OPTIMA Compact EP

DN50-DN200

Application

OPTIMA Compact EP (Extended Performance) pressure independent balancing & control valves (PICVs) are used in applications with high demands for temperature and differential pressure, such as district heating and low-temperature cooling applications. The OPTIMA Compact EP provides modulating control with full authority, regardless of any fluctuations in the system's differential pressure.

The OPTIMA Compact EP combines an externally adjustable balancing valve, a differential pressure control valve, and a full-authority modulating control valve. This integration makes it simple to achieve 100% control of the flow in the building, enhancing comfort and achieving energy savings simultaneously.

An additional benefit is that no balancing is required when further stages are added to the system or when the dimensioned capacity changes. Energy savings are achieved through optimal control, lower flow, and reduced pump pressure. The maximised ΔT, due to faster response and increased system stability, further contributes to overall efficiency.

Benefits

Design

- Less time to define the necessary equipment for a hydraulic balanced system (only flow data are required)
- No need to calculate valve authority - always one
- Flexibility if the system is modified after the initial installation

Installation

- No further regulating valves required in the distribution pipework when OPTIMA Compact EP is installed at the units
- Total number of valves minimized due to the 3-in-1 design
- Minimized commissioning time due to automatic balancing of the system
- No minimum straight pipe lengths required before or after the valve

Operation

- High comfort for the end-users due to high precision temperature control
- Longer life due to less movements of the actuator

Features

- The valve is specifically engineered to operate efficiently across a wide temperature range, from -10°C to +150°C, ensuring reliable performance in both low and high-temperature environments
- Differential pressure operating range up to 1200 kPa
- The presetting function has no impact on the stroke; Full stroke modulation at all times, regardless the preset flow
- Regulation characteristic remains unchanged regardless of preset flow
- The constant differential pressure across the modulating control component guarantees 100% authority
- Automatic balancing eliminates overflows, regardless of fluctuating pressure conditions in the system
- Motoric actuator 0-10 V, 4-20 mA and 3 point control
- High flows with minimal required differential pressure due to advanced design of the valve
- Small dimensions due to compact housing
- Higher presetting precision due to stepless analogue scale
- Rangeabililty > 100:1

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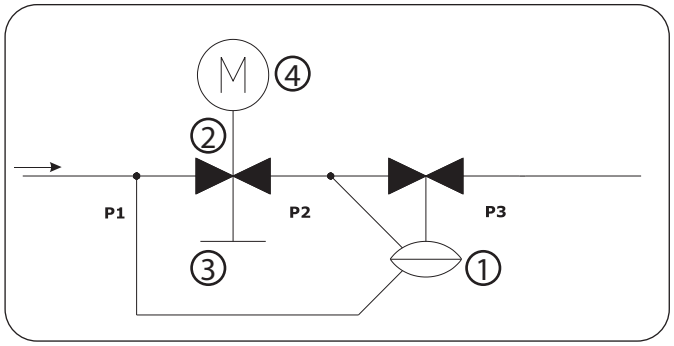


Design

The design of OPTIMA Compact EP combines high performance and a compact design.

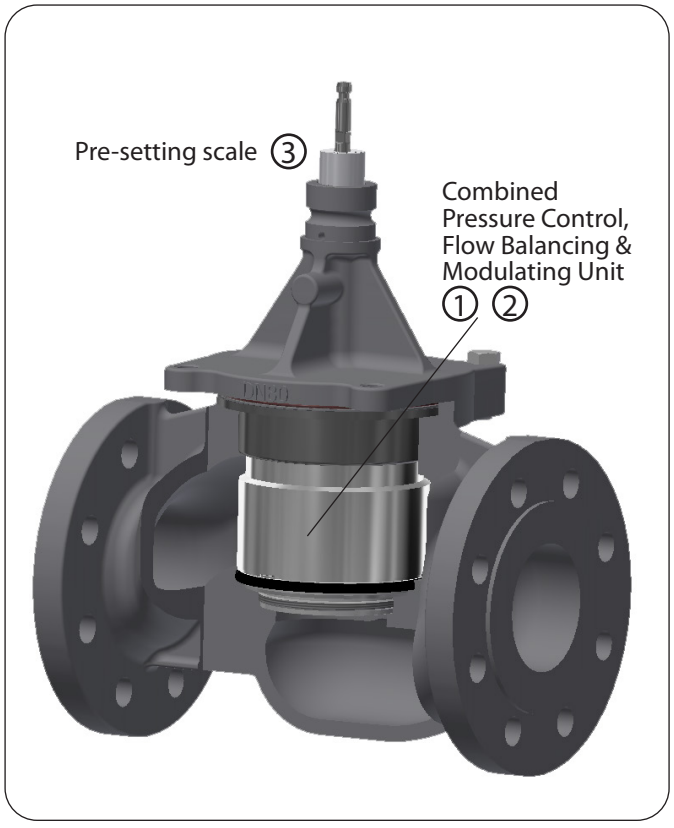
The main components of the valve are:

① Differential pressure control

② Modulating control component

③ Presetting scale

④ Actuator



Function

The OPTIMA Compact EP can be flushed and commissioned before the actuator is installed.

The presetting of the dial is user-friendly requiring only a simple flow vs. presetting graph.

Once the flow is set, the actuator can be mounted and the valve ready to operate.

For lowest energy consumption, check the differential pressure at the index valve to set the pump at minimum speed.

Operating Pressure

OPTIMA Compact EP DN50-DN200 can operate to a maximum differential pressure of 1200 kPa (12 bar)

Close Off Pressure

The OPTIMA Compact EP is capable of closing against the following differential pressure to EN 1349 Class IV:

DN50 to DN125: 1200 kPa - based on 800N actuator force
DN150 to DN200: 1200 kPa - based on 1100N actuator force

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Operation principle

The innovative design of OPTIMA Compact EP features a modulating control component that retains 100% authority at all times.

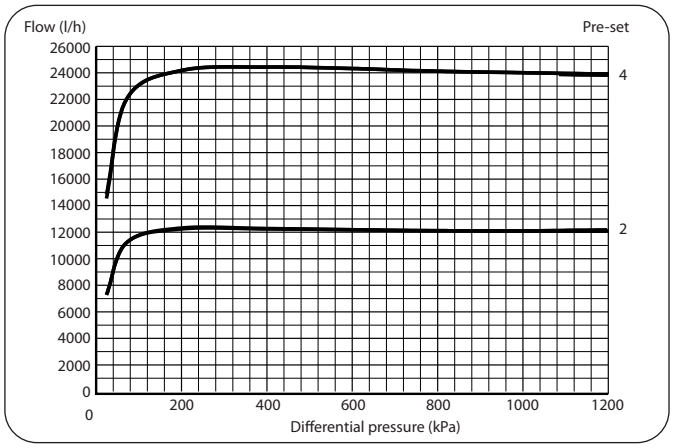
With the OPTIMA Compact EP, there are two independent movements for the presetting and the modulating function.

During presetting, the inlet area moves radially without interfering with the length of the stroke. During modulating, the inlet area moves axial taking advantage of the full stroke. Whilst the control component provides proportional modulation irrespective of the preset flow, the automatic balancing guarantees that the flow will never exceed the maximum preset flow.

Regardless of pressure fluctuations in the system, the maximum flow is kept constant up to a maximum differential pressure of 1200 kPa.

Flow rate vs. Differential Pressure

Preset flow: 24000 l/h, 12000 l/h



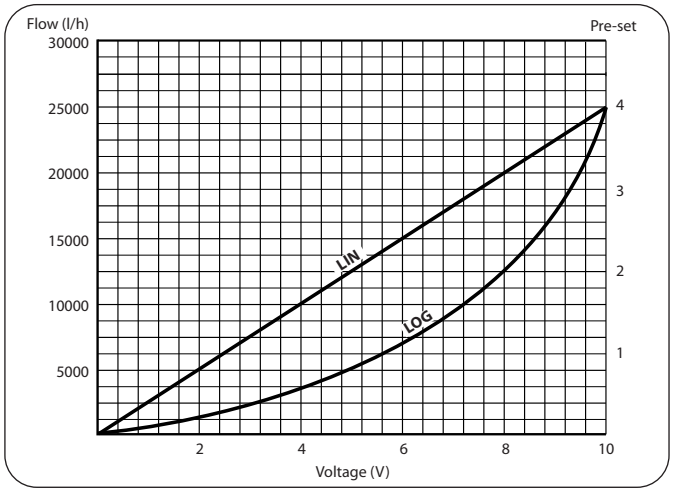
Flow rate vs. Voltage

Preset flow: 25000 l/h

Valve Characteristic:

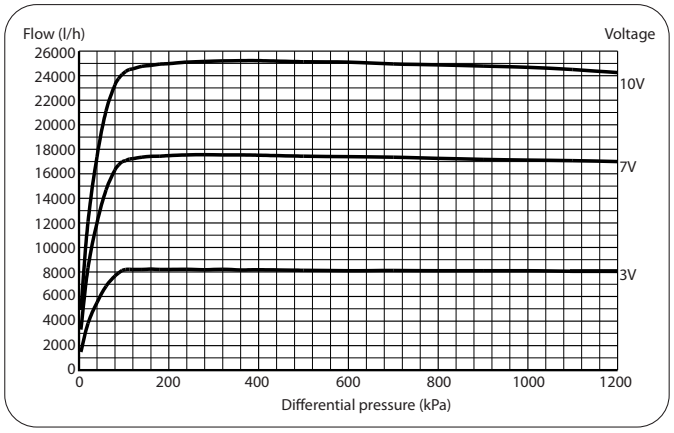
OPTIMA Compact EP valve design has a linear control characteristic. The control characteristic is independent of the flow setting and available pressure.

Because of the independent characteristic the actuator setting can be used to change the valve response from linear to logarithmic (Equal Percentage).



Flow rate vs. Differential Pressure

Voltage: 10V, 7V, 3V
(Liniar actuator characteristic)



OPTIMA Compact EP

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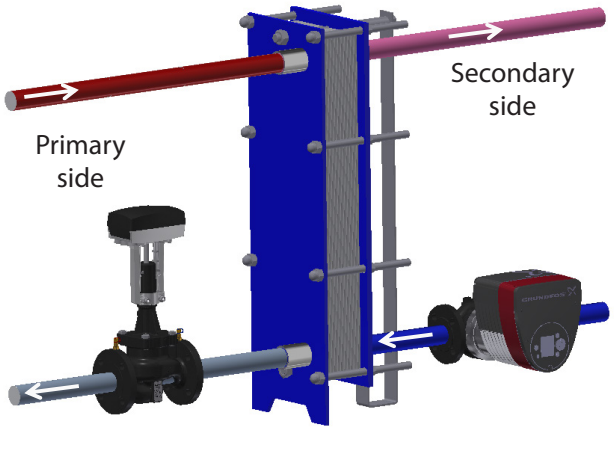
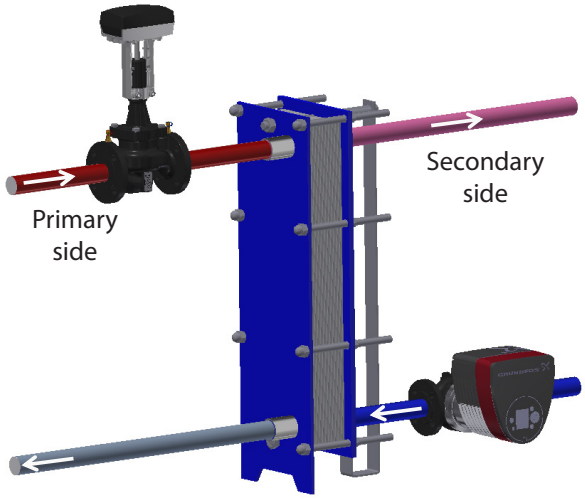
Application Diagrams

OPTIMA Compact EP can be installed in any heating and cooling system where full pressure independent modulating control is required. The valve can be installed both on the flow and return side of a plate heat exchanger, as long as the temperature and differential pressure specifications are taken into consideration.



OPTIMA Compact EP installed on the return side



OPTIMA Compact EP installed on the flow side

OPTIMA Compact EP sizing example

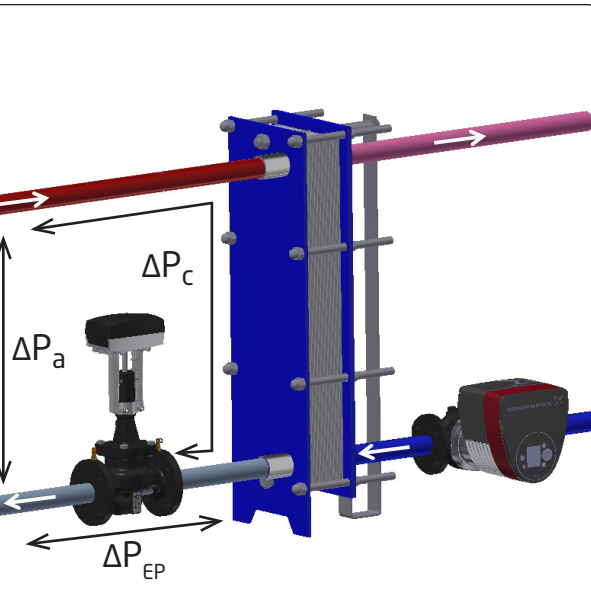
A district heating substation should be sized for a building's central heating system.

The substation uses a heat exchanger. The flow through the heat exchanger must be controlled by means of a motorized valve in order to achieve the required water temperature on the secondary system side.

OPTIMA Compact EP is chosen for the application.

The valve must be sized for the following conditions:

- The heat exchanger must provide 750 kW
- The supply water temperature on the primary system side is 130°C
- The return water temperature on the primary system side is 70°C
- The differential pressure available on the primary system side is ΔP_a = 900 kPa (9 bar)
- The pressure loss in all the pipes, heat exchanger and other components of the substation except for the control valve (OPTIMA Compact EP) is ΔP_c= 50 kP$_a$ (0.5 bar)



OPTIMA Compact EP

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OPTIMA Compact EP sizing example (continued...)

The required flow through OPTIMA Compact EP is:

$$Q = \frac{E\ [kW]}{cp\ [kJ/(kg\ K)] * \rho\ [kg/dm^3] * \Delta T[K]}$$

cp – water heat capacity, kJ/(kg K)

ρ – water density, kg/dm^3

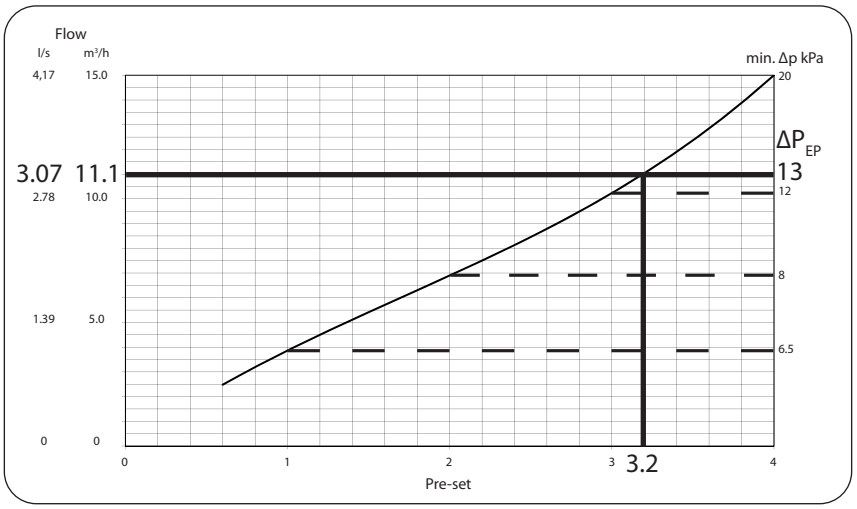
ΔT – supply and return water temperature difference, K

E – heat exchanger capacity, kW

$$Q = \frac{750\ kW}{4.20\ [kJ/(kg\ K)] * 0{,}970\ [kg/dm^3] * (130\text{-}70)K} = 3{,}07\ dm^3/s = 11{,}100\ l/h$$

The required OPTIMA Compact EP should be selected based on the graphs.

In this case the OPTIMA Compact EP DN50 LF meets the specification.



The selected OPTIMA Compact EP DN50 LF requires ΔP_{EP} = 13 kPa of differential pressure and should be set to position 3.2 to provide the sizing flow.

The total required pressure loss in the substation is:

$$\Delta Pc + \Delta P_{EP} = 50\ kPa + 13\ kPa = 63\ kPa$$

It is lower than the available differential pressure in the substation: ΔPa = 900 kPa.

The greatest differential pressure that OPTIMA Compact EP could be subjected to in the substation during sizing conditions is:

$$\Delta Pmax = \Delta Pa - \Delta Pc = 900kPa - 50kPa = 850\ kPa$$

Since OPTIMA Compact EP can operate at a differential pressure of 1200 kPa (12 bar) and the greatest differential pressure in the district heating system is 900 kPa, the valve can be used in the substation.

No additional differential pressure control valve is required in the substation as the integrated in OPTIMA Compact EP differential pressure controller will compensate for any pressure fluctuations in the district heating system.

OPTIMA Compact EP

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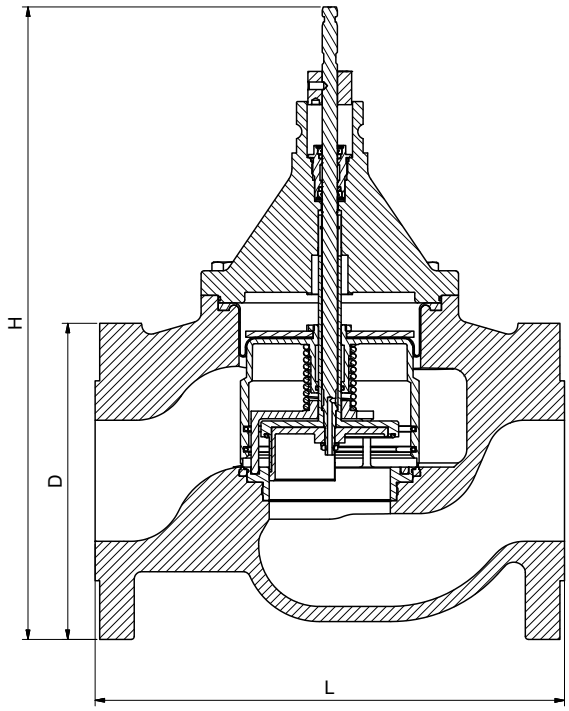
Technical data · DN50 - DN80

Valve housing DN50-DN65:	GJL-250 PN16 GJS-400 PN25
Valve housing DN80:	GJS-400 PN16/PN25
DP controller:	Stainless steel
Spring:	Stainless steel
Diaphragm:	Reinforced EPDM
O-rings:	EPDM
Pressure class:	PN16/25
Stroke:	20 mm
Flange connections:	ISO 7005-2 / EN 1092-2
Max. differential pressure:	1200 kPa
Medium temperature:	-10°C to 150°C

When used at temperatures below 0°C, a stem heater must be used, to prevent ice on the spindle



The pipe system shall be properly ventilated to avoid risk of air pockets. Glycolic mixtures up to 50 % are applicable (both ethylene and propylene). Frese A/S can accept no responsibility if another actuator is used instead of the Frese actuator. Recommendation: Water treatment to VDI 2035.

Dimension & Weight · DN50 - DN80

Dim.		DN50	DN65	DN80
Dimensions [mm]	L	230	290	310
	H	367	384	413
	D	165	185	200
Weight [kg]		14.5	18.9	27.3

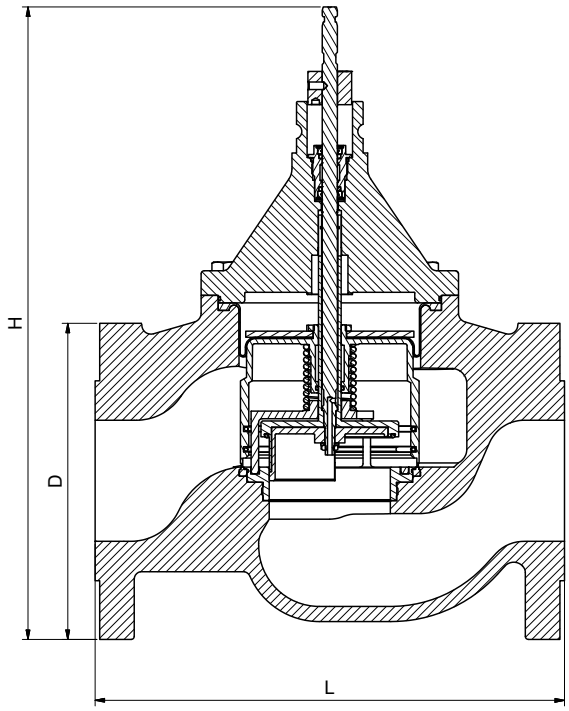
OPTIMA Compact EP

DN50-DN200

Technical data · DN100 - DN125

Valve housing DN100:	GJS-400 PN16/PN25
Valve housing DN125:	GJL-250 PN16 GJS-400 PN25
DP controller:	Stainless steel
Spring:	Stainless steel
Diaphragm:	Reinforced EPDM
O-rings:	EPDM
Pressure class:	PN16/25
Stroke:	40 mm
Flange connections:	ISO 7005-2 / EN 1092-2
Max. differential pressure:	1200 kPa
Medium temperature:	-10°C to 150°C

When used at temperatures below 0°C, a stem heater must be used, to prevent ice on the spindle



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Dimension & Weight · DN100 - DN125

Dim.		DN100	DN125
Dimensions [mm]	L	350	400
	H	566	608
	D	235	270
Weight [kg]		50.1	77.2

OPTIMA Compact EP

DN50-DN200

Technical data · DN150 - DN200

Valve housing: GJS-400 PN16

DP controller: Stainless steel

Spring: Stainless steel

Diaphragm: Reinforced EPDM

O-rings: EPDM

Pressure class: PN16

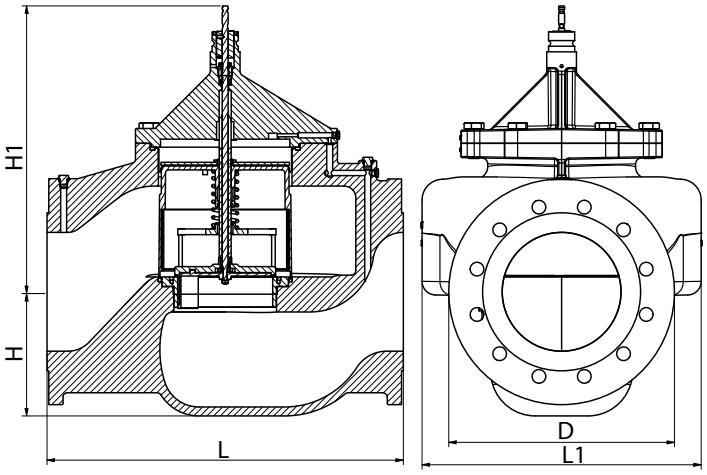
Stroke: 43 mm

Flange connections: ISO 7005-2/EN 1092-2

Max. differential pressure: 1200 kPa

Medium temperature: -10°C to 150°C

When used at temperatures below 0°C, a stem heater must be used, to prevent ice on the spindle



The pipe system shall be properly ventilated to avoid risk of air pockets. Glycolic mixtures up to 50% are applicable (both ethylene and propylene). Frese A/S can accept no responsibility if another actuator is used instead of the Frese actuator. Recommendation: Water treatment to VDI 2035.

Dimension & Weight · DN150 - DN200

Dim.		DN150	DN200
Dimensions [mm]	L	480	600
	L1	352	470
	H	169	206
	H1	518	524
	D	300	380
Weight [kg]		111	175

OPTIMA Compact EP

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Product programme

Dim.	Type	Flow m^3/h	PN16	PN25
DN50	Low flow	2.5 - 15.0	53-8000	53-8020
	High flow	3.9 - 24.0	53-8010	53-8030
DN65	Low flow	4.4 - 25.0	53-8001	53-8021
	High flow	5.9 - 35.0	53-8011	53-8031
DN80	Low flow	5.3 - 34.0	53-8002	53-8022
	High flow	7.0 - 43.0	53-8012	53-8032
DN100	Low flow	12.1 - 68.0	53-8003	53-8023
	High flow	14.8 - 90.0	53-8013	53-8033
DN125	Low flow	18.5 - 110	53-8004	53-8024
	High flow	23.0 - 135	53-8014	53-8034
DN150	Low flow	25.6 - 148	53-8005	NA
	High flow	32.0 - 195	53-8015	
DN200	Low flow	95.0 - 210	53-8006	
	High flow	130 - 280	53-8016	

OPTIMA Compact EP

DN50-DN200

Setting and Flow

Dim.	DN50 LF				DN50 HF			
Pre-set	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa
0.6	2.50	0.689	10.9	7	3.90	1.09	17.3	19
0.8	3.20	0.887	14.1	7	5.10	1.41	22.3	19
1.0	3.90	1.07	17.0	7	6.20	1.71	27.2	19
1.2	4.50	1.25	19.8	7	7.20	2.00	31.8	19
1.4	5.10	1.42	22.5	7	8.20	2.29	36.2	19
1.6	5.70	1.59	25.1	7	9.20	2.56	40.6	20
1.8	6.30	1.75	27.7	8	10.2	2.83	44.9	20
2.0	6.90	1.92	30.4	8	11.2	3.11	49.2	21
2.2	7.50	2.08	33.0	9	12.2	3.39	53.7	22
2.4	8.10	2.26	35.8	9	13.2	3.67	58.2	24
2.6	8.80	2.44	38.7	10	14.3	3.97	62.9	25
2.8	9.50	2.64	41.8	11	15.4	4.28	67.9	27
3.0	10.2	2.84	45.0	12	16.6	4.61	73.1	30
3.2	11.0	3.07	48.6	13	17.9	4.97	78.7	33
3.4	11.9	3.31	52.4	15	19.2	5.35	84.7	36
3.6	12.8	3.57	56.6	16	20.7	5.75	91.2	40
3.8	13.9	3.86	61.1	18	22.3	6.19	98.1	45
4.0	15.0	4.17	66.0	20	24.0	6.67	106	50

Dim.	DN65 LF				DN65 HF			
Pre-set	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa
0.6	4.40	1.22	19.3	15	6.00	1.65	26.2	30
0.8	5.60	1.54	24.5	15	7.60	2.11	33.4	30
1.0	6.60	1.85	29.3	15	9.10	2.53	40.1	30
1.2	7.70	2.13	33.7	16	10.5	2.93	46.4	31
1.4	8.60	2.40	38.0	17	11.9	3.31	52.5	32
1.6	9.60	2.66	42.2	17	13.3	3.69	58.5	32
1.8	10.5	2.93	46.4	18	14.7	4.07	64.5	32
2.0	11.5	3.20	50.6	18	16.0	4.46	70.7	32
2.2	12.5	3.47	55.0	18	17.5	4.86	77.0	32
2.4	13.5	3.76	59.6	19	19.0	5.28	83.6	32
2.6	14.7	4.07	64.5	19	20.6	5.72	90.6	33
2.8	15.8	4.40	69.7	19	22.3	6.19	98.1	34
3.0	17.1	4.75	75.3	20	24.1	6.69	106	35
3.2	18.5	5.13	81.3	21	26.0	7.22	114	37
3.4	19.9	5.54	87.8	21	28.0	7.79	123	40
3.6	21.5	5.98	94.7	22	30.2	8.40	133	44
3.8	23.2	6.45	102	24	32.5	9.04	143	49
4.0	25.0	6.95	110	25	35.0	9.72	154	55

Dim.	DN80 LF				DN80 HF			
Pre-set	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa
0.6	5.30	1.48	23.5	9	7.00	1.95	30.9	15
0.8	6.90	1.91	30.2	9	9.00	2.51	39.8	15
1.0	8.30	2.30	36.5	9	11.0	3.04	48.2	15
1.2	9.60	2.68	42.4	9	12.8	3.55	56.2	15
1.4	10.9	3.04	48.2	9	14.5	4.03	63.9	15
1.6	12.2	3.40	53.8	9	16.2	4.51	71.5	15
1.8	13.5	3.75	59.5	9	18.0	4.98	79.0	16
2.0	14.8	4.11	65.2	9	19.6	5.46	86.5	16
2.2	16.2	4.49	71.1	9	21.4	5.94	94.2	16
2.4	17.6	4.88	77.3	9	23.2	6.45	102	17
2.6	19.1	5.30	83.9	10	25.1	6.97	111	17
2.8	20.7	5.74	91.0	10	27.1	7.53	119	18
3.0	22.4	6.23	98.7	11	29.3	8.13	129	19
3.2	24.3	6.76	107	12	31.6	8.78	139	20
3.4	26.4	7.34	116	13	34.1	9.47	150	22
3.6	28.7	7.98	126	15	36.8	10.2	162	24
3.8	31.2	8.68	138	17	39.8	11.1	175	26
4.0	34.0	9.45	150	19	43.0	12.0	189	29

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Setting and Flow

Dim.	DN100 LF				DN100 HF			
Pre-set	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa
0.6	12.1	3.37	53.4	10	14.8	4.10	65.0	16
0.8	15.3	4.25	67.3	10	18.9	5.25	83.2	16
1.0	18.1	5.04	79.9	10	22.6	6.28	99.5	16
1.2	20.8	5.76	91.4	10	26.0	7.22	114	16
1.4	23.2	6.44	102	10	29.1	8.09	128	16
1.6	25.5	7.08	112	10	32.1	8.92	141	16
1.8	27.8	7.71	122	10	35.1	9.74	154	16
2.0	30.0	8.35	132	10	38.1	10.6	168	16
2.2	32.4	9.00	143	10	41.2	11.4	181	16
2.4	34.9	9.70	154	11	44.5	12.4	196	16
2.6	37.6	10.5	166	11	48.2	13.4	212	18
2.8	40.6	11.3	179	12	52.2	14.5	230	19
3.0	44.0	12.2	194	13	56.7	15.8	250	22
3.2	47.7	13.3	210	14	61.9	17.2	272	25
3.4	51.9	14.4	229	16	67.7	18.8	298	29
3.6	56.7	15.7	249	19	74.2	20.6	327	34
3.8	62.0	17.2	273	22	81.7	22.7	360	39
4.0	68.0	18.9	299	25	90.0	25.0	396	45

Dim.	DN125 LF				DN125 HF			
Pre-set	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa
0.6	18.5	5.14	81.5	16	23.0	6.39	101	27
0.8	23.6	6.54	104	16	29.9	8.31	132	27
1.0	28.5	7.92	125	16	36.5	10.1	161	27
1.2	33.3	9.26	147	17	42.8	11.9	188	28
1.4	38.0	10.6	167	17	48.7	13.5	215	28
1.6	42.6	11.8	188	17	54.5	15.1	240	28
1.8	47.1	13.1	207	18	60.0	16.7	264	29
2.0	51.5	14.3	227	18	65.5	18.2	288	29
2.2	55.9	15.5	246	18	70.9	19.7	312	29
2.4	60.4	16.8	266	19	76.4	21.2	336	30
2.6	65.0	18.1	286	19	82.0	22.8	361	31
2.8	69.8	19.4	308	20	87.8	24.4	387	32
3.0	75.0	20.8	330	21	94.0	26.1	414	33
3.2	80.6	22.4	355	22	101	28.0	443	35
3.4	86.7	24.1	382	24	108	30.0	475	37
3.6	93.6	26.0	412	26	116	32.2	511	41
3.8	101	28.1	446	30	125	34.7	550	46
4.0	110	30.6	484	35	135	37.5	594	53

Dim.	DN150 LF				DN150 HF			
Pre-set	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa
0.6	25.6	7.11	113	21	32.0	8.89	141	33
0.8	32.6	9.05	143	21	41.3	11.5	182	33
1.0	39.2	10.9	173	21	50.0	13.9	220	33
1.2	45.6	12.7	201	21	58.2	16.2	256	33
1.4	51.8	14.4	228	21	66.0	18.3	291	33
1.6	58.0	16.1	255	21	73.7	20.5	324	33
1.8	64.1	17.8	282	21	81.3	22.6	358	33
2.0	70.4	19.6	310	22	89.0	24.7	392	34
2.2	76.8	21.3	338	23	96.9	26.9	427	36
2.4	83.4	23.2	367	25	105	29.2	463	38
2.6	90.3	25.1	398	27	114	31.6	501	40
2.8	97.5	27.1	429	28	123	34.2	542	43
3.0	105	29.2	462	30	133	36.9	586	46
3.2	113	31.3	497	32	144	39.9	632	49
3.4	121	33.6	533	33	155	43.1	683	53
3.6	130	36.0	571	34	167	46.5	737	57
3.8	139	38.5	610	35	181	50.2	796	61
4.0	148	41.1	652	35	195	54.2	859	65

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Setting and Flow

Dim.	DN200 LF				DN200 HF			
Pre-set	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa	Flow m³/h	Flow l/s	Flow gpm	Min.Δp kPa
1.0	95	26.4	418	11	130	36.1	572	31
1.2	100	27.8	440	12	137	38.1	604	32
1.4	105	29.3	464	12	145	40.2	638	33
1.6	112	31.0	491	13	153	42.4	673	35
1.8	118	32.8	520	15	161	44.8	710	38
2.0	125	34.7	550	16	170	47.2	748	41
2.2	132	36.8	583	17	179	49.8	789	45
2.4	140	38.9	617	19	189	52.4	831	49
2.6	148	41.1	652	21	199	55.2	875	53
2.8	156	43.5	689	22	209	58.1	921	57
3.0	165	45.8	726	24	220	61.1	969	61
3.2	174	48.3	765	26	231	64.2	1018	65
3.4	183	50.7	804	27	243	67.4	1069	69
3.6	192	53.3	844	29	255	70.8	1122	72
3.8	201	55.8	884	31	267	74.2	1176	75
4.0	210	58.3	925	32	280	77.8	1233	78

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DN50-DN200

Documentation formula

Valve ID (own choice)	Valve type	Dimension	Pre-setting	Verified Δp [kPa]	Min. Δp (see flow rate graph) [kPa]	Flow

Pump type	Regulation mode	Set point
Installation		
Signature	Date	

Text for technical specifications

The length of the modulating stroke shall be independent of flow setting. The valve shall have full stroke modulating control at all flow settings and the stroke should not be restricted by the flow setting position.

The modulation and flow setting shall be one combined unit with a linear modulating motion and a rotational flow setting motion.

The valve characterization shall not be changed at different flow settings.

The combined flow setting and modulating control unit shall be pressure independent.

The pressure independent control valve shall contain a combined flow setting, differential pressure control and modulating bonnet assembly.

The valve housing shall be GJL-250/GJS-400.

The valve shall have a spring made of stainless steel, a Diaphragm made of Reinforced EPDM and O-rings made of EPDM.

The valve shall have flange connections according to EN 1092.

The valve shall have a maximum operating differential pressure of 1200 kPa (12 Bar), and a temperature range, from -10°C to +150°C.

The valve shall have an external adjustable analogue step less presetting scale from minimum to maximum flow.

The valve shall be capable of closing against a maximum differential pressure of 1200 kPa (12 bar) with a leakage rate at maximum 0.01 % of max rated volumetric flow and comply to EN1349 Class IV.

Pressure independent control valves must be tested in accordance with the BSRIA document BTS.1 'Test Method for Pressure Independent Control Valves' and manufacturers must be able to provide the test results upon request.

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