

DESALINATION

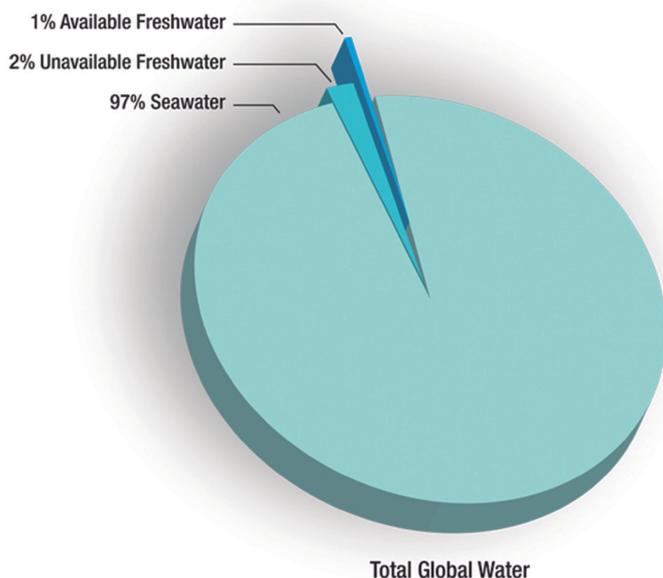
EQUIPMENT FOR REVERSE OSMOSIS
DESALINATION SYSTEM (SWRO)

VALVES | FILTERS | INSTRUMENTATION | PIPING AND FITTINGS

Introduction

Desalination or desalinization is a process that removes minerals from saline water to get fresh water.

The freshwater is water containing less than 1000 milligrams per liter of dissolved solids, most often salt. The global distribution of freshwater resources varies greatly from region to region but as a conclusion it is stated that approximately 97% of the global water supply is found in the oceans, which are saline, and a very small amount of salty water is also located in saline lakes. Therefore, the remaining water inventory (3%) is 'freshwater', and only the 1% is considered available for human use.



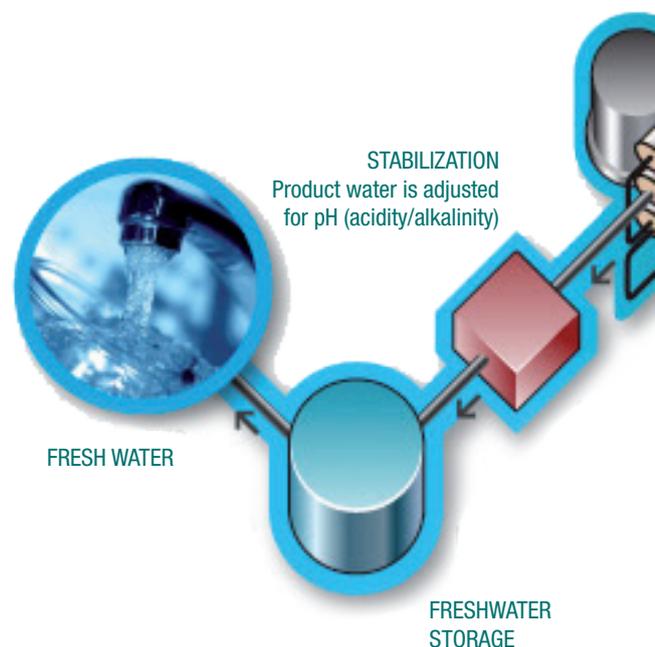
Oceans hold almost all the water on Earth and they are a source of drinking water thanks to the technological advances that make possible to remove salt from seawater. The proliferation of desalination plants to achieve freshwater human demand is a fact.

How does it work?

This filtration process uses pressure to force water through a membrane. In seawater desalination plants salts are separated from the fresh water applying pressure to the seawater, which is 60 to 70 times higher than the atmospheric pressure. The salt remains on one side of the membrane, while the pure solvent (freshwater) passes to the other side. The water moves from an area of high solute concentration to an area of low solute concentration.

While osmosis was discovered as early as the 1700s, it wasn't until the 1960s that scientists were able to use the process to desalinate water. As its name indicates, this process is the reverse of normal osmosis, in which a solvent moves with no added pressure from an area of low solute concentration to an area of high solute concentration.

This technology has been taken into a industrial desalination plant, which involves different steps: Seawater supply, pretreatment system, reverse osmosis process and concentrated salty water disposal, stabilization of the permeate, and finally storage and distribution of freshwater.



Getting more and more efficient

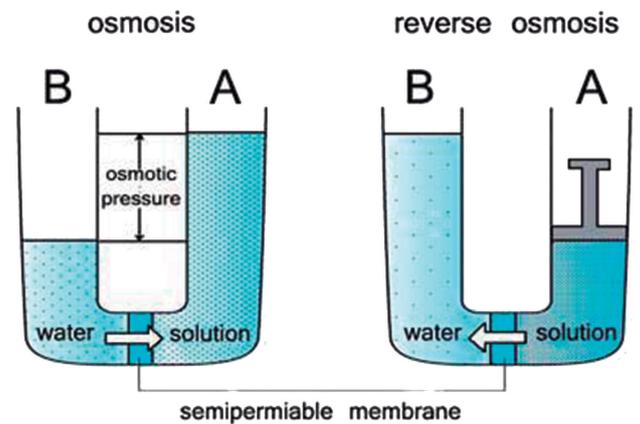
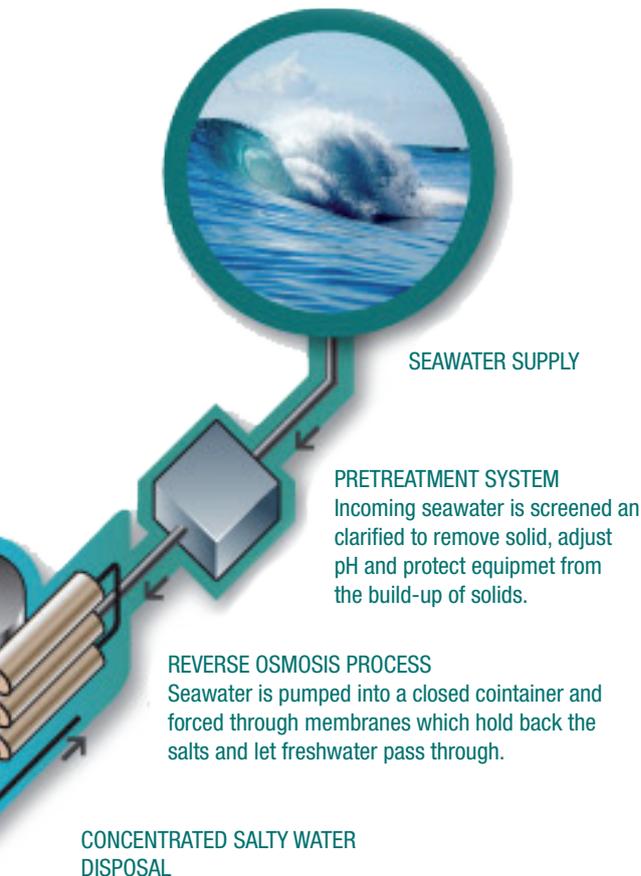
Historically, the key concern related to the use of seawater desalination in a large scale has been the high cost of water production. Cost-saving innovations in seawater desalination technology are transforming the once expensive option of last resort into a economical viable alternative.

Typically, a large seawater desalination plant has thousands of membrane elements connected into a highly automated and efficient water treatment system.

The productivity, energy use, salt separation efficiency, cost of production and durability of the membrane elements by enlarge determine the cost of the desalinated water. Technological and

production improvements in all of these areas in the last two decades are rendering water supply from the ocean affordable.

Dramatic improvements of the membrane element materials and energy recovery equipment for the last 20 years coupled with enhancements in the efficiency of RO feed pumps, and reduction of the pressure losses through the membrane elements have allowed to reduce the use of power to desalinate seawater.



Spreading all over the world

Desalination has evolved into a viable water supply alternative allowing to tap the largest water reservoir in the world – the ocean. Seawater desalination technology, available for decades, made great strides in many arid areas of the world such as the Middle East, the Mediterranean, and the Caribbean.

Desalination plants operate in more than 120 countries in the world.

Worldwide, desalination plants produce over 14 million cubic meters of potable water a day. The installed reverse osmosis desalination plant capacity has increased in an exponential scale over the last 30 years and it is highly probable that will increase even more.

PRODUCTS GUIDE



3. REVERSE OSMOSIS

P – Duplex, superduplex, superaustenitic piping, fittings and flanges for high pressure lines. PP/PE100 piping and fittings for low pressure lines.

V – Ball, plug, butterfly, globe, check valves made of duplex, super duplex, super austenitic materials for high pressure lines. Valves made of plastic for low pressure lines. Automatization according to customer requirements.

I – Pressure meters, flowmeters.

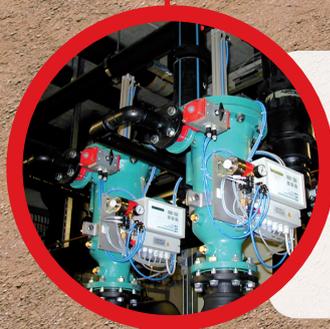
O – Victaulic unions, rigid and flexible couplings. GRP structures, ladders, handrails.

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2. PRETREATMENT SYSTEM

P – Piping, flanges and fittings.

V – Gate, butterfly, ball, plug, diaphragm and check valves.

F – Selfclean filters, sand filters, cartridge filters.

I – Pressure meters, flowmeters, temperature, level meters.

4. FRESHWATER STORAGE AND DISTRIBUTION

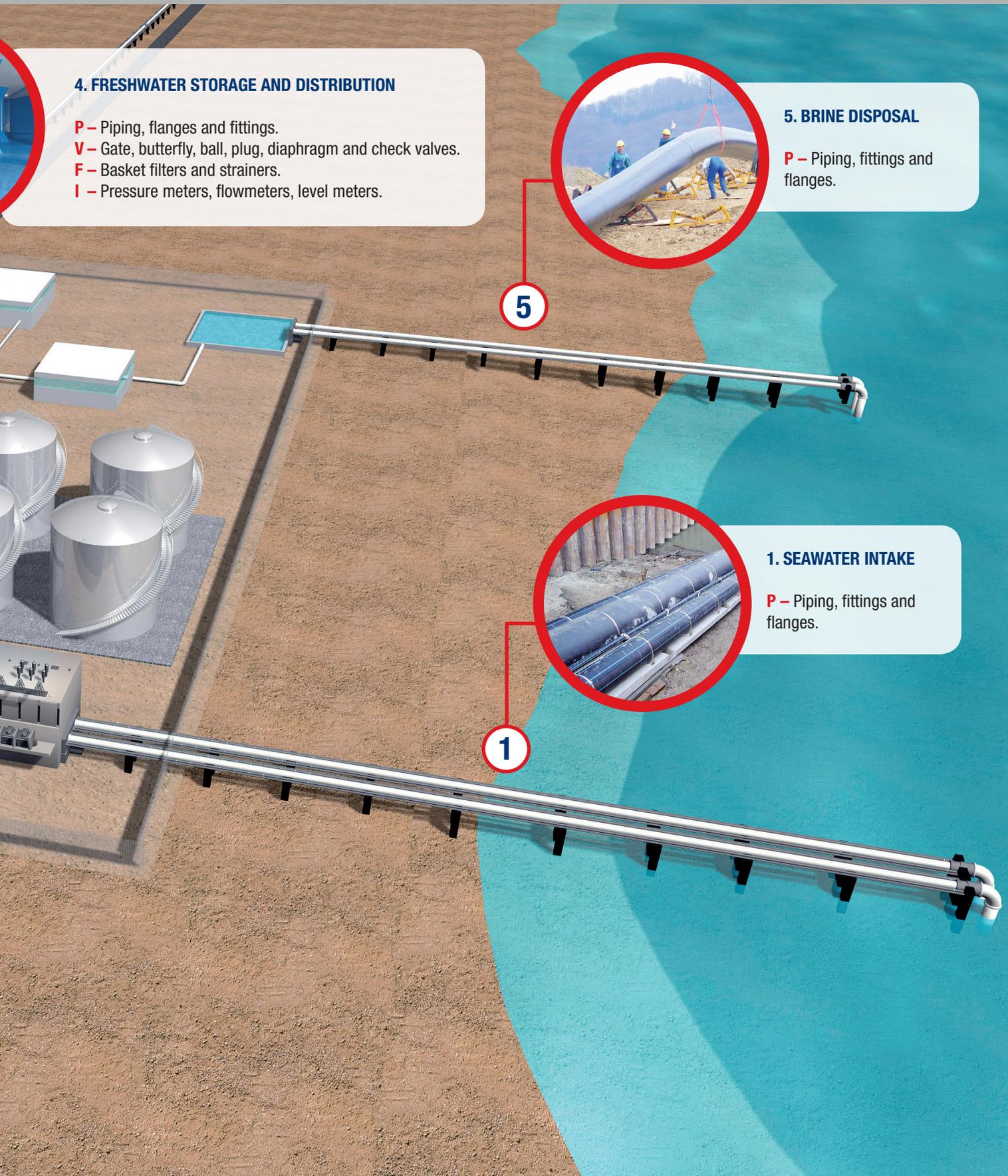
- P** – Piping, flanges and fittings.
- V** – Gate, butterfly, ball, plug, diaphragm and check valves.
- F** – Basket filters and strainers.
- I** – Pressure meters, flowmeters, level meters.

5. BRINE DISPOSAL

- P** – Piping, fittings and flanges.

1. SEAWATER INTAKE

- P** – Piping, fittings and flanges.





VALVES

V1 – SEAWATER INLET AND BRINE LINES *

Type	Gate, butterfly, plug, ball valves
Materials	Duplex, Super duplex, Aluminium – bronze, Ductil iron. Internal coating in halar, epoxi, thermoplastic materials or others • PVC, PP, PVDF
Sizes	<DN4000 • <DN1400
Rating/ Pressure	PN10/PN16/PN25 • PN10
Application	Seawater inlet - pretreatment line; Brine line. Valves capable to work with high flowrates and low pressures. Material highly resistant to seawater corrosion



Type	Swing check, spring piston check, wafer check, ball check valves
Materials	Duplex, Super duplex, Aluminium – bronze, Ductil iron. Internal coating in halar, epoxi, thermoplastic materials or others • PVC, PP, PVDF
Sizes	<DN4000 • <DN1000
Rating/ Pressure	PN10/PN16/PN25 • PN10
Application	Seawater inlet - pretreatment line; Brine line. Material highly resistant to seawater corrosion



V2 – CHEMICAL DOSING LINES *

Type	Diaphragm valves, Ball valves – 2 or 3 ways, Ball check valves
Materials	Ductil iron ETFE or PFA lined. • PVC, PP, PVDF, CPVC, • E-CTFE
Sizes	<DN350 • <DN250
Rating/ Pressure	PN10/PN16/PN25 • PN10/PN16
Application	Chemical dosing systems. Materials chemically compatibles with the different reagents used



* All these kind of valves can be hand wheel or gearbox operated when operation is manual or electric/pneumatic actuated from a control panel when are automatic.

V3- REVERSE OSMOSIS - HIGH PRESSURE LINE *

Type	Plug, ball and globe control valves
Materials	Duplex, Super duplex, special alloys. PFA or PTFE coated
Sizes	<DN600
Rating/ Pressure	150# to 4500#
Application	High pressure lines in RO system. Recovery energy line



Type	Double check valve; axial type check valve
Materials	Duplex, Super duplex, special alloys. PFA or PTFE coated
Sizes	<DN600
Rating/ Pressure	150# to 4500#
Application	High pressure lines in RO system. Recovery energy line

V4 – WASHING SYSTEM LINE AND FRESHWATER LINES *

Type	Gate, butterfly, plug, diaphragm, ball valves – 2 or 3 ways
Materials	Carbon steel, Stainless steel, ductil iron. • PP
Sizes	<DN1400 • <DN250
Rating/ Pressure	PN10/PN16 • PN10/PN16
Application	Washing system for RO membranes maintenance. Permeate or freshwater lines



Type	Swing check, wafer check valves
Materials	Carbon steel, Stainless steel, ductil iron. • PP
Sizes	<DN1000 • <DN250
Rating/ Pressure	PN10/PN16 • PN10/PN16
Application	Washing system for RO membranes maintenance. Permeate or freshwater lines



V5- COMPLEMENTARY VALVES *

Type	Ball, butterfly, plug, diaphragm, check valves.
Materials	Carbon steel, Stainless steel coated
Sizes	Wide range according to the flow rates
Rating/ Pressure	Up to 600#
Application	Out of the main desalination process there are a lot of complementary systems which require different valves according to the selected process: air pressure system, vents, drains, ...





FILTERS

F1 – SELF CLEANING FILTERS

Self-cleaning filters perform as prefilter before reverse osmosis membrane equipment, regardless if the water is taken from the sea or from a deep well.

Type	Bernoulli Effect
Materials	Housing: GRP, coated Carbon Steel, Stainless steel Strainer: Stainless Steel, duplex, super duplex and Titanium (Perforate plate or wedge wire)
Fineness	100 µm - 3 mm
Flow Rate	From 10 m³/h to 50.000 m³/h
Pressure	PN6, PN8 y PN10 (minimum pressure required = 0,6 bar)
Clean Performance	Cleaning Bernoulli effect through flushing disc pneumatic or electrical operated
Advantages	Continuous Filtration, high performance in high suspended particles water (up to 200 mg/l). Low maintenance due to the absence of contact between mobile parts.



Type	Screen type
Materials	Housing: coated Carbon Steel, Stainless Steel Strainer: Duplex, Super duplex
Fineness	10 µm - 1000 µm
Flow Rate	Up to 7.200 m³/h
Pressure	2 bar - 10 bar
Clean Performance	Backflushing by nozzles
Advantages	Continuous filtration. Able to reach very low fineness. Chance of getting high flow rates joining more filters and controlling them with the same control unit.



Type	Filter discs
Materials	Housing: Reinforced Polyamid. Manifolds and discs: High Density Polyethylene
Fineness	5 µm - 500 µm
Flow Rate	from 30 m³/h
Pressure	1,5 bar - 16 bar
Clean Performance	Back Washing
Advantages	High filtration Surface (5050 cm²/per filter). Modular unit which allows to be adapted according to the flow rate. Minimum maintenance.



F2 – BED SAND FILTERS

Sand filtration is used to remove suspended solids and colloidal material in water.

Type	Sand Filter
Materials	Housing: GRP / Carbon steel Bed: flint, charcoal, activated carbon (traces of oils, fats and hydrocarbons)
Flow rate	<100 m ³ /h
Pressure	1,5 bar - 6 bar
Cleaning	Back Washing
Advantages	Easily operated. Minimum Civil Works. Low power consumption



F3 – CARTRIDGE FILTERS

Used as security filters in the previous step of reverse osmosis.

Type	Cartridge Filters
Materials	Housing: GRP / PVC
Flow Rate	Multi – Cartridge solutions until 365 m ³ /h
Pressure	1,5 bar - 6 bar
Advantages	Easy maintenance. Compact Filter



F4 – PROTECTION FILTERS

Type	“Y”, “T”, basket (simplex and duplex), temporal (conical and troncoconical)
Materials	Housing: GRP, Stainless steel, Duplex and super duplex Screen: Stainless steel, Duplex and super duplex (Perforate plate + mesh)
Flow Rate	Any flow rate
Fineness	30 µm - 6 mm
Pressure	PN10, PN16, PN40, 150#, 300#,800# and others
Connections	BSP, NPT, Flanged, BW, SW
Advantages	Low cost with high efficiency. Option to do the maintenance without interrupting the pipe line by using duplex basket filter





INSTRUMENTATION

I1- PRESSURE AND DIFFERENTIAL PRESSURE TRANSMITTERS

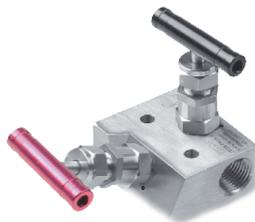
- Features**
- High Reference Accuracy: +/- 0,075 % of Calibrated Span
 - High Rangeability (100:1)
 - Hastelloy-C available for process connection and diaphragm



I2- NEEDLE VALVES AND INSTRUMENT MANIFOLDS



GAUGE VALVES



2-VALVE MANIFOLDS

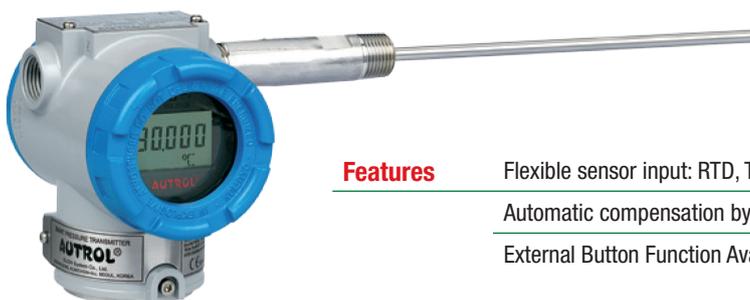


3-VALVE MANIFOLDS



5-VALVE MANIFOLDS

I3- TEMPERATURE TRANSMITTER



- Features**
- Flexible sensor input: RTD, T/C, mV, Ohm
 - Automatic compensation by Linearization table
 - External Button Function Available

14 – PLASTIC TUBE VARIABLE AREA FLOWMETERS



Features

½" ... 3"

4 l/h ... 50 m³/h H₂O

200 NI/h ... 1500 Nm³/h air

Accuracy: 4% ... 6% (q_G=50%)

Materials: Flow tube: Polysulfone, Trogamid® T or NAS®. Connections: PVC, PP, galvanized and painted steel, EN 1.4404 (AISI 316L)

1 or 2 switches

0 ... 4-20 mA output (max. resolution 18 points)

Ex version and HART®, Profibus or Fieldbus protocols on request

15 – GLASS TUBE VARIABLE AREA FLOWMETERS



Features

½" ... 3"

2.5 l/h ... 50 m³/h H₂O

50 NI/h ... 1500 Nm³/h air

Accuracy: 1.6% (q_G=50%)

Materials: Flow tube: borosilicate glass. Connections: galvanized and painted steel, EN 1.4404 (AISI 316L), PVC, PP, PTFE, PVDF

1 or 2 switches

0 ... 4-20 mA output (max. resolution 18 points)

Ex version and HART®, Profibus or Fieldbus protocols on request

16 – METAL TUBE VARIABLE AREA FLOWMETERS



Features

DN15 ... DN150

2.5 l/h ... 180 m³/h H₂O

80 NI/h ... 5500 Nm³/h air

Accuracy: 2.5% (q_G=50%) (1.6% (q_G=50%) on request

Materials: EN 1.4404 (AISI 316L), PVC, PP, PTFE, Titanium, Hastelloy C

1 or 2 switches

4-20 mA output

Totalizer

Ex version and HART® protocols on request

Aluminium housing, optional in AISI 316L or PP

Suitable for all flow directions

Programmable by means of PC and USB cable

17 – ELECTROMAGNETIC FLOWMETERS



Features

Pipe sizes: DN3 ... DN1000. Others on request

Accuracy: ±0.5% reading value

Materials: Flow tube: EN 1.4301 (AISI 304). Liner: PP, PVDF, Ebonite, PTFE. Electrodes: Hastelloy C, EN 1.4404 (AISI 316L), Zirconium, Titanium, Tantalum

Flow indication

4-20 mA / Pulse outputs

Totalizer

2 alarm outputs

Batching function (depending on converter)

HART® and Modbus RTU RS485 protocols on request

Programmable by means of PC and USB cable

18 – INSERTION ELECTROMAGNETIC FLOWMETERS



Features

Pipe sizes: DN40 ... DN2000

Accuracy: ±3.5% reading value

Materials: Sensor: EN 1.4404 (AISI 316L), PVDF. Head: PVDF. Electrodes: EN 1.4404 (AISI 316L). Others on request

Flow indication

4-20 mA / Pulse outputs

Totalizer

2 alarm outputs

HART® and Modbus RTU RS485 protocols on request

Flomat-Tap accessory for maintenance purposes without flow interruptions

Programmable by means of PC and USB

19 – LEVEL INDICATORS, TRANSMITTERS AND SWITCHES



Features

Tank side mounted

Measuring range: 0.15 ... 15 m

Accuracy: ±4 mm reading value

Materials: EN 1.4404 (AISI 316L), PVC, PP, PTFE, PVDF

Adjustable switches. Optional with Ex d IIC T6 version

4-20 mA output, Ex version and HART®, Profibus or Fieldbus protocols on request

4-20 mA output, Ex version and HART®, Plastic housing, optional in aluminium

TUBES, FITTINGS AND FLANGES

P1- PIPING

Type	Tubes
Materials	Duplex (1.4462), Super duplex (1.4410 and 1.4501), Super austenitic (1.4547) – Seamless acc. to ASTM A-790 and welded acc. to ASTM A-928
Sizes	<DN600 - Duplex, Super duplex, Super austenitic
Rating/ Pressure	SCH-40S; SCH-80S
Application	Main and secondary lines, seawater intake, brine disposal, chemical lines, others.



P2 - FITTINGS

Type	BW Fittings – Seamless or welded manufactured upon ASTM A-815 / Forged Fittings / Plastic Fittings
Materials	Duplex (1.4462), Super duplex (1.4410 and 1.4501), Super austenitic (1.4547)
Sizes	<DN600 - Duplex, Super duplex, Super austenitic From 1/2" to 2" forged fittings
Rating/ Pressure	SCH-40S; SCH-80S – BW fittings Class 3000 to Class 6000 – Forged fittings
Application	Main and secondary lines, seawater intake, brine disposal, chemical lines, others.



P3 - FLANGES

Type	Forged flanges acc. to ASTM A-182 Blind, EN, SW and SO.
Materials	Duplex (1.4462), Super duplex (1.4410 and 1.4501), Super austenitic (1.4547)
Sizes	From 1" to 24"
Rating/ Pressure	Class 150, 300, 600, 900 and 1500
Application	Main and secondary lines, seawater intake, brine disposal, chemical lines, others.



OTHERS

01 - VICTAULIC UNIONS

Type	Unions Victaulic type
Sizes	Up to 24"
Schedules	Up to 1.200 PSI
Materials	Stainless steel, Duplex and Super duplex
Application	Main and secondary lines, seawater intake, brine disposal, others



02 - RIGID AND FLEXIBLE COUPLINGS

Type	Rigid and flexible couplings
Sizes	Up to 24"
Schedules	Up to 1.200 PSI
Materials	Duplex and Super duplex
Application	High pressure lines



03 – SERIES 466 HIGH PRESSURE VALVES (CLAMP UNION TYPE)

Type	Plug valves feature grooved ends
Sizes	From 10" to 16"
Schedules	Up to 1.200 PSI
Materials	A890 Grade 5A Super duplex (Body & Plug)
Application	The series 466 Plug Valve is suited for use in reverse osmosis desalination plants for on/off and control services



04 - GRP GRATINGS, STRUCTURES, PROFILES, HANDRAILS AND LADDERS

Type	Grating modular structures (open/close surface Grating) Profiles (IPN/HEB; UPN; ANGLE); plates; square and tubular pipes Handrails, ladders, caps, accessories
Sizes	Structures – Module sizes: 30 x 38 x 38 mm / 38 x 38 x 38 mm
Schedules	Grey or green
Materials	Glassfiber Reinforced Plastic
Application	Building of floors, platforms, footbridges, ramps, ladders, etc.



References

Year	Client	Project	Country	EPC	Product
2004	Saline Water Conversion Corporation	Jeddah Plant Group 3	Saudi Arabia	Alstom	Gear operated Butterfly valves
2007	Beni Saf Water Company Spa	Beni Saf Desalination Plant	Argelia	BEFESA - COBRA - SADYT	Tubes, fittings and flanges
2007	Sabic	Yanbu Phase 2 Expansion MED Seawater Desalination Plant	Saudi Arabia	Doosan Heavy Industries & Construction	Manual and actuated butterfly valve.
2007	Sabic	Yanbu Phase 2 Expansion MED Seawater Desalination Plant	Saudi Arabia	Doosan Heavy Industries & Construction	Globe control valves
2008	Algerian Energy Company	Mostaganem	Argelia	INIMA - AQUALIA	Tubes, fittings and flanges
2008	Acuamed	Almanzora Desalination Plant	Spain	BEFESA - AQUALIA	Tubes, fittings and flanges
2008	Acuamed	Aguilas Desalination Plant	Spain	FERROVIAL - CADAGUA	Tubes, fittings and flanges
2008	SKPC/Fluor	Saudi Kayan Petrochemical Complex	Saudi Arabia	SABIC, Al-Kayan Petrochemical Company, public shareholders	Butterfly valves
2008	Sigurd Sorum	Pazflor test rig	North Sea	Sigurd Sorum	Control valves
2009	JV of Geida and Algerian Energy Company	Honaine	Argelia	BEFESA - SADYT	Tubes, fittings and flanges
2009	La Algerian Energy Company (AEC)	Tenés	Argelia	BEFESA	Tubes, fittings and flanges
2010	Acuamed (Aguas de las Cuencas Mediterráneas, S.A.)	Campo de Dalias	Spain	VEOLIA	Tubes, fittings and flanges
2010	Acemsa	Ceuta Desalination Plant	Spain	FERROVIAL-CADAGUA	Tubes, fittings and flanges
2010	Acemsa	Ceuta Desalination Plant	Spain	FERROVIAL-CADAGUA	Plug valves
2011	Qingdao Water Group	Qingdao	China	BEFESA	Self - Cleaning Filters

Year	Client	Project	Country	EPC	Product
2011	Ghana Government	Ghana Desalination Plant	Ghana	ABENGOA	Self - Cleaning Filters Tubes, fittings and flanges
2011	BEFESA	Desalination Cartagena Plant	Spain	DEGREMONT	Flowmeters
2011	Acuamed	Moncófar	Spain	INIMA - ISOLUX CORSÁN – RENOS – FACSA	Tubes, fittings and flanges
2011	Algerian Energy Company	Cap Djinet	Argelia	FCC e Inima (OHL)	Tubes, fittings and flanges
2012	South Korea Government	BUSAN desalination plant	South Korea	DOOSAN HEAVY INDUSTRIES AND CONSTRUCTION	Pressure and temperature transmitters
2013	ACWA Power International	Barka	Oman	ABENGOA	Self - Cleaning Filters Tubes, fittings and flanges
2013	Ghana Water Limited Company (GWCL)	Nungua Desalination Plant	Ghana	ABENGOA	Plug valves & Double check valves
2014	Desalitech Inc., a developer of desalination and industrial water- treatment technologies	Dead sea works LTD	Israel	ABEINSA	“Y” & Basket Filters
2014	ABAQUA	Alcudia	Spain	DEGREMONT	Self - Cleaning Filters
2014	Petroleum Chemicals and Mining Company (PCMC)	Jubail	Saudi Arabia	ACCIONA	Tubes, fittings and flanges
2014	Emirates sembs Corp - Water and Power Company	Fujairah	Emirates	ACCIONA	Tubes, fittings and flanges
2015	ABEINSA	Agadir	Agadir	ABENGOA	Self - Cleaning Filters
2015	Qatar General Electricity & Water Corporation (Kahramaa)	Ras Abu Fontas A3	Qatar	ACCIONA	Tubes, fittings and flanges
2015	Qatar General Electricity & Water Corporation (Kahramaa)	Facility-D	Qatar	ACCIONA	Tubes, fittings and flanges



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