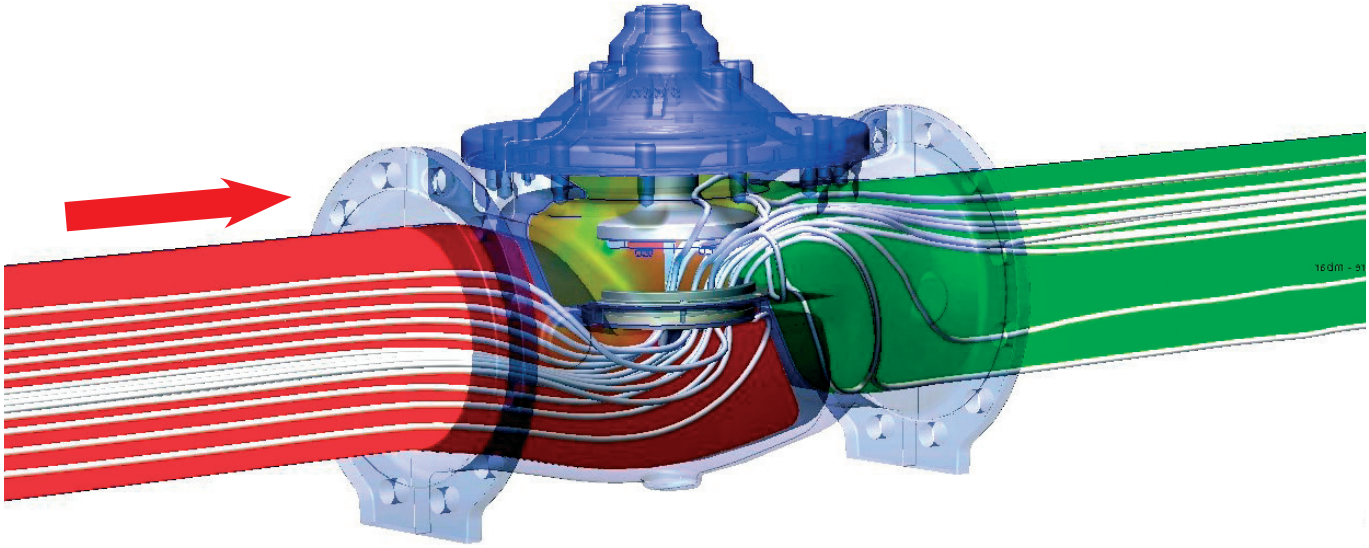
# M2000 - M3000
# DIAPHRAGM ACTUATED AUTOMATIC CONTROL VALVE



*Automatic control valves, as defined by EN1074-5 standard: "have the integral capacity to control the function using energy from the conveyed water by adjusting the position of the shutter. They can be directly operated, i.e. the force is applied (via a spring or diaphragm) directly to the shutter." Alternatively, "They can be pilot operated i.e. the force is applied through an adjustable pilot valve".*

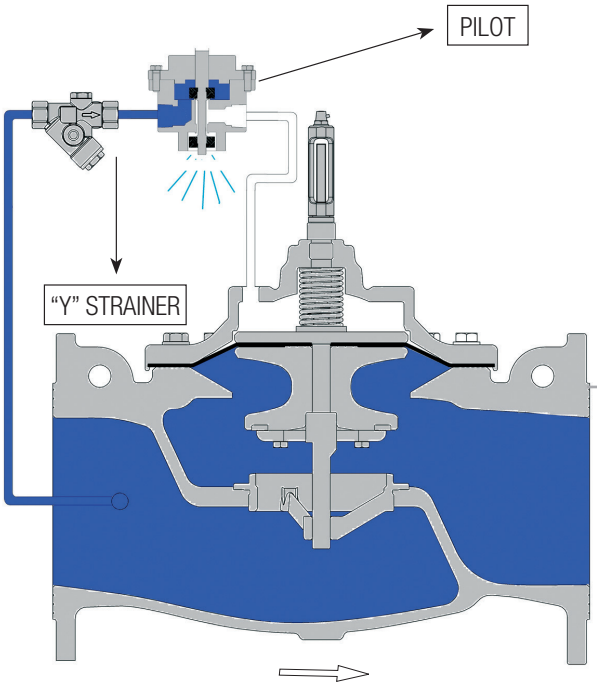
This type of T-pattern flow valve is the result of years of study, design, and development by T.I.S. Nuoval. These valves are available in sizes from DN50 to DN1200 flanged according to EN 1092-2, with nominal pressures of PN10 - PN16 - PN25. The valves are hydraulically actuated, with a metal shutter released by the action of pressure on a diaphragm. The use of a particularly high-performance sealing gasket developed by T.I.S. Nuoval ensures an excellent seal and extended duration even under very demanding operating conditions.

The M3000 series valves are standard passage (seat size smaller than the nominal diameter of the valve). This offers intrinsically superior regulation and dissipation capacity. The M2000 series valves are full passage (seat size equal to the nominal diameter of the valve). This generates a very limited pressure drop with the shutter fully open.

NUOVAL LINE

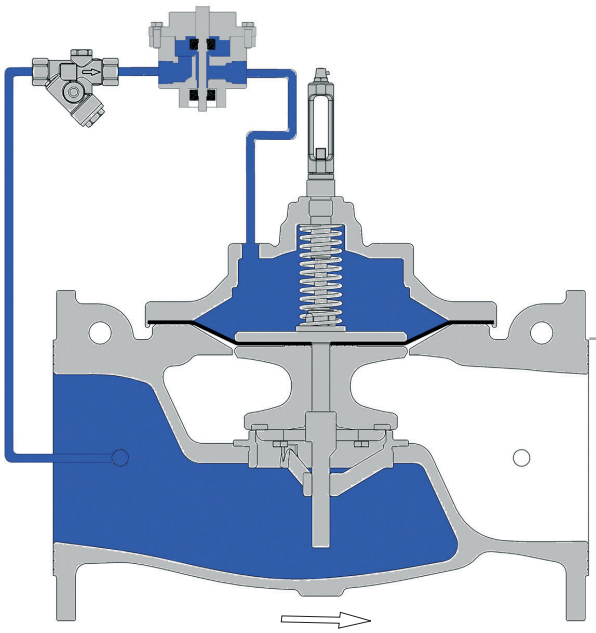
# OPERATING PRINCIPLE

## ON-OFF VALVE CONFIGURATION




### "VALVE OPEN" POSITION

The release of pressure from the control chamber enables the line pressure, which acts on the lower surface of the diaphragm, to move the valve shutter to the open position.



### "VALVE CLOSED" POSITION

The line pressure acts on the upper surface of the diaphragm and moves the valve shutter to the closed position.



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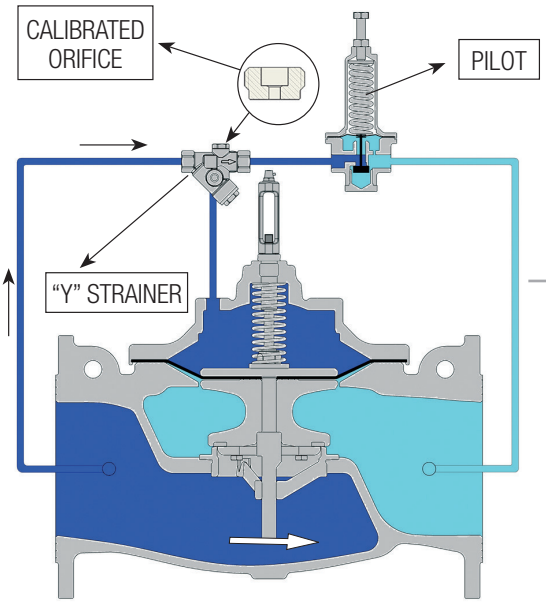
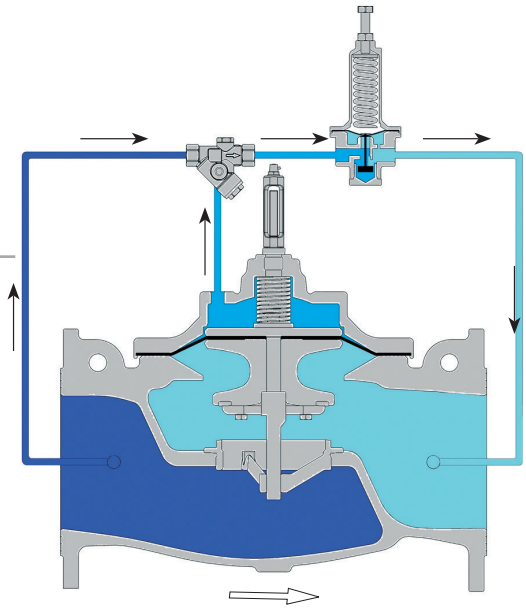
# CONTROL VALVE CONFIGURATION (E.G. DOWNSTREAM PRESSURE REDUCER)



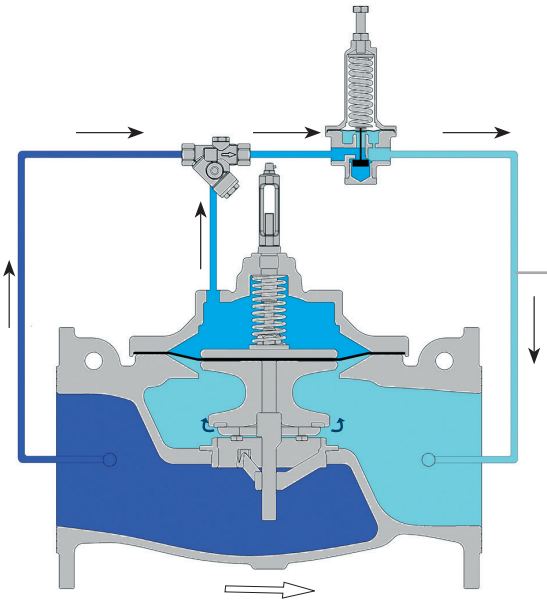

## CLOSED POSITION

The pilot deviates upstream pressure into valve control chamber. The resulting pressure on the diaphragm moves the shutter to the closed position.



## OPEN POSITION

The pilot opens, increasing the pressure drop of the orifice and so releasing the pressure in the control chamber. The resulting force on the diaphragm moves the shutter to the open position.



## REGULATION

The state of balance between the flow capacity of the calibrated orifice (located in the "Y" filter) and the flow rate controlled by the pilot, keeps the valve shutter in the position it has reached.

## DESIGN FEATURES

- Hydraulic testing according to EN1074-5;
- Compliance with EN 1074-5 and EN 1074-1;
- Parts in contact with the water comply with DM 174 of 06/04/2004 and KTW, DVGW W270, WRAS;
- One-piece body in ductile cast iron EN GJS 400-15 EN 1563 (GS 400-15);
- Face to face according to EN 558 Series 1;
- Flanges dimensioned and drilled according to EN 1092-2;
- Stem in 1.4301 EN10088-3 (AISI304) and guided at both ends;
- Seat ring in 1.4408 EN10283 (AISI316);
- Seal retaining ring in 1.4301 EN10088-3 (AISI304);
- Main seal in EPDM;
- Spring in 1.4310 EN10270-3 (AISI302);
- Obturator in 1.4401 EN10088-3 (AISI316) stainless steel, ductile cast iron EN GJS 400-15 and coated steel (according to DN and PN of the valve);
- Diaphragm in EPDM with nylon reinforcement;
- All screws, washers and nuts in stainless steel A2-70 EN ISO3506-1 (inside);
- Internal/external FBE coating protection (Fusion Bonded Epoxy), blue RAL5015, 250 µm thickness.

## MAIN VALVE ACCESSORIES

- Depending on the operating conditions, a V-PORT (see dedicated page) can be supplied in 1.4301 EN10088-3 (AISI304) or 1.4306 EN10088-3 (AISI304L) can be supplied;
- Depending on the operating conditions, a DOUBLE SLOTTED CYLINDER (see dedicated page) can be supplied in 1.4301 EN10088-3 (AISI304) and 1.4401 EN10088-3 (AISI316) can be supplied.

## PILOT CIRCUIT ACCESSORIES

- Pipes in 1.4401 EN10088-3 (AISI316), fittings made in 1.4401 EN10088-3 (AISI316);
- Compression fittings in brass / 1.4401 EN10088-3 (AISI316);
- Strainers and speed regulators in 1.4401 EN10088-3 (AISI316) and brass;
- Isolating ball valves made in Nickel-plated brass;
- Pilots made in 1.4401 EN10088-3 (AISI316) and brass;
- Position indicator in hardened glass and brass;
- Pressure gauges case in 1.4301 EN10088-3 (AISI304) and glycerin;
- Gauge holder with drainage in Nickel-plated brass;
- Floaters in 1.4306 EN10088-3 (AISI304L).

## OPERATIVE LIMITS

Valves are designed and manufactured to operate with drinking or industrial water without suspended solids.

For any other use, please contact the manufacturer.

- Working temperature: (water temp.) min.+0°C (excluding frost) max. + 70°C (on request up to 90°C).
- Storage temperature: (air temp.) min. - 20°C max. + 70°C.



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## DESIGN FEATURES HQ VALVES

- Hydraulic testing according to EN1074-5;
- Compliance with EN 1074-5 and EN 1074-1;
- Parts in contact with the water comply with DM 174 of 06/04/2004 and KTW, DVGW W270, WRAS;
- One-piece body in ductile cast iron EN GJS 400-15 EN 1563 (GS 400-15);
- Face to face according to EN 558 Series 1;
- Flanges dimensioned and drilled according to EN 1092-2;
- Stem in 1.4401 EN10088-3 (AISI316) and guided at both ends;
- Seat ring in 1.4408 EN10283 (AISI316);
- Seal retaining ring made of 1.4401 EN10088-3 (AISI316);
- Main seal in EPDM;
- Spring in 1.4310 EN10270-3 (AISI302);
- Obturator in 1.4401 EN10088-3 (AISI316) stainless steel, ductile cast iron EN GJS 400-15 and coated steel (according to DN and PN of the valve);
- Diaphragm in EPDM with nylon reinforcement;
- All screws, washers and nuts in stainless steel A4-70 EN ISO3506-1 (inside);
- Internal/external FBE coating protection (Fusion Bonded Epoxy), blue RAL5015, 250 µm thickness.

## MAIN VALVE ACCESSORIES

- Depending on the working conditions V-PORT made of 1.4401 EN10088-3 (AISI316) or 1.4404 EN10088-3 (AISI316L) can be supplied;
- Depending on the working conditions DOUBLE DISSIPATING CYLINDER made of 1.4401 EN10088-3 (AISI316) and 1.4404 EN10088-3 (AISI316L) can be supplied.

## PILOT CIRCUIT ACCESSORIES

- Pipes in 1.4401 EN10088-3 (AISI316), fittings in 1.4401 EN10088-3 (AISI316);
- Compression fittings in 1.4401 EN10088-3 (AISI316);
- Strainers and speed regulators in 1.4401 EN10088-3 (AISI316);
- Isolating ball valves in 1.4401 EN10088-3 (AISI316);
- Pilots in 1.4401 EN10088-3 (AISI316) and brass;
- Position indicator in 1.4401 EN10088-3 (AISI316) and hardened glass;
- Pressure gauges case in 1.4401 EN10088-3 (AISI316) and glycerine;
- Pressure gauge holder in 1.4401 EN10088-3 (AISI316);
- Floaters in 1.4404 EN10088-3 (AISI316L).

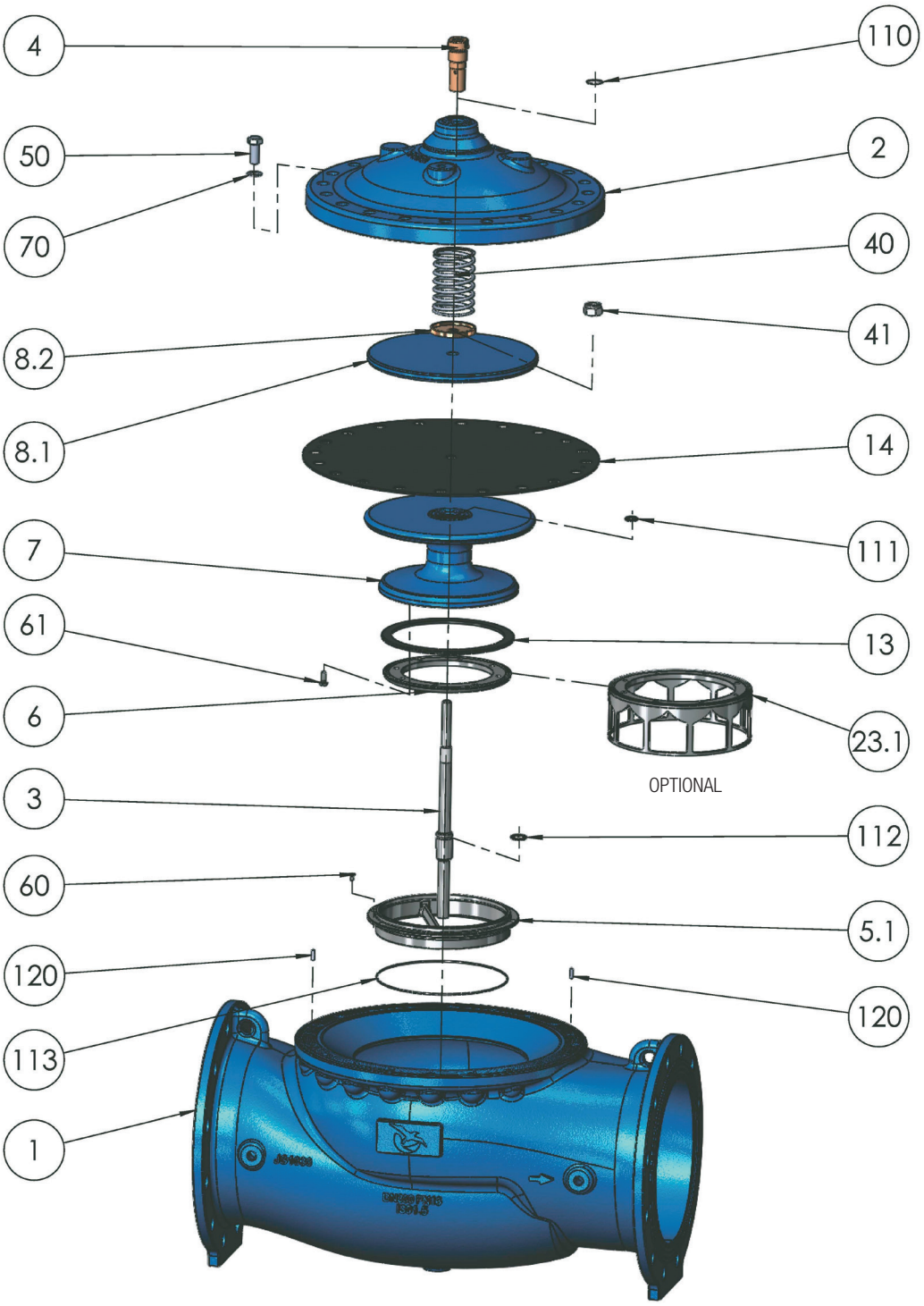
## OPERATIVE LIMITS

Valves are designed and manufactured to operate with drinking or industrial water without suspended solids. For any other use, please contact the manufacturer.

- Working temperature: (water temp.) min.+0°C (excluding frost) max. + 70°C (on request up to 90°C).
- Storage temperature: (air temp.) min. - 20°C max. + 70°C.

NUOVAL LINE

## COMPONENTS



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## M3000

| ITEM | DESCRIPTION | DN | PN | MATERIALS (STANDARD) | MATERIALS (HQ) |
|---|---|---|---|---|---|
| 1 | Body | | | EN-GJS 400-15 EN1563 (GS400) | EN-GJS 400-15 EN1563 (GS400) |
| 2 | Cover | | | EN-GJS 400-15 EN1563 (GS400) | EN-GJS 400-15 EN1563 (GS400) |
| 3 | Stem | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 4 | Cover bearing | | | CC333G CuAl10Fe5Ni5-C EN1982 | 1.4462 EN10088-3 (DUPLEX) |
| 5.1 | Seat Ring | | | 1.4408 EN10283 (AISI316) | 1.4408 EN10283 (AISI316) |
| - | V-Port Seat Ring | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 6 | Seal Retaining Ring | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 7 | Obturator | From 50 to 150 | 10 - 16 - 25 | 1.4401 EN10088-3 (AISI316) | 1.4401 EN10088-3 (AISI316) |
| | | From 200 to 1000 | 10 - 16 - 25 | EN-GJS 400-15 EN1563 (GS400) | EN-GJS 400-15 EN1563 (GS400) |
| | | From 500 to 800 | 25 | S275JR EN10025-2 (Fe430B) | S275JR EN10025-2 (Fe430B) |
| 8.1 | Diaphragm disc | From 50 to 100 | 10 - 16 - 25 | 1.4401 EN10088-3 (AISI316) | 1.4401 EN10088-3 (AISI316) |
| | | From 125 to 1000 | 10 - 16 - 25 | S275JR EN10025-2 (Fe430B) | S275JR EN10025-2 (Fe430B) |
| 8.2 | Spring Washer | | | 1.4401 EN10088-3 (AISI316) | 1.4401 EN10088-3 (AISI316) |
| 13 | Main Seal | | | EPDM (85Sh A) | EPDM (85Sh A) |
| 14 | Diaphragm | | | NYLON-reinforced EPDM | NYLON-reinforced EPDM |
| 23.1 | V-Port | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 40 | Spring | 50 - 600 | 10 - 16 - 25 | 1.4310 EN10270-3 (AISI302) | 1.4310 EN10270-3 (AISI302) |
| 41 | Self-Locking nut | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 50 | Cover Bolts | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 60 | Seat Ring Bolts | 200 - 1000 | 10 - 16 - 25 | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 61 | Retaining ring bolts | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 70 | Cover washers | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 111<br>112 - 113 | O-ring | | | EPDM | EPDM |
| 120 | Pin | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |

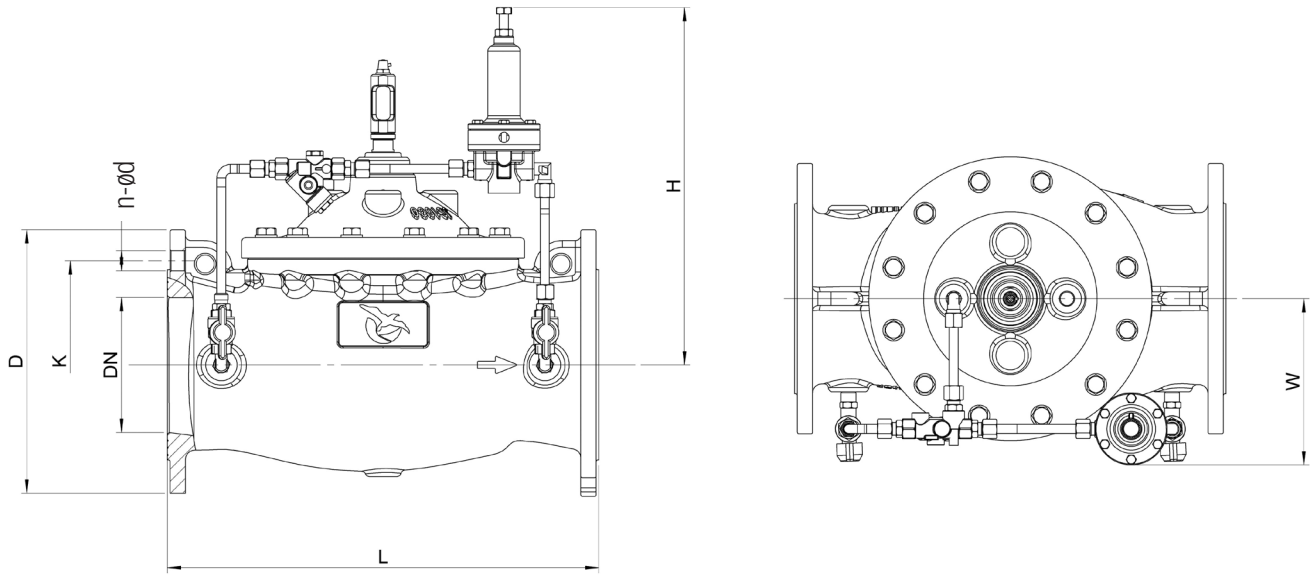
All parts subject to corrosion are protected by epoxy powder coating with a minimum thickness of 250 micron

## M2000

| ITEM | DESCRIPTION | DN | PN | MATERIALS (STANDARD) | MATERIALS (HQ) |
|---|---|---|---|---|---|
| 1 | Body | | | EN-GJS 400-15 EN1563 (GS400) | EN-GJS 400-15 EN1563 (GS400) |
| 2 | Cover | | | EN-GJS 400-15 EN1563 (GS400) | EN-GJS 400-15 EN1563 (GS400) |
| 3 | Stem | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 4 | Cover bearing | | | CC333G CuAl10Fe5Ni5-C EN1982 | 1.4462 EN10088-3 (DUPLEX) |
| 5.1 | Seat Ring | | | 1.4408 EN10283 (AISI316) | 1.4408 EN10283 (AISI316) |
| - | V-Port Seat Ring | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 6 | Seal Retaining Ring | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 7 | Obturator | From 50 to 100 | 10 - 16 - 25 | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| | | From 150 to 200 | 10 - 16 - 25 | S275JR EN10025-2 (Fe430B) | S275JR EN10025-2 (Fe430B) |
| 8.1 | Diaphragm disc | From 50 to 100 | 10 - 16 - 25 | 1.4408 EN10283 (AISI316) | 1.4401 EN10088-3 (AISI316) |
| | | From 150 to 200 | 10 - 16 - 25 | S275JR EN10025-2 (Fe430B) | S275JR EN10025-2 (Fe430B) |
| 8.2 | Spring Washer | | | 1.4401 EN10088-3 (AISI316) | 1.4401 EN10088-3 (AISI316) |
| 13 | Main Seal | | | EPDM (85Sh A) | EPDM (85Sh A) |
| 14 | Diaphragm | | | NYLON-reinforced EPDM | NYLON-reinforced EPDM |
| 23.1 | V-Port | | | 1.4301 EN10088-3 (AISI304) | 1.4401 EN10088-3 (AISI316) |
| 40 | Spring | | | 1.4310 EN10270-3 (AISI302) | 1.4310 EN10270-3 (AISI302) |
| 41 | Self-Locking nut | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 50 | Cover Bolts | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 60 | Seat Ring Bolts | 150 - 200 | 10 - 16 - 25 | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 61 | Retaining ring bolts | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 70 | Cover washers | | | A2-70 EN ISO3506-1 | A4-70 EN ISO3506-1 |
| 111<br>112 - 113 | O-Ring | | | EPDM | EPDM |

All parts subject to corrosion are protected by epoxy powder coating with a minimum thickness of 250 micron

NUOVAL LINE




## M2000

| DN | K | | | D | | | n-ød | | | L | L (FLOW CONTROL FUNCTION) | H | W | WEIGHT (Kg*) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PN10 | PN16 | PN25 | PN10 | PN16 | PN25 | PN10 | PN16 | PN25 | | | | | |
| 50 | 125 | 125 | 125 | 165 | 165 | 165 | 4-19 | 4-19 | 4-19 | 230 | 250 | 220 | 170 | 20 |
| 65 | 145 | 145 | 145 | 185 | 185 | 185 | 4-19 | 4-19 | 8-19 | 290 | 310 | 250 | 180 | 24 |
| 80 | 160 | 160 | 160 | 200 | 200 | 200 | 8-19 | 8-19 | 8-19 | 310 | 330 | 280 | 200 | 30 |
| 100 | 180 | 180 | 190 | 220 | 220 | 235 | 8-19 | 8-19 | 8-23 | 350 | 370 | 310 | 210 | 43 |
| 150 | 240 | 240 | 250 | 285 | 285 | 300 | 8-23 | 8-23 | 8-28 | 480 | 500 | 420 | 250 | 90 |
| 200 | 295 | 295 | 310 | 340 | 340 | 360 | 8-23 | 12-23 | 12-28 | 600 | 620 | 520 | 280 | 142 |

## M3000

| DN | K | | | D | | | n-ød | | | L | L (FLOW CONTROL FUNCTION) | H | W | WEIGHT (Kg*) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PN10 | PN16 | PN25 | PN10 | PN16 | PN25 | PN10 | PN16 | PN25 | | | | | |
| 50 | 125 | 125 | 125 | 165 | 165 | 165 | 4-19 | 4-19 | 4-19 | 230 | 250 | 220 | 170 | 20 |
| 65 | 145 | 145 | 145 | 185 | 185 | 185 | 4-19 | 4-19 | 8-19 | 290 | 310 | 250 | 180 | 24 |
| 80 | 160 | 160 | 160 | 200 | 200 | 200 | 8-19 | 8-19 | 8-19 | 310 | 330 | 280 | 200 | 30 |
| 100 | 180 | 180 | 190 | 220 | 220 | 235 | 8-19 | 8-19 | 8-23 | 350 | 370 | 310 | 210 | 43 |
| 125 | 210 | 210 | 220 | 250 | 250 | 270 | 8-19 | 8-19 | 8-28 | 400 | 420 | 380 | 230 | 48 |
| 150 | 240 | 240 | 250 | 285 | 285 | 300 | 8-23 | 8-23 | 8-28 | 480 | 500 | 420 | 250 | 70 |
| 200 | 295 | 295 | 310 | 340 | 340 | 360 | 8-23 | 12-23 | 12-28 | 600 | 620 | 520 | 280 | 118 |
| 250 | 350 | 355 | 370 | 405 | 405 | 425 | 12-23 | 12-28 | 12-31 | 730 | 750 | 600 | 300 | 173 |
| 300 | 400 | 410 | 430 | 460 | 460 | 485 | 12-23 | 12-28 | 16-31 | 850 | 870 | 740 | 340 | 280 |
| 350 | 515 | 470 | 490 | 520 | 520 | 555 | 16-23 | 16-28 | 16-34 | 980 | 1000 | 800 | 380 | 510 |
| 400 | 515 | 525 | 550 | 565 | 580 | 620 | 16-28 | 16-31 | 16-37 | 1100 | 1130 | 810 | 390 | 550 |
| 500 | 620 | 650 | 660 | 670 | 715 | 730 | 20-28 | 20-34 | 20-37 | 1250 | 1270 | 890 | 460 | 873 |
| 600 | 725 | 770 | 770 | 780 | 840 | 845 | 20-31 | 20-37 | 20-41 | 1450 | 1480 | 970 | 540 | 1400 |
| 700 | 840 | 840 | 875 | 895 | 910 | 960 | 24-31 | 24-37 | 24-44 | 1650 | 1680 | 1250 | 730 | 2400 |
| 800 | 950 | 950 | / | 1015 | 1025 | / | 24-34 | 24-41 | / | 1850 | 1880 | 1250 | 730 | 2600 |
| 900 | 1050 | 1050 | / | 1115 | 1125 | / | 28-34 | 28-41 | / | 2050 | 2080 | 1250 | 730 | 2900 |
| 1000 | 1160 | 1170 | / | 1230 | 1255 | / | 28-37 | 28-44 | / | 2250 | 2290 | 1360 | 820 | 4500 |
| 1200 | 1380 | 1390 | / | 1455 | 1485 | / | 32-41 | 32-44 | / | 2250 | 2290 | 1360 | 820 | 4900 |

*indicative weight (related to face to face of the STD valve "L") related to PN25 up to DN600 and to PN16 for larger sizes



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# M3000 PRESSURE DROP

Pressure drop of automatic control valves can be evaluated by using below equation:

$$\Delta P = (Q / K_{VS})^2 \text{ [bar]}$$

Where:

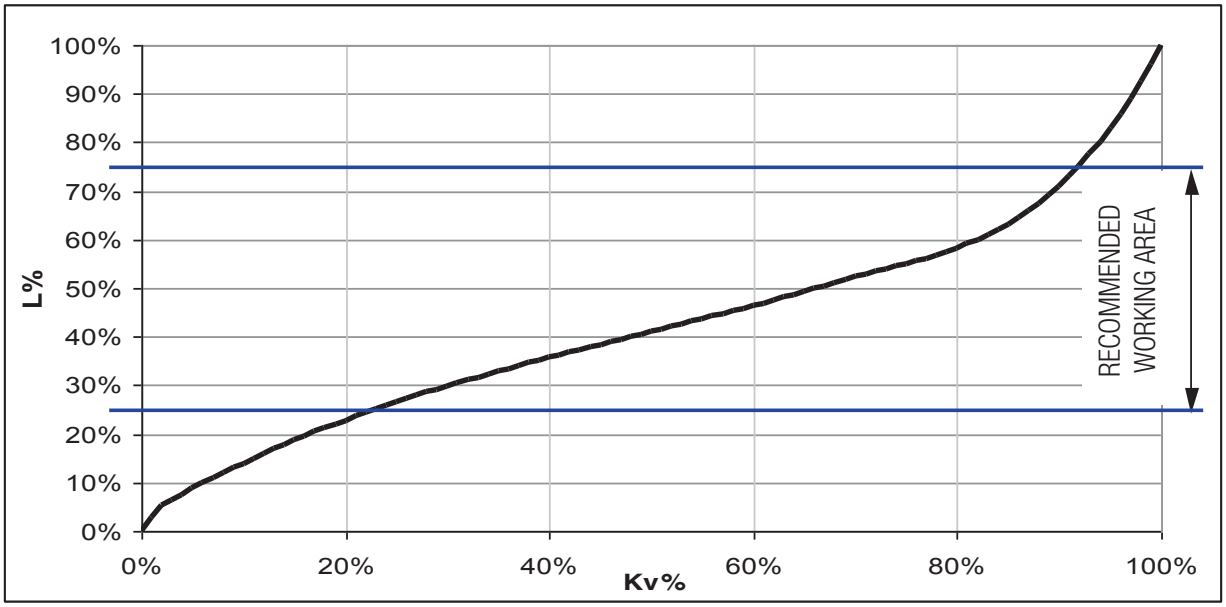
- $\Delta P$ = pressure drop [bar]
- $K_{VS}$ = flow coefficient [m³/h]
- Q = flow rate [m³/h]

$K_{VS}$ flow coefficient indicates 20°C water flow rate [m³/h], through the fully open valve, that induces 1bar pressure drop.

## M3000 HYDRAULIC SPECIFICATIONS

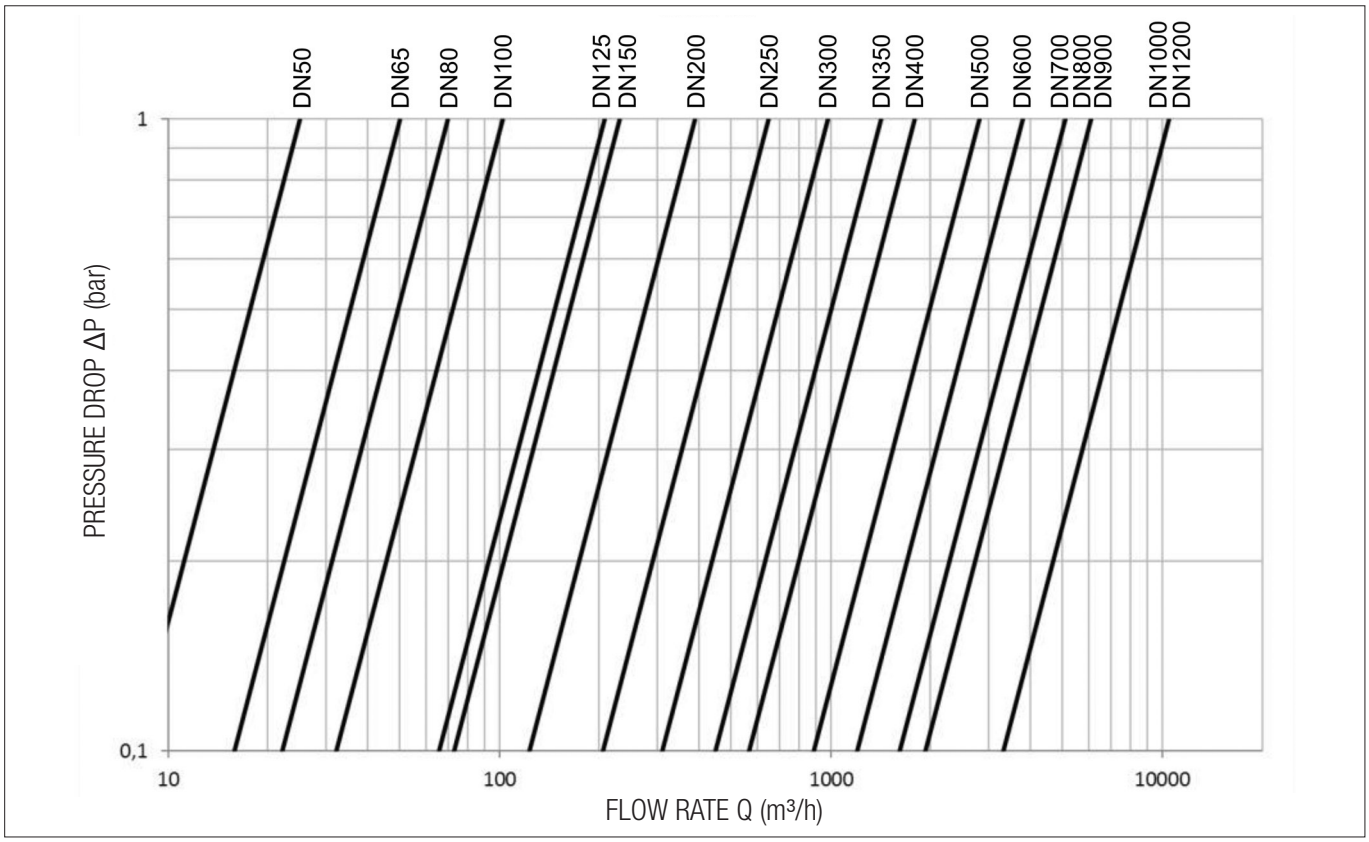
| DN | 50 | 65 | 80 | 100 | 125 | 150 | 200 | 250 | 300 | 350 | 400 | 500 | 600 | 700 | 800 | 900 | 1000 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kvs [m³/h] | 25 | 50 | 70 | 102 | 208 | 230 | 390 | 650 | 980 | 1420 | 1790 | 2800 | 3800 | 5800 | 6500 | 6500 | 9800 | 9800 |
| Lift [mm] | 12 | 19,5 | 20,5 | 23,5 | 38 | 38 | 45 | 58 | 63 | 73 | 87 | 102 | 124 | 150 | 160 | 160 | 195 | 195 |

## LIFT-KV DIAGRAM




| | |
|---|---|
| Flow coefficient at L% opening | Kv = Kv% * Kvs |
| Flow coefficient at 100% open valve | Kvs |
| Kv% | From the above diagram: Kv% - L% |

## M3000 PRESSURE DROP DIAGRAM (VALVE 100% OPEN)




## M3000 RECOMMENDED FLOW RATE

| DN | ADVISABLE | | IRRIGATION<br>FIRE PROTECTION | | MAX ALLOWED | |
|---|---|---|---|---|---|---|
| | l/s | m³/h | l/s | m³/h | l/s | m³/h |
| 50 | 4,4 | 15,8 | 5,6 | 20,4 | 8,8 | 31,7 |
| 65 | 10,5 | 37,6 | 13,4 | 48,4 | 20,9 | 75,3 |
| 80 | 11,6 | 41,8 | 14,9 | 53,8 | 23,2 | 83,6 |
| 100 | 17,6 | 63,3 | 22,6 | 81,4 | 35,2 | 126,7 |
| 125 | 35 | 128,6 | 45,9 | 165 | 71,4 | 257 |
| 150 | 43 | 155 | 55,2 | 199 | 86 | 309 |
| 200 | 62 | 223 | 80 | 286 | 125 | 445 |
| 250 | 172 | 619 | 220 | 795 | 345 | 1237 |
| 300 | 247 | 891 | 318 | 1145 | 495 | 1781 |
| 350 | 340 | 1212 | 433 | 1559 | 675 | 2425 |
| 400 | 440 | 1583 | 565 | 2036 | 880 | 3167 |
| 500 | 687 | 2474 | 885 | 3181 | 1374 | 4948 |
| 600 | 990 | 3563 | 1272 | 4580 | 1979 | 7125 |
| 700 | 1347 | 4849 | 1730 | 6250 | 2700 | 9700 |
| 800 - 900 | 1759 | 6333 | 2260 | 8143 | 3520 | 12667 |
| 1000 - 1200 | 2750 | 9900 | 3534 | 12723 | 5498 | 19792 |

The tables can be used for preliminary selection of the nominal valve diameter. The appropriate DN will be calculated using the sizing software developed by T.I.S. Please contact us with the required operating conditions of the valve. Above data are valid for valves with standard plug (without V-port).



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# M2000 PRESSURE DROP

Pressure drop of automatic control valves can be evaluated by using below equation:

$$\Delta P = (Q / K_{VS})^2 \text{ [bar]}$$

Where:

- $\Delta P$ = pressure drop [bar]
- $K_{VS}$ = flow coefficient [m³/h]
- Q = flow rate [m³/h]

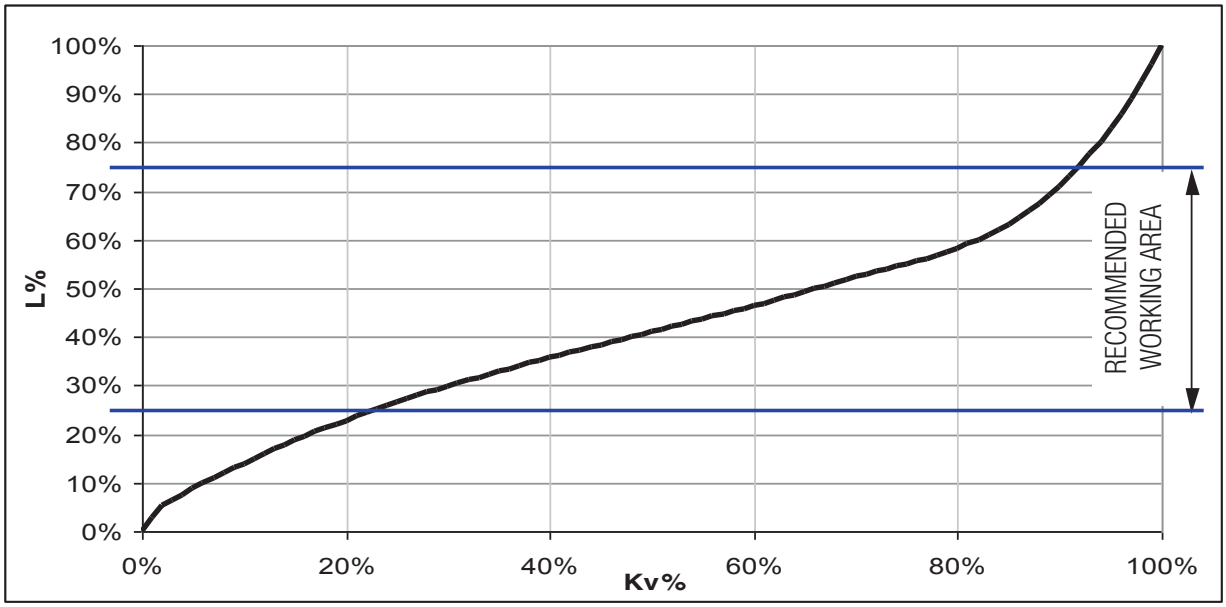
$K_{VS}$ flow coefficient indicates 20°C water flow rate [m³/h], through the fully open valve, that induces 1bar pressure drop.



## M2000 HYDRAULIC SPECIFICATIONS

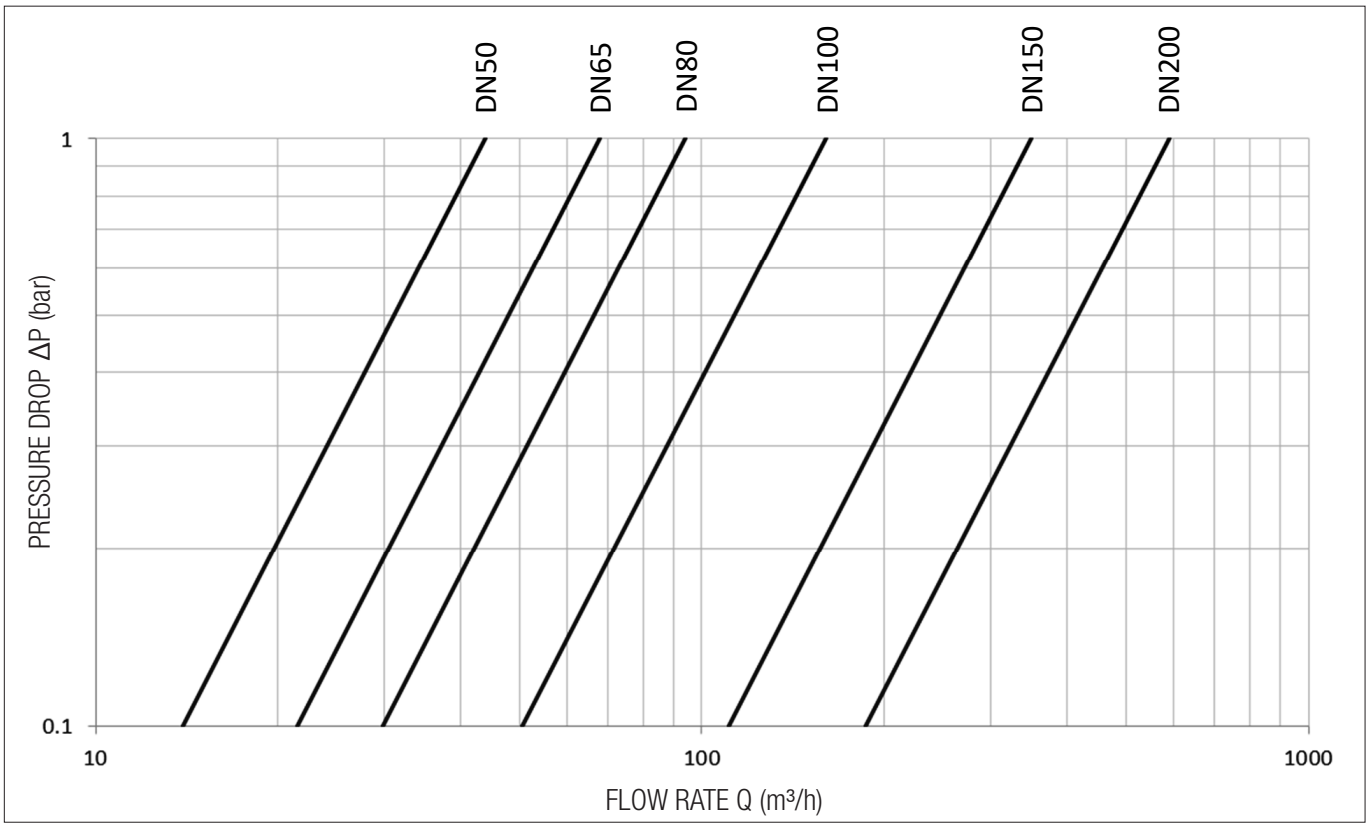
| DN | 50 | 65 | 80 | 100 | 150 | 200 |
|---|---|---|---|---|---|---|
| Kvs [m³/h] | 44 | 68 | 94 | 160 | 350 | 590 |
| Lift [mm] | 15 | 18 | 20 | 25 | 39 | 50 |

## LIFT-KV DIAGRAM




| | |
|---|---|
| Flow coefficient at L% opening | $K_V = K_V\% * K_{VS}$ |
| Flow coefficient at 100% open valve | $K_{VS}$ |
| $K_V\%$ | From the above diagram: $K_V\%$ - L% |

## M2000 PRESSURE DROP DIAGRAM (VALVE 100% OPEN)




## M2000 RECOMMENDED FLOW RATE

| DN | ADVISABLE | | IRRIGATION<br>FIRE PROTECTION | | ALLOWED MAX | |
|---|---|---|---|---|---|---|
| | l/s | m³/h | l/s | m³/h | l/s | m³/h |
| 50 | 6,9 | 24,7 | 8,8 | 31,8 | 13,7 | 49,5 |
| 65 | 11,6 | 41,8 | 14,9 | 53,8 | 23,2 | 83,6 |
| 80 | 17,6 | 63,3 | 22,6 | 81,4 | 35,2 | 126,7 |
| 100 | 27,5 | 99,0 | 35,3 | 127 | 55,0 | 198 |
| 150 | 61,9 | 223 | 79,5 | 286 | 123,7 | 445 |
| 200 | 110,0 | 396 | 141,4 | 509 | 219,9 | 792 |

The tables can be used for preliminary selection of the nominal valve diameter. The appropriate DN will be calculated using the sizing software developed by T.I.S Nuoval. Please contact us with the required operating conditions of the valve. Above data are valid for valves with standard plug (without V-port).



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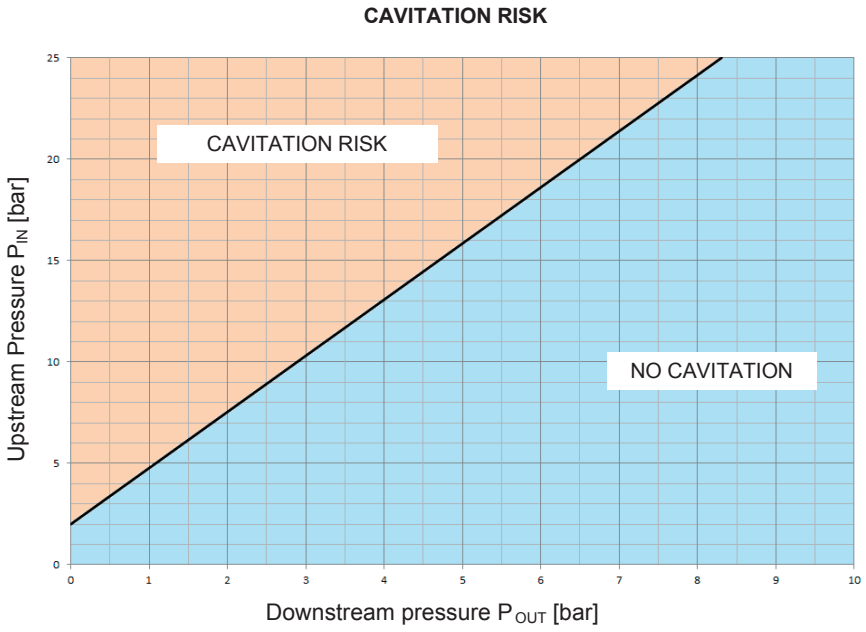
# CAVITATION

The stream velocity is not constant through the valve and reaches the higher values close to the valve seat (vena contracta). This produces a significant local reduction of the pressure. The higher the valve pressure drop ΔP, the higher the local stream velocity, the lower the local pressure. If, due to high valve pressure drop, the pressure in the vena contracta pressure is reduced down to the vapor pressure, small bubbles of vapour develop. Downstream the vena contracta, the pressure increases again and the steam bubbles rapidly implode, dissipating high rates of energy and generating strong pressure waves. Pressure waves produce intense surficial stress on the valve. Pressure drop must therefore be contained in order to avoid noise and erosion of the valve.
The valve operating conditions can be preliminary checked by using the cavitation diagram below. The valve shall not continuously operate under cavitation risk.
It can be accepted that the valve operates under light cavitation conditions for short periods.



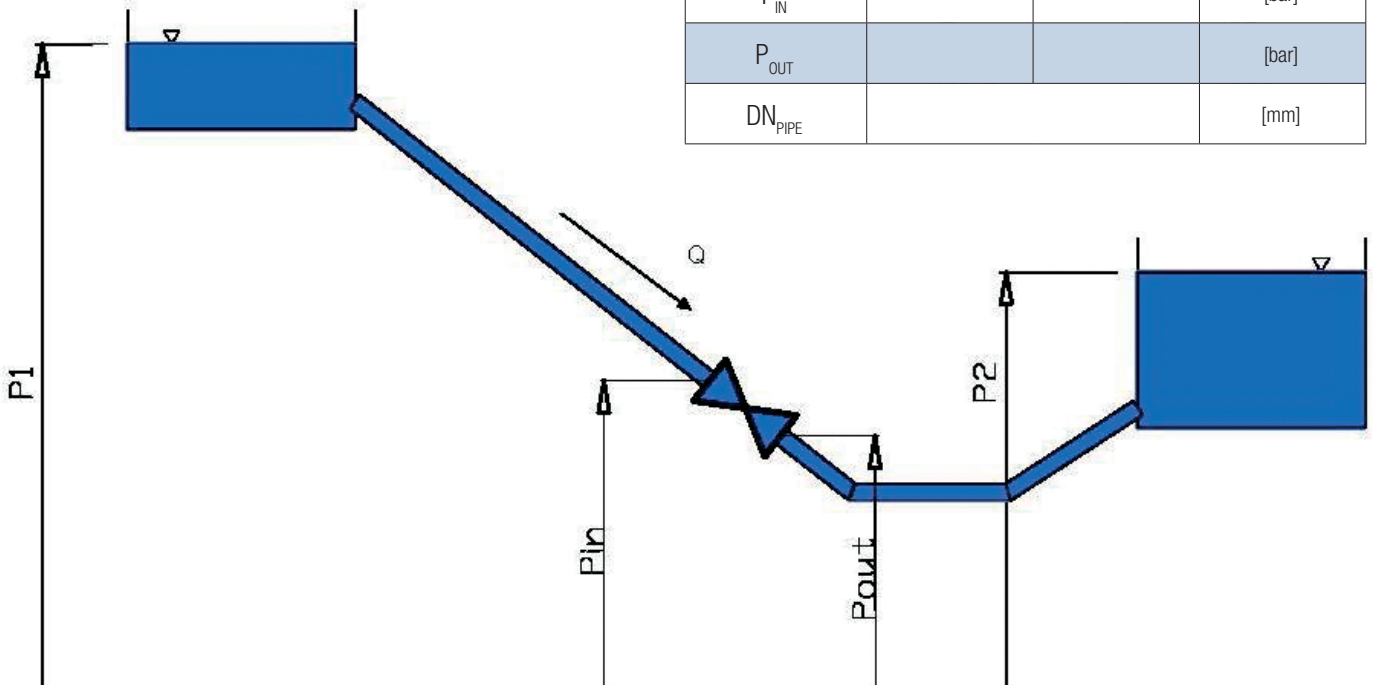

Cavitation diagram refers to 40% open valves. When the opening degrees of the valve significantly differs from this value, we recommend to verify the actual cavitation conditions by using the software specifically developed by T.I.S. Please contact us providing valve's required operating conditions.

M3000 and M2000 automatic control valves shall operate within the following limits. Should deviations occur, please, contact the manufacturer.

| | |
|---|---|
| Valve min pressure drop | 0.3 [bar] |
| Valve max pressure drop | See above cavitation diagram |
| Min inlet pressure | 0.5 [bar] |
| Recommended opening degree for modulating valves: | M3000: 15% ≤ L% ≤ 75%<br>M2000: 20% ≤ L% ≤ 75% |
| Recommended opening degree for on-off valves: | L% = 0-100% |

## VALVE SIZING DATA

| DATA TABLE FOR VALVE SIZING | | | |
|---|---|---|---|
| | Qmax | Qmin | |
| Q | | | [m³/h] |
| $P_{IN}$ | | | [bar] |
| $P_{OUT}$ | | | [bar] |
| $DN_{PIPE}$ | | | [mm] |




Q = Flow rate (maximum & minimum).
$P_{IN}$ = The pressure at minimum / maximum flow measured at the valve upstream flange.
$P_{OUT}$ = The pressure at minimum / maximum flow measured at the valve downstream flange.

For adequate valve analysis, T.I.S. use a special sizing software developed in our hydraulic laboratory (see example on the next pages). For this purpose, please contact us and provide the operating conditions of the valve. See the sizing data table above.



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# AUTOMATIC CONTROL VALVE SIZING EXAMPLE

Fill in “DATA TABLE FOR VALVE SIZING”:

| DATA TABLE FOR VALVE SIZING | | | |
|---|---|---|---|
| | Qmax | Qmin | |
| Q | 65 | 36 | $m^3/h$ |
| $P_{IN}$ | 6 | 8 | bar |
| $P_{OUT}$ | 3 | 3 | bar |
| $DN_{PIPE}$ | 100 | | mm |

**EXAMPLE**

Red data are an example of sizing.

## WATERWORKS APPLICATION

Preliminary selection of the valve DN.

From the table “M3000 RECOMMENDED FLOW RATE”, in correspondence of the advisable flow column, can be seen that the appropriate diameter for the maximum flow rate of 65 m3/h is DN100.

## M3000 RECOMMENDED FLOW RATE

| DN | ADVISABLE | | IRRIGATION FIRE PROTECTION | |
|---|---|---|---|---|
| | l/s | $m^3/h$ | l/s | $m^3/h$ |
| 50 | 4,4 | 15,8 | 5,6 | 20,4 |
| 65 | 10,5 | 37,6 | 13,4 | 48,4 |
| 80 | 11,6 | 41,8 | 14,9 | 53,8 |
| 100 | 17,6 | 63,3 | 22,6 | 81,4 |
| 125 | 35,7 | 128,6 | 45,9 | 165 |

From the table M3000 “HYDRAULIC SPECIFICATIONS” can be seen that this valve has a flow coefficient, with fully open obturator, Kvs=102 $m^3/h$.

## M3000 HYDRAULIC SPECIFICATIONS

| DN | 50 | 65 | 80 | 100 | 125 | 150 | 200 | 250 | 300 | 350 |
|---|---|---|---|---|---|---|---|---|---|---|
| Kvs [$m^3/h$] | 28 | 50 | 70 | 102 | 208 | 230 | 390 | 650 | 980 | 1420 |
| Lift [mm] | 12 | 19,5 | 20,5 | 23,5 | 38 | 38 | 45 | 58 | 63 | 73 |

Minimum and maximum opening degree calculation.

Kv = $Q / \sqrt{(PIN-POUT)}$

$Kv_{Qmax}$ = $65 / \sqrt{(6-3)} = 37.5$ $m^3/h$ (at MAX flow rate “$Q_{max}$”) which corresponds to

Kv% = $K_v/K_{vs} = 37.5 / 102 = 0.36$ (36%)

$Kv_{Qmin}$ = $36 / \sqrt{(8-3)} = 16$ $m^3/h$ (at MIN flow rate “$Q_{min}$”) which corresponds to

Kv% = $K_v/K_{vs} = 16 / 102 = 0.15$ (15%)

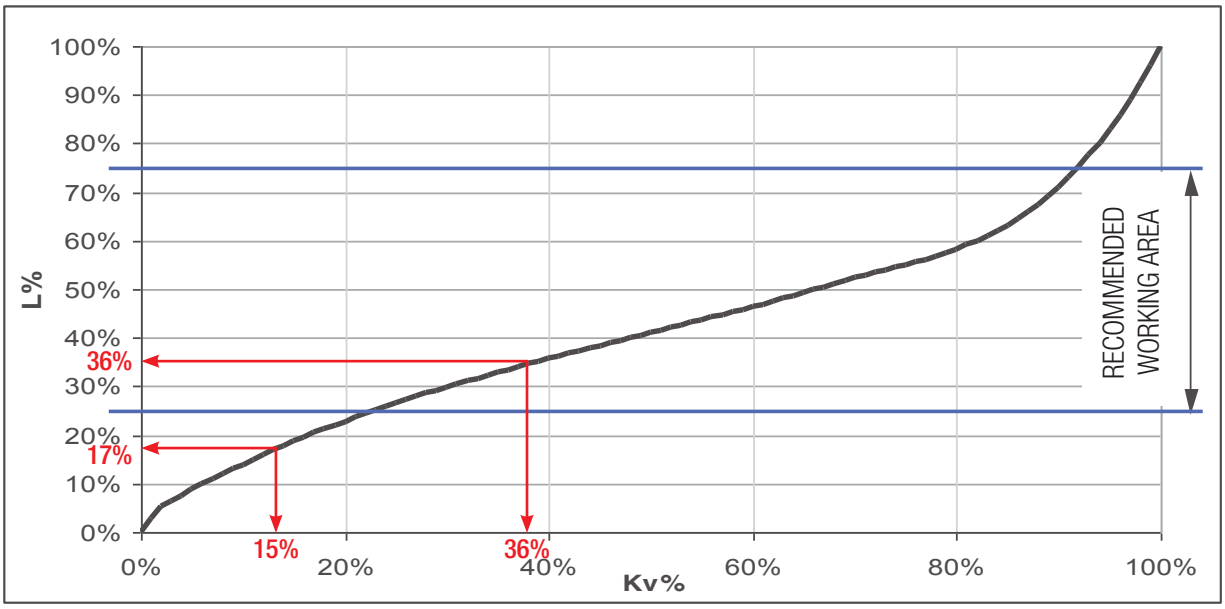
## VALVE OPERATING LIMITS

From “LIFT-KV DIAGRAM” it can be seen that the degree of shutter opening at maximum and minimum flow rate is respectively:

$L\%(Q_{MAX}) = 36\%$

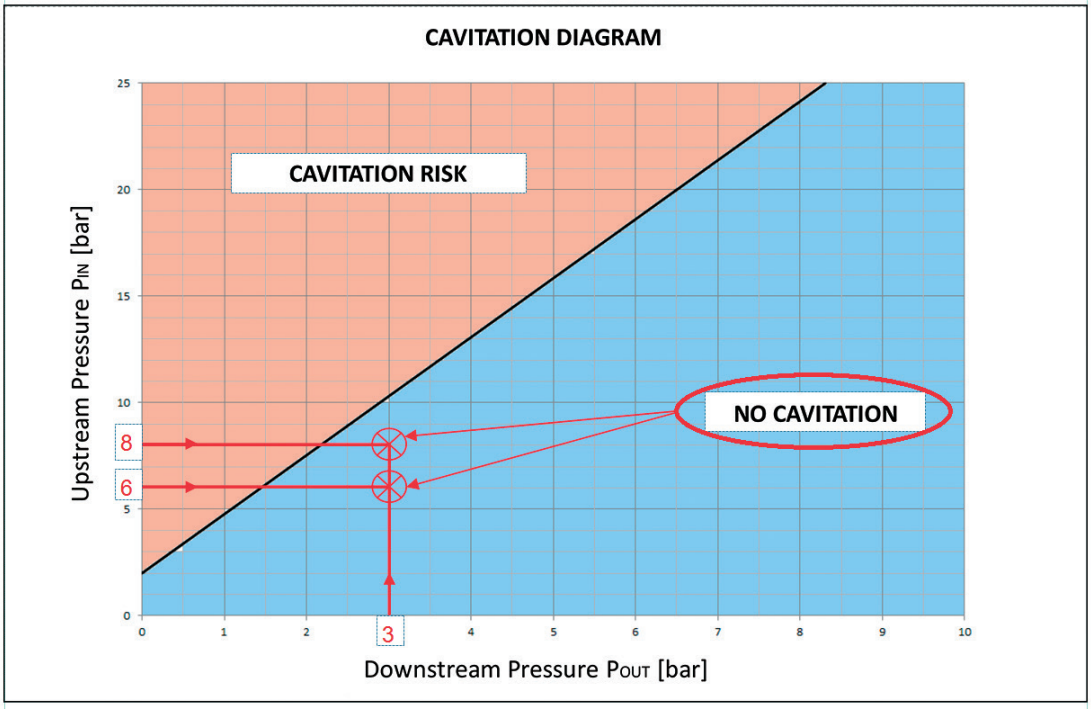
$L\%(Q_{MIN}) = 17\%$

The valve operates between 17% and 36% of opening degree.




## CAVITATION CHECK

The “CAVITATION DIAGRAM” shows that the valve operates outside the cavitation zone.



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# AUTOMATIC CONTROL VALVES SIZING SOFTWARE

A dedicated software provides accurate sizing of automatic valves according to the relevant conditions.
The cavitation analysis is calculated according the real range opening of the valve's shutter.
Before the order, please provide operating conditions to carry out specific analysis of valve performance.

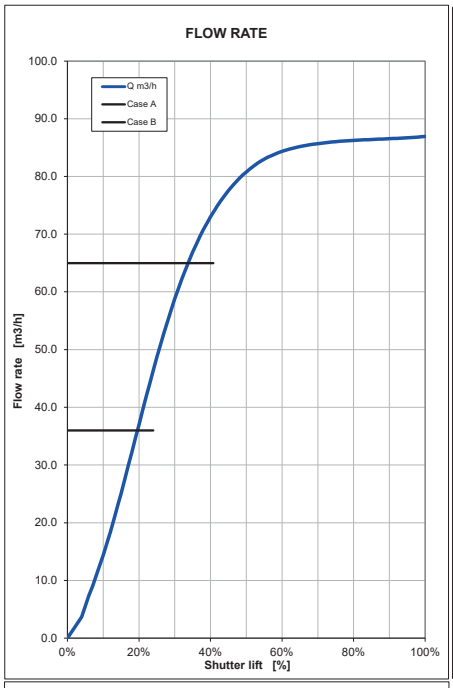
**AUTOMATIC CONTROL VALVE serie 2000 - 3000: flow analysis and cavitation control**
**MODULATING VALVE**
Upstream-downstream reservoirs at constant level

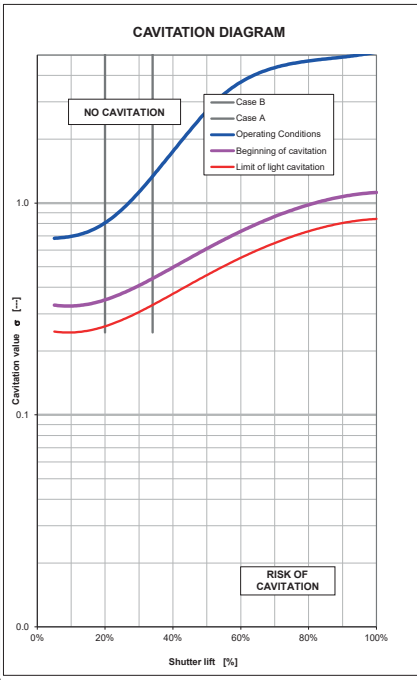
Rev 3.6

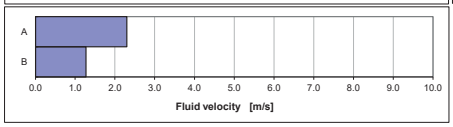
| | | | | | |
|---|---|---|---|---|---|
| **Description** | | SIZING | | | |
| ***Valve specifications*** | | M3100 | | | |
| **Valve size** | | 100 | | | (C) |
| **Obturator** | | Standard | | | |
| **Shutter max stroke** | L100% | 23.6 | | [mm] | |
| **PN** | | 16 | | OK | |
| **Valve description** | | PRESSURE REDUCING V. STANDARD DISK | | | |
| ***Static pressures*** | | A | B | | |
| **Flow rate** | Q | 65.0 | 36.0 | m3/h | |
| | | 65.0 | 36.0 | [m3/h] | |
| **Upstream press. (dynamic)** | Pin | 60.0 | 80.00 | [m] | |
| **Downstream press. (dynamic)** | Pout | 30.0 | 30.00 | [m] | |
| **Flow velocity** | v | 2.30 | 1.27 | [m/s] | |
| **Flow coefficient (%)** | Kv% | 36% | 15% | [%] | |
| **Approx. valve opening** | L% | **36%** | **17%** | [%] | |
| | L | 8.0 | 4.7 | [mm] | |
| ***Valve pressure drops (valve 100% open)*** | | | | | |
| **Flow coeff.** | Kvs | 102.0 | | [m3/h] | |
| **P drop coeff. (100% open)** | ξ_v100% | 15.08 | | [---] | |
| **Valve P. drop (100% open)** | ΔP100% | 4.06 | 1.25 | [m] | |
| **Upstream pipe** | ζin | 107.1 | OK | [--] | |
| **Downstream pipe** | ζout | 0.0 | OK | [--] | |

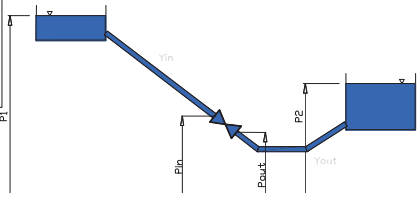
| ***Calibrated orifice (ISO 5167)*** | --> | ***NO*** | | |
|---|---|---|---|---|
| Internal valve diameter | D | 100.0 | | [mm] |
| Orifice diameter | d | 78.0 | | [mm] |
| Diameter ratio | b = d/D | 0.780 | | [---] |
| Reynolds | Re | 1.53E+05 | 8.49E+04 | [---] |
| Flow rate factor | C | 0.00 | 0.000 | [---] |
| Orifice pressure head | DH | 0.000 | 0.000 | [bar] |
| Flow coefficient | Cq | 0.00 | 0.00 | [---] |
| Orifice flow coeff. | Csi_orif | 0.00 | | |

| ***Drilled plate*** | --> | NO | | |
|---|---|---|---|---|
| Internal valve diameter | D | 100.0 | | [mm] |
| Number of holes | Nh | 1 | | [mm] |
| Hole diameter | d | 43.0 | | [mm] |
| Area ratio | f | 0.185 | | [---] |
| Drilled plate Pdrop coeff. | csi_dr | 0.00 | | |
| Drilled plate Pressure drops | DP_dr | 0.00 | | bar |



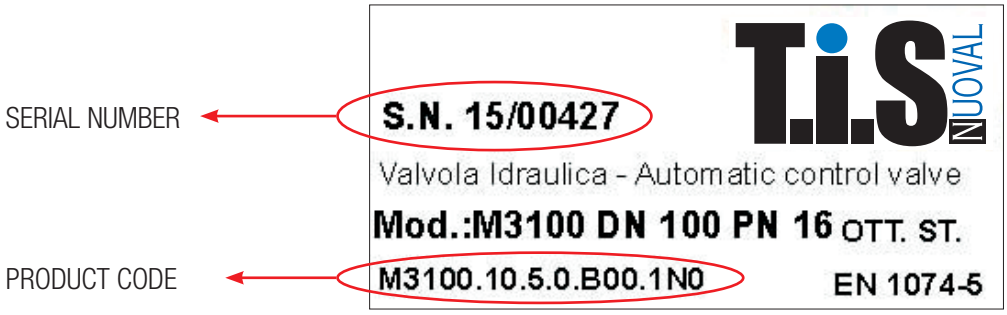




Note:
Pressure drop ΔP = (Q/Kvs)^2
Pressure drop in bar; Flow rate in m3/h

## PRODUCT TRACKING




| M | X | XXX | .XX | .X | .... |
|---|---|---|---|---|---|

.... : ACCESSORIES

.X : PRESSURE RATING IDENTIFICATION CODE

.XX : NOMINAL DIAMETER IDENTIFICATION CODE

XXX : FUNCTIONS

| | |
|---|---|
| 100 | PRESSURE REDUCING VALVE |
| 120 | PRESSURE REDUCING AND SUSTAINING CONTROL VALVE |
| 200 | PRESSURE SUSTAINING / RELIEF VALVE |
| 400 | FLOW CONTROL VALVE |
| 500 | FLOAT CONTROLLED MODULATING CONSTANT LEVEL VALVE |
| 600 | FLOAT CONTROLLED ON-OFF VALVE |
| 700 | HYDRAULIC ON-OFF VALVE WITH ELECTRICAL REMOTE CONTROL (FROM DN300 TO DN1000) |
| 800 | ON/OFF ALTITUDE LEVEL CONTROL VALVE |
| 900 | EXCESS FLOW GATE VALVE |

X : SERIES

| | |
|---|---|
| 2 | M2000 SERIES (FULL PORT) |
| 3 | M3000 SERIES (STANDARD PORT) |

M : DIAPHRAGM ACTUATED AUTOMATIC CONTROL VALVE



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# HYDRAULIC LABORATORY

The T.I.S. hydraulic laboratory is divided into two areas:

- the first (figure above) is used for teaching/training purposes (training customers, public and private companies, engineerings companies, operators, and T.I.S. staff);
- the second (figure below) is used to measure the fluodynamic behaviour of valves (e.g. pressure drop), to verify valve's functionality and its components under extreme conditions (e.g. endurance test), or using glass pipes (DN100) to simulate and observe the cavitation phenomenon.

During the development of control valves, the laboratory test results are combined with three-dimensional modelling, structural testing, fluodynamic modelling. This ensures a process of continuous improvement of T.I.S. brand products.

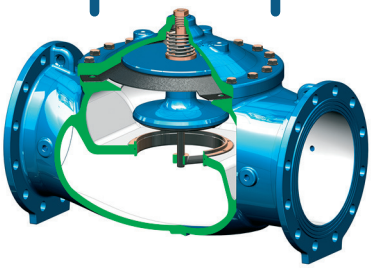
NUOVAL LINE

# MAIN FUNCTIONS

**M3100**
PRESSURE REDUCING VALVE

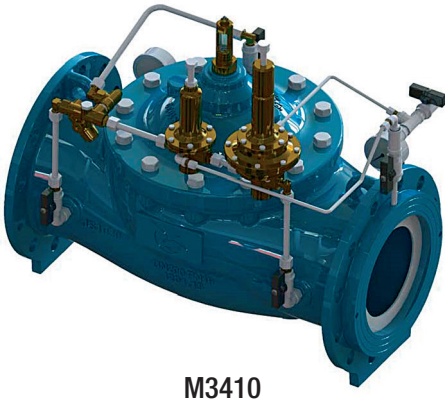
**M3200**
PRESSURE SUSTAINING / RELIEF VALVE

**M3400**
FLOW CONTROL VALVE



MAIN VALVE

**M3219**
SURGE ANTICIPATOR / PRESSURE RELIEF VALVE



**M3410**
FLOW CONTROL / PRESSURE REDUCING VALVE

**M3120**
PRESSURE REDUCING / SUSTAINING



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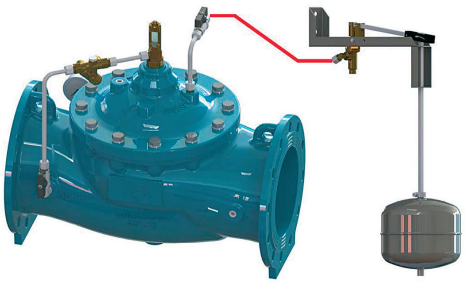
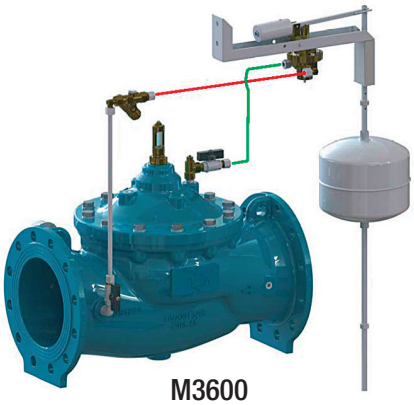
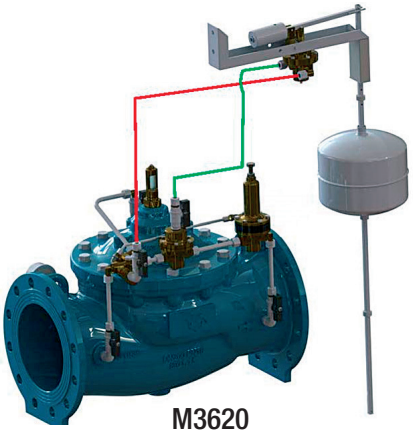


**M3500**
MODULATING FLOAT CONTROLLED
CONSTANT LEVEL VALVE

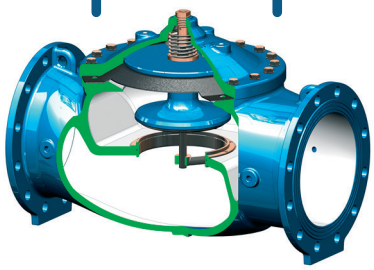


**M3600**
ON-OFF FLOAT CONTROLLED VALVE

**M3800**
ALTITUDE VALVE ONE-WAY FLOW

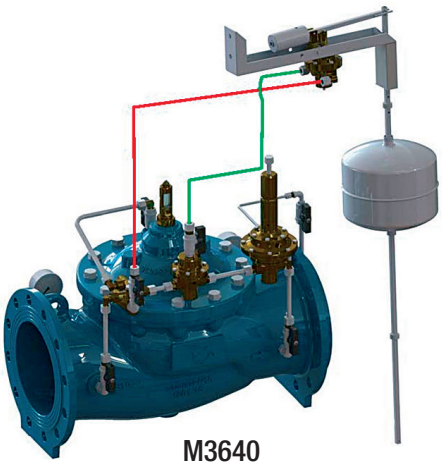


**M3620**
ON-OFF FLOAT CONTROLLED VALVE
WITH PRESSURE SUSTAINING

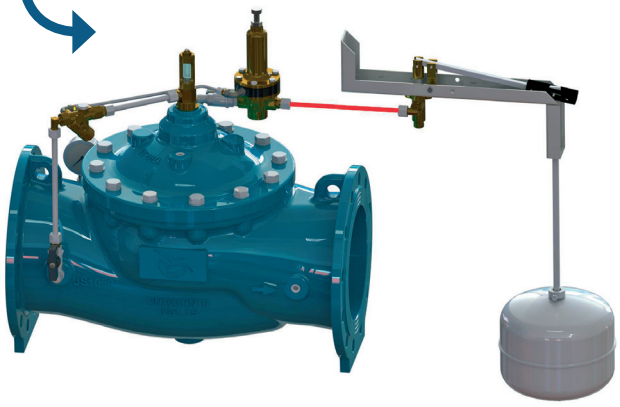


MAIN VALVE

**M3805**
MODULATING ALTITUDE VALVE



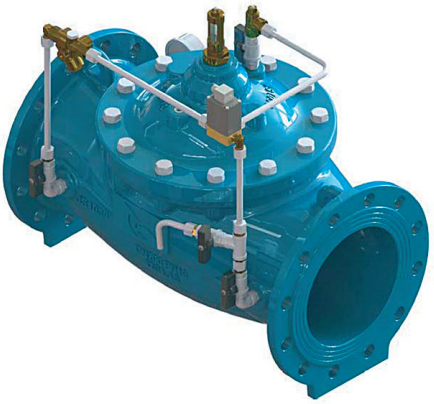
**M3640**
ON-OFF FLOAT CONTROLLED VALVE
WITH RATE OF FLOW CONTROL FUNCTION



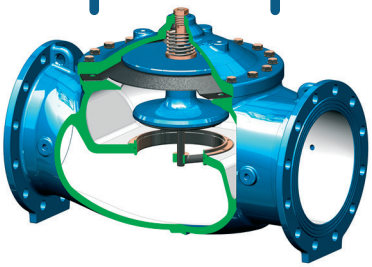
**M3520**
MODULATING FLOAT CONTROLLED
CONSTANT LEVEL VALVE
WITH PRESSURE SUSTAINING

**M3170**
PRESSURE REDUCING VALVE WITH SOLENOID CONTROL

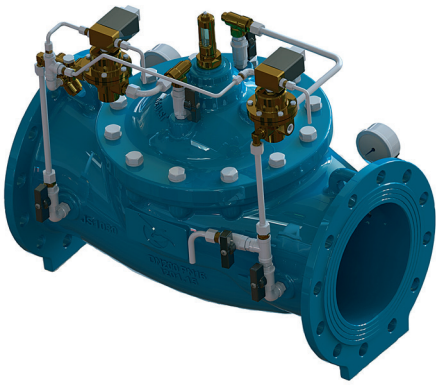
**M3771** *[DN50 to DN250]*
SOLENOID CONTROLLED / ELECTRICALLY OPERATED "STEP BY STEP"



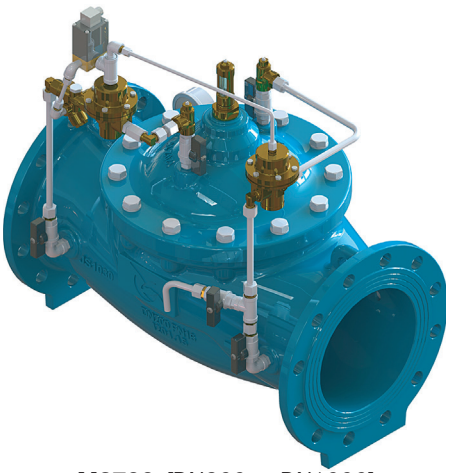
**M3701** *[DN50 to DN250]*
SOLENOID CONTROLLED ON-OFF VALVE



MAIN VALVE



**M3770** *[DN300 to DN1000]*
SOLENOID CONTROLLED / ELECTRICALLY OPERATED "STEP BY STEP"



**M3700** *[DN300 to DN1000]*
SOLENOID CONTROLLED ON-OFF VALVE

**M3900**
EXCESS FLOW VALVE



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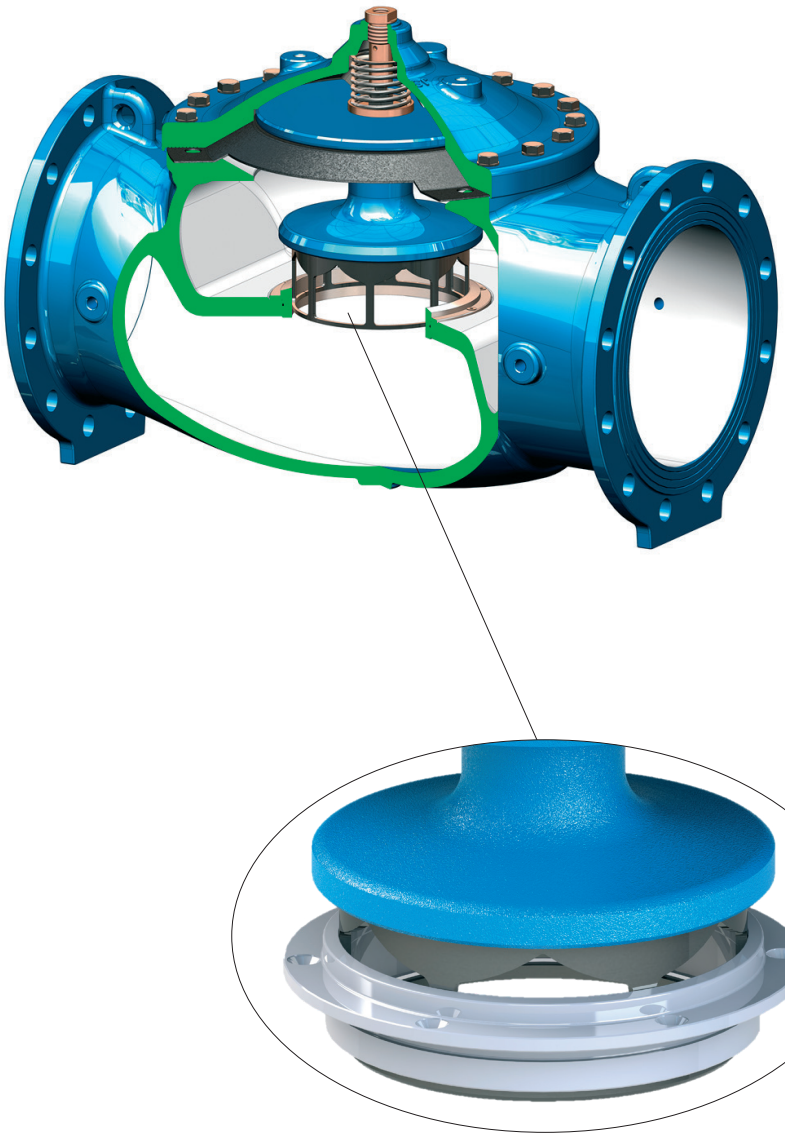
# ACCESSORIES

## V-PORT

Many applications of automatic control valves are used in distribution networks, or in tourist facilities (e.g. camping, hotels, resorts), where an high range of flow rate is required due to the presence of elevated number of guests. In cases like this, the valve can be equipped with a V-PORT device, avoiding the use of a bypass valve to manage low flow rate demands.

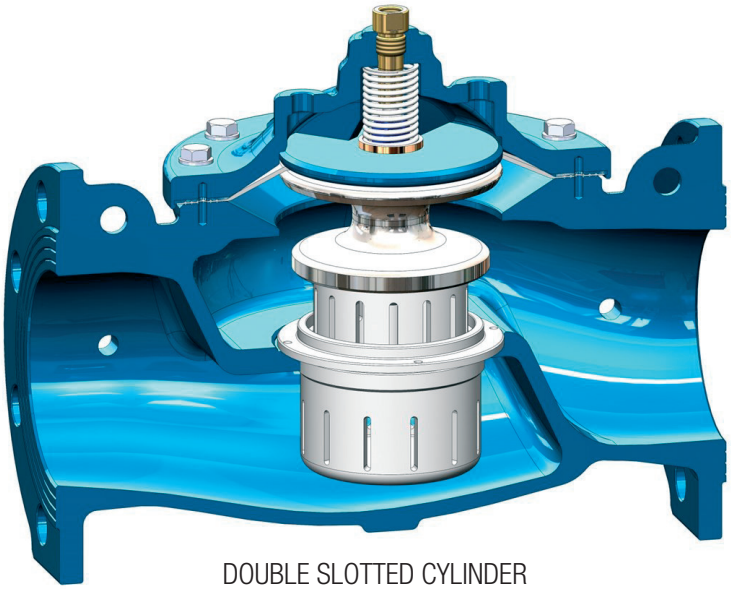


V-PORT
Main valve configuration

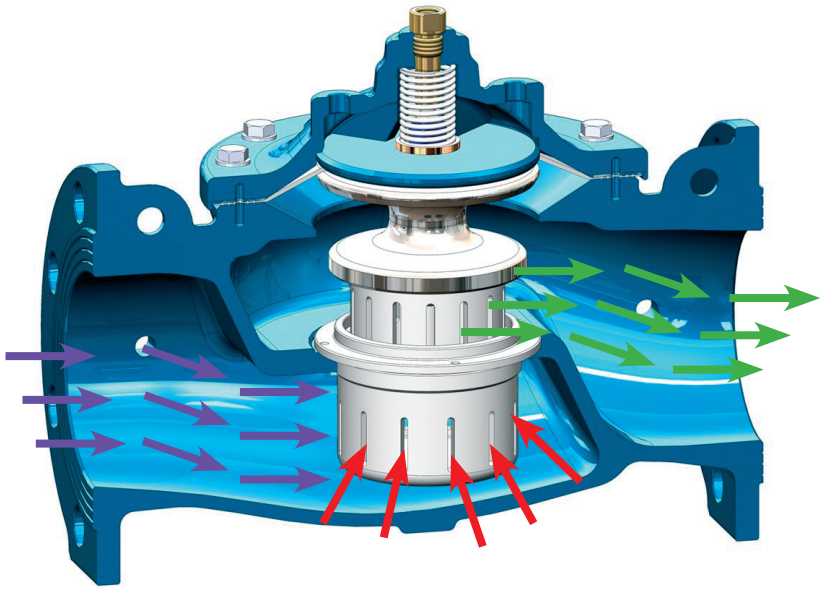
## DOUBLE SLOTTED CYLINDER (DSC)

In the presence of high loads to be dissipated and in situations where the main valve with standard parabolic obturator is subjected to cavitation, it is possible to equip the valve itself, in its interior, with a double stain-less steel slotted cylinder where, through the specially designed slots, the flow is divided into radial flow jets, colliding with each other at the center of the valve, thus allowing to dissipate this energy. This accessory allows to obtain a curve of dissipation of energy which is adjusted to the actual working conditions of the val-ve, according to the actual needs of plant. This accessory allows to achieve an energy dissipation curve which is adjusted to the real working conditions of the valve, according to the plant's effective requirements.

A significant noise reduction is achieved with the use of the DSC.



DOUBLE SLOTTED CYLINDER
Main valve configuration





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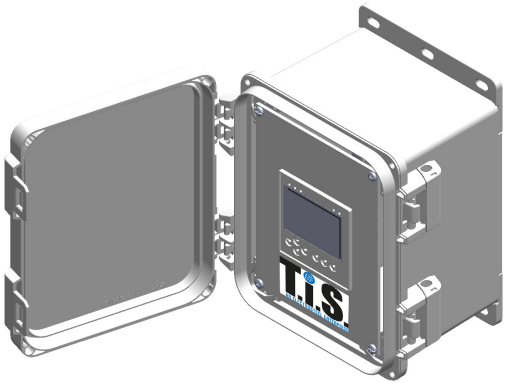
# IDC • SMART AND COMPACT VALVE MICROCONTROLLER



T.I.S. IDC is a family of compact, intelligent, and flexible controllers, open to communication with various remote units and also available with cloud connectivity: controlling and visualizing your application just got easier.

T.I.S. IDC is designed as a controller for automatic diaphragm/piston control valves and needle valves, with an open, modular system and preloaded applications for the main control functions, customizable according to the end user's requirements.

The range of applications that can be implemented with T.I.S. IDC is more versatile than ever, both in the classic version with touchscreen display and the recent compact "Light" version, with an integrated display and robust touch controls.

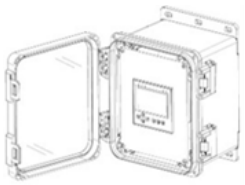
Valve control is finally open and based on curves or setpoints that can be configured simply and intuitively. Multiple PID controllers, including self-tuning, allow for accurate, continuous positioning of actuators or management of digital outputs (solenoid valve controls).

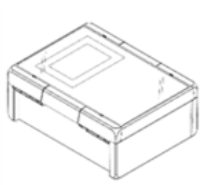
The operating logic is created using intuitive standard languages: "Function Block Diagram" (FBD) or "Ladder Diagram" (LAD).

The availability of multiple analog and digital inputs allows IDC to be fully adaptable to various control applications and customer-specific customizations. It can also process alarms, such as flooding signals, threshold violations, etc.

Each microcontroller is housed in a robust ABS enclosure for wall mounting, certified to IP68.

# TECHNICAL SPECIFICATIONS





| Functions and Features | IDC Light | IDC Classic |
|---|---|---|
| | | |
| REGULATION FUNCTIONS | | |
| Flow rate regulation | ■ | ■ |
| Upstream pressure regulation (sustaining) | ■ | ■ |
| Downstream pressure regulation (reducing) | ■ | ■ |
| Valve opening regulation | ■ | ■ |
| Regulation with day/night time setpoint | ■ | ■ |
| Regulation with multipoint time setpoint | □ | ■ |
| Flow rate regulation based on the tank level | □ | ■ |
| Pressure regulation based on flow rate | □ | ■ |
| Customization upon customer request | ■ | ■ |
| | | |
| TECHNICAL CHARACTERISTICS | | |
| Approximate dimensions LxWxH | 260x185x280 mm | 285x160x365 mm |
| Power supply | 230 VAC/ 24VDC | 12-24 VDC |
| Controller power consumption | 15 VA/W | 10 W |
| HMI power consumption | - | 15 W |
| Display | 3,5" Color | 7" Touchscreen (*) |
| Tactile buttons | ■ | □ |
| Enclosure protection rating | IP68 | IP68 |
| Temperature range | -20..+55 °C | 0..+50 °C |
| Real-time clock with battery backup | ■ | ■ |
| Configurable data logging | ■ | ■ |
| | | |
| INPUTS OUTPUTS (**) | | |
| Digital inputs | 8 | 8 |
| Digital outputs | 8 | 8 |
| Analog inputs | 4 | 6 |
| Analog outputs | 2 (4-20mA/0-10V) | 4 (4-20mA/0-10V) |
| | | |
| COMMUNICATION | | |
| Industrial Ethernet Port 10 / 100 Mbit/s (Modbus TCP/IP) | 1 | 1 |
| USB Port | 1 | 1 |
| RS485 Port (Modbus RTU) | 2 (Master/Slave) | 1 (Master/Slave) |
| CAN Port | - | 1 |

(*) The touchscreen display size may vary based on the availability of new hardware.

(**) The number of available I/Os can be expanded with additional modules or otherwise vary based on the availability of new hardware.



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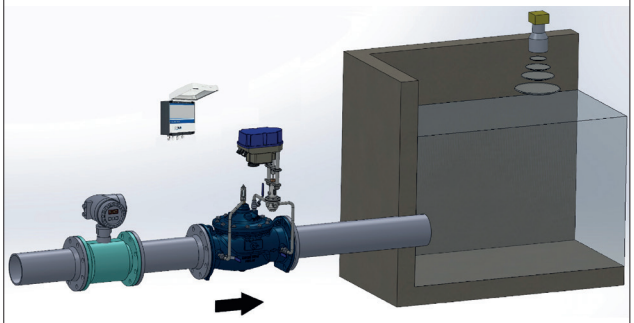
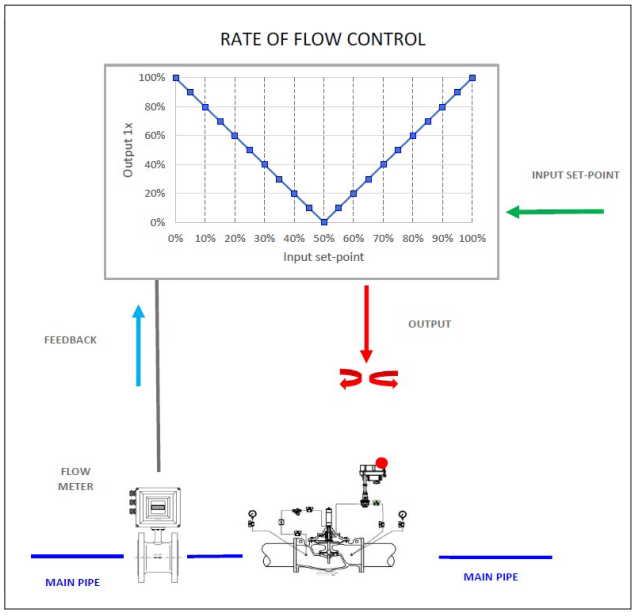
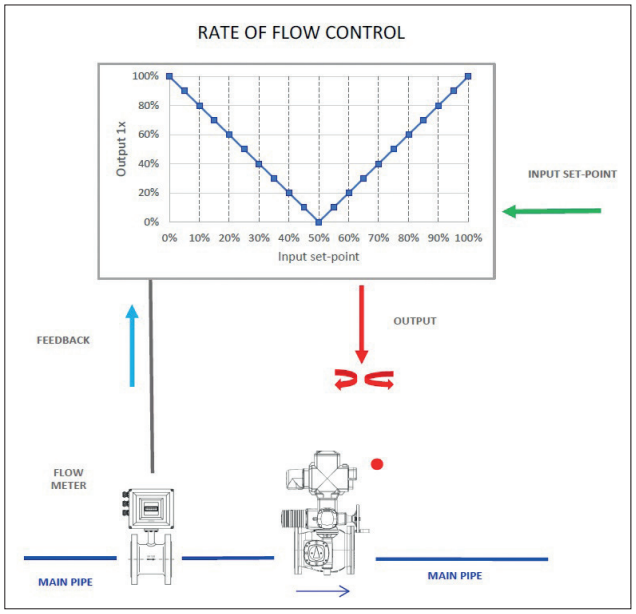
# INSTALLATION EXAMPLE

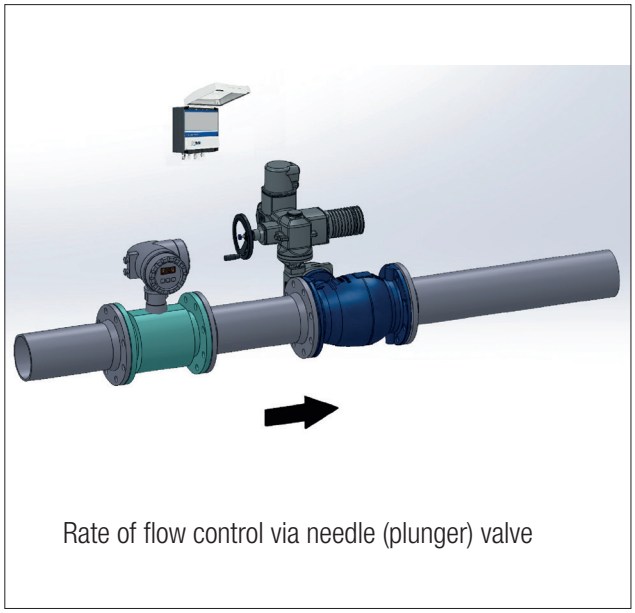
- RATE OF FLOW CONTROL;
- RATE OF FLOW CONTROL BASED ON SUPPLIED TANK LEVEL;
- BLENDING;
- PRESSURE CONTROL;
- PRESSURE CONTROL BASED ON SUPPLIED TANK LEVEL;
- OPENING DEGREE REGULATION.



Rate of flow control according to tank level
via automatic control valve.



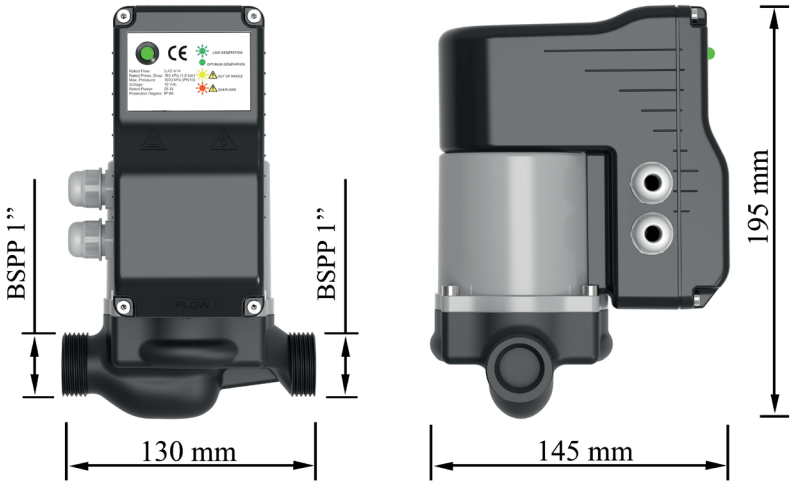



Rate of flow control via needle (plunger) valve

NUOVAL LINE

## SELF-POWERED VERSION ACCESSORY: MINI-TURBINE FOR BATTERY PACK CHARGING




## ELECTRICAL SPECIFICATIONS

| | |
|---|---|
| Generator type | Brushless |
| Nominal output voltage | 12 V |
| Maximum output current | 2 A |
| Maximum output power | 25 W |
| Allowed batteries | Lead-acid Sealed |
| Allowed batteries capacity | 9-45 Ah |
| Output control | Output for EV control latch type of 2 wires |
| Status signalling | Built in status led light.<br>Status digital output (1), free potential transistor output (suitabie for PLC or datalogger inputs) |
| Minimum voltage of battery V1 | 10,5 V |
| Timed ignition voltage V2 | 12,5 V |
| Instant ignition voltage V3 | 12,3 V |
| Minimum full-charged voltage V4min | 14,6 V |
| Minimum full-charged voltage V4max | 15,0 V |
| Minimum operation timing T1 | 20 minutes |
| Security timing T2 (timed ignition) | 5 minutes |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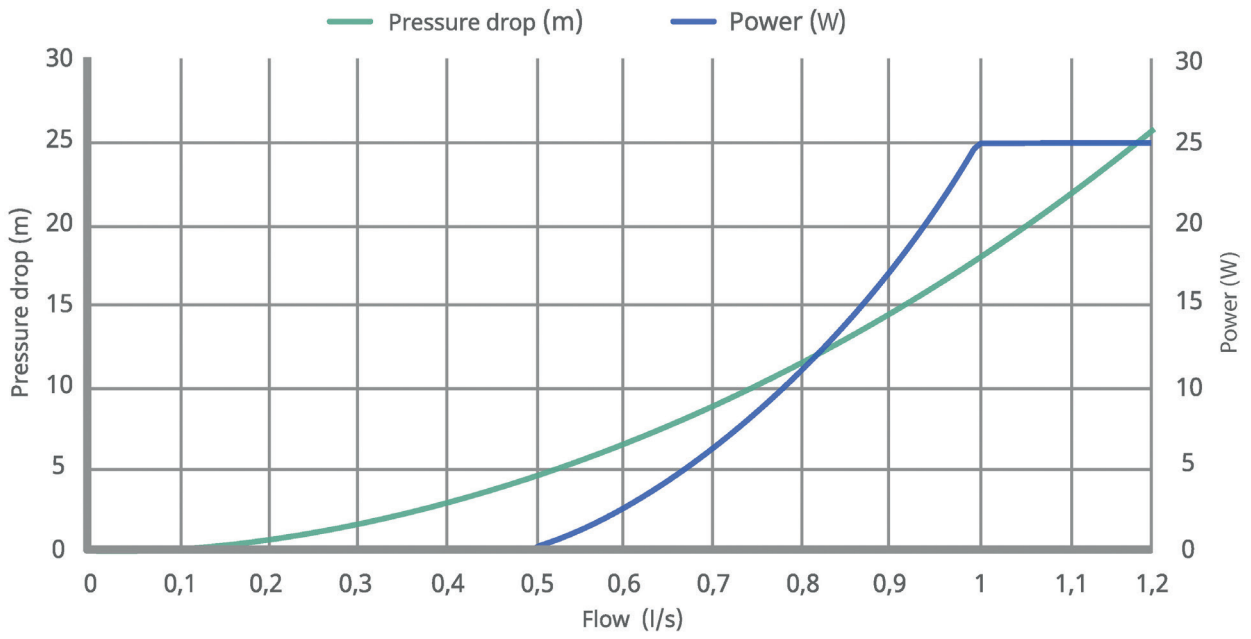
## HYDRAULIC SPECIFICATIONS

| | |
|---|---|
| Nominal pressure | 10 bar (PN10) |
| Minimum Δ pressure inlet-outlet | 0,45 bar |
| Maximum Δ pressure inlet-outlet | 1,8 bar |
| Δ absolute maximum pressure inlet-outlet ΔPmax | 2,0 bar |
| Minimum flow | 0,50 litres/second |
| Maximum flow | 0,95 litres/second |
| Absolute maximum flow Qmax | 1,00 litres/second |

## MINI-TURBINE OPERATING RANGE CURVES



## MECHANIC SPECIFICATIONS

| | |
|---|---|
| Enclosure protection | IP68 |
| Nominal pressure | 10bar (PN10) |
| Inlet / outlet diameter and thread | 15mm, BSPP 1" |
| Free passage of solids | Maximum 1 mm |
| Net weight | 2,7 kg |
| Dimensions | 130 x 145 x 195 mm |

## COMPONENTS MATERIALS

| | |
|---|---|
| Hydraulic body | Cast steel |
| Impeller | Noryl |
| Rotor | AISI 316 Stainless steel |
| Gasket | EPDM |
| Shafts | Ceramic |
| Bearing | Fluid refrigerated ceramic |

## PROTECTIONS

| | |
|---|---|
| Battery cut off (low battery protection) | 10,5 V |
| Overvoltage | Electronic protection |
| Generation overload | Fuse #1 of 0,5 A |
| Overcurrent, short-circuit electrovalve | Fuse #2 of 2,5 A |
| Overcurrent, battery short-circuit | Fuse #3 of 3,0 A |
| Reduction of power due to heating | Depending on battery voltage and ambient temperature |

## ENVIRONMENT CONDITIONS

| | |
|---|---|
| Working temperature | -20 °C to +60 °C (power reduction from 50°C) |
| Working humidity | 10 % ~ 90 % non-condensation |

216/42/CEE, 2004/108/CEE, 2011/65/CEE, EN 12100-1/2, EN 14121-1/2007



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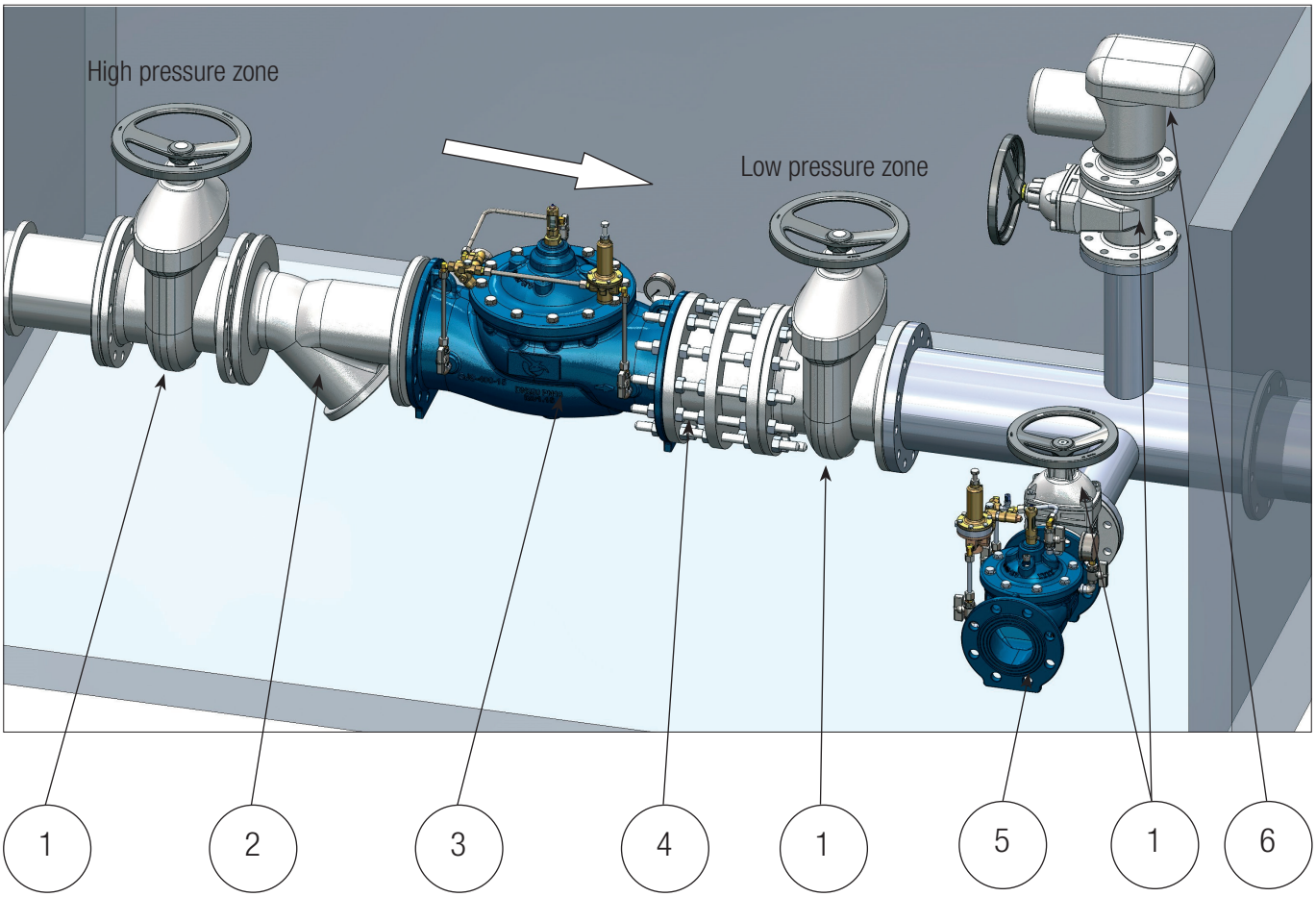
# INSTALLATION LAYOUT

Below an example of installation with a control valve. This ensures extended operating life and correct operation of the valve, reducing the probability of damage or operating faults.




1 ISOLATING GATE VALVE;

2 “Y” STRAINER;

3 AUTOMATIC CONTROL VALVE (PRESSURE REDUCING VALVE);

4 DISMANTLING JOINT;

5 AUTOMATIC CONTROL VALVE (PRESSURE RELIEF VALVE);

6 AIR RELEASE VALVE (TRIPLE FUNCTIONS)

It remains at the customer’s discretion to create a by-pass line to the valve to ensure water service even in the event of maintenance or failure of the main line valve. By-pass installation is strongly recommended.