and shell tests are performed according to the specified standards
- The design vs. actual flow values and pressures are tested and confirmed

Automatic Recirculation Valve MIAM

1. Design points:		Flow			Pressure			
		gpm US	m³/h		Ft . Hd	psi g	bar g
Normal (operating) flow	Q100	180	40,9	H100	625	271	18,7
Minimum flow (= maximum bypass flow at closed main plug)	Qmin *	60	13,6	Hmin	750	325	22,4
Switch point (start of bypass opening)	Q_{SP} **	75	17,0	H_{SP}	740	321	22,1
Maximum flow	Qmax	220	50,0	Hmax	575	249	17,2

f bypass line at minimum conditions with pmin=22,6 bar g; pback=0,2 bar g; pmin=957

$$Cv = 1{,}156 \cdot Qmin \cdot \sqrt{\frac{1}{pmin - pback} \cdot \frac{\rho min}{1000}} = 3{,}3$$

**: QSP = 1,25xQmin

2. Test Results

Date: 13,06,2017

Location / Manufac-turer: Magdeburger Industriarmatur Manufaktur MIAM

Specimen: Flow Test Rig Water

Specimen: Automatic Recircultin Valve 2" Mainline; 1" Bypass Line

Tester: ; G. Dörner

Quang Tran

measured values in yellow cells

	Pressure drop Main Line		Pressure drop Bypass Line		Flow Main Line		Flow Bypass Line		Flow Coefficient Cv		Calculated Minimum flow Bypass Line with service conditions $Qmin\left(\frac{m^3}{h}\right) = \frac{3{,}9}{1{,}156} \cdot \sqrt{(22{,}4 - 0{,}21) \cdot \frac{1000}{957}}$	
	bar g	psi g	bar g	psi g	m³/h	gpm (US)	m³/h	gpm (US)	Main Line	Bypass Line	m³/h	gpm (US)
1. Main Line	1,5	21,75			46,6	205,2			44,0			
	1	14,5			39,9	175,7			46,1			
2. Switch point	0,6	8,7			22	96,9						
	0,5	7,25			16,7	73,5						
3. Bypass flow	0	0	1	14,5	0	0,0	3,4	15,0		3,9	16,4	72,2
	0	0	0,2	2,9	0	0,0	1,5	6,6		3,9	16,2	71,2

ARV; ARV_Test

MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems

Range:

- 1” – 16” Inlet/Outlet Size, larger on request
- Cl 150 – Cl 600, higher on request
- Flanged acc. ASME B16.5, EN1092-1, BW Ends
- Carbon Steel, Stainless Steel, Alloy Steels, Titanium, Duplex
- Linear or equal % control characteristic
- Vertical or Horizontal installation

MIAM – INNO-ARV – Pump Protection System

Pump Protection Systems

Applications:

- Centrifugal Pumps
- Boiler Feed Water Pumps
- Crude Oil Pumps
- Tank Farm Feed Pumps
- Cooling Process Feed Pumps
- Fluidized Gas Pumps such as in LNG, LPG
- Process Plants Liquid Pumps
- Seawater Pumps
- Offshore Pumps
- Fire Fighter Water Feed Pumps
- Refinery Processing
- Chemical Plants
- Power Plants
- LNG/LPG
- Offshore

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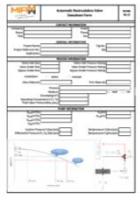
Pump Protection Systems

Information Required for Sizing:

1. Please fill the form to enable us to size your ARV according to your conditions
2. Additional please provide your pump operation curves



	Automatic Recirculation Valve Datasheet Form	REV00 06.15

CONTACT INFORMATION

Company: | Email:
Name: | Phone
Title: | Fax:

GENERAL INFORMATION

Project Name: | Tag No.:
Project Reference No.: | Qty
Application:

PROCESS INFORMATION

Valve Inlet Size: | Valve Inlet Pressure Rating:
Valve Outlet Size: | Valve Outlet Pressure Rating:
Bypass Outlet Size: | Bypass Outlet Pressure Rating:

Installation: ☐ Vertical ☐ Horizontal

Valve Material: | Trim Material:

Process:
Medium: ☐ Liquid ☐ Gas
Density(Kg/m³):
Operating Temperature (°C / °F):
Fluid Vapor Pressure(bar_a/psi_a):

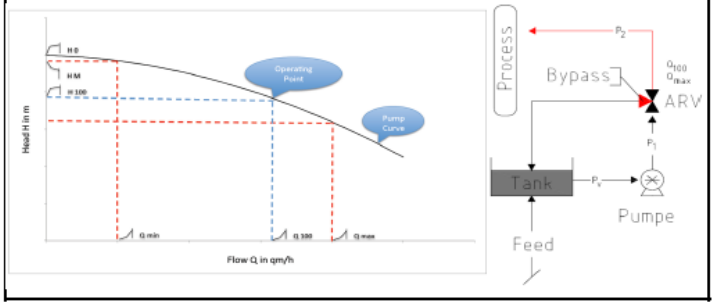
PUMP INFORMATION

Q_{min}(m³/h):
Q_{100}(m³/h):
Q_{max}(m³/h):
Q_{by}(m³/h):

H_m(m):
H_{100}(m):

Suction Pressure P_v(bar/psi):
Differential Pressure (P_1-P_N) (Bar/psi):

Backpressure P_1(bar/psi):
Backpressure P_N(bar/psi):



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Thank You!

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