



**Marine Technology**

# **Pneumatics**

for MARINE applications

## Aventics Marine Applications

### Pneumatics

- Control of two-stroke engines
- Control of four-stroke engines
- Remote/local controls
- Clutch controls
- Air preparation
- Monitoring
- Spare parts & service

### Ship Controls

For

- Commercial vessels
- Workboats
- Pleasure boats

To control

- FPP systems
- CPP systems
- Waterjets
- Hybrid systems
- and more

Via

- Control heads
- Joysticks

Including

- Alarm & Monitoring

### Valve Control Systems

- Valve controls
- Tank sounding systems
- Air preparation
- SOS units
- Back up systems
- Monitoring & Control
- Data interface to ship management systems

### Selective Catalytic Reduction (SCR)

- Low-pressure solution for 2-stroke engines
- Low pressure solution for 4-stroke engines
- High pressure solution for 2-stroke engines
- Control units
- Urea supply and dosing units
- Soot blowing and venting units

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## Product requirements

Requirements to products in commercial shipping:

- ✓ Robust
- ✓ Salt-water resistant
- ✓ Humidity resistant
- ✓ Temperature resistant
- ✓ Vibration resistant
- ✓ Short response times in operation
- ✓ Long lifetime
- ✓ Long-term availability of parts
- ✓ Low maintenance
- ✓ Compliance with classification rules



Vessel example

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## Industrial Automation and Marine Technology Comparison of product characteristics

	Industrial Automation	Marine
<b>Filter Particle size</b>	≤ 5 µm	≤ 40 µm
<b>Admissible ambient temperature</b>	-15 to +50 °C mostly	- 20 up to min. +70°C
<b>Housing material</b>	Synthetics	Sea water resistant material Aluminum
<b>Sealing material</b>	Suitable for industry applications	Sealings suitable for extreme temperatures
<b>Supply voltage</b>	24V DC ±10%	24V DC -30%/+25%
<b>Vibration resistance</b>	Low	Class-compliant at minimum
<b>Field of application</b>	Factory Automation	Marine and offshore, heavy industry
<b>Availability / Spares</b>	Frequent design changes	10-30 years

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## Pneumatics at 2-stroke diesel engines

### Mechanically controlled (camshaft):

- ✓ Air preparation
- ✓ Pressure reduction (30 to 7 bar)
- ✓ Engine start and stop
- ✓ Start interlock
- ✓ Reverse the camshaft (ahead/astern)
- ✓ Emergency Stop
- ✓ Fuel injection timing
- ✓ RPM setting
- ✓ Slow turning
- ✓ Local (at the engine) and remote engine control

### Common rail:

- ✓ Air preparation
- ✓ Starting air and distribution



Pneumatic control panel at 2-stroke diesel engine

Major **OEMs** of such engines are:

MAN Diesel & Turbo, Wärtsilä, HHI, Doosan, Mitsubishi, ...

✓ Overview

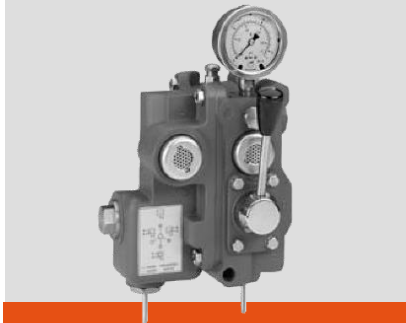
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## Range of pneumatic products of Aventics Marine



**Compressed air preparation**

- ✓ Filters
- ✓ Pressure reducing units and valves
- ✓ Anti-freezers
- ✓ Air Reservoirs
- ✓ Oilers



**Maneuvering valves + control heads**

- ✓ Pneumatic control heads
- ✓ Electric control heads



**Valves**

- ✓ Manually actuated
- ✓ Mechanically actuated
- ✓ Pneumatically actuated
- ✓ Safety valves
- ✓ Starting valves



**Pressure regulating valves**

- ✓ Controlair valves
- ✓ Pressure transformers
- ✓ E/P pressure regulating valves

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## Range of pneumatic products of Aventics Marine



### Working logic

- ✓ Valves
- ✓ Distributors and connecting parts
- ✓ Check-/Shuttle valves
- ✓ Time delay and timing valves
- ✓ Reservoirs
- ✓ Pressure switches
- ✓ Single- and multiple subplates



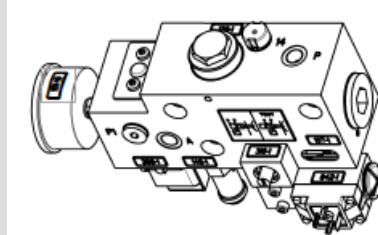
### Positioning units Cylinders+Actuators

- ✓ Single and double-acting cylinders
- ✓ Multi-position cylinders
- ✓ Positioning units
- ✓ Pneumatically and electrically actuated actuators



### Accessories

- ✓ Pressure switches
- ✓ Pressure gauges



### Customer specific devices

- ✓ Pressure reducing stations
- ✓ Local operation panels
- ✓ Mounting units



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## Compressed air preparation

Product Type	Example	
Twin pressure reducing station with lever	335 320 000 0	<ul style="list-style-type: none"> <li>▪ With filter and mechanical trip point</li> <li>▪ 0 – 70°C</li> <li>▪ M14 x 1.5</li> <li>▪ M22 x 1.5</li> <li>▪ Aluminium, sea water resistant</li> <li>▪ Approved by GL</li> </ul> 
Single pressure reducing station	335 379 100 0	<ul style="list-style-type: none"> <li>▪ With filter and safety valve</li> <li>▪ -20°C to +70°C</li> <li>▪ ND 7</li> <li>▪ M14 x 1.5</li> <li>▪ 25 . 40 µm</li> <li>▪ Stainless, Aluminium, sea water resistant</li> <li>▪ Approved by GL</li> </ul> 

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## Compressed air preparation

Product Type	Example	
Pressure regulator G 3/8, 30 bar	375 001 030 0	<ul style="list-style-type: none"><li>▪ Diaphragm pressure regulator with secondary ventilation</li><li>▪ -20°C to +80°C</li><li>▪ max. 1333 NI/min</li><li>▪ GL approved</li></ul> 
Pressure regulator G 1, 40 bar	R417000616	<ul style="list-style-type: none"><li>▪ Diaphragm pressure regulator with secondary ventilation</li><li>▪ -10°C to +90°C</li><li>▪ GL approved</li></ul> 

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## Compressed air preparation

Product Type	Example	
Pressure regulator G 1 1/2, 40 bar	R417001141	<ul style="list-style-type: none"><li>▪ Diaphragm pressure regulator with secondary ventilation</li><li>▪ -10°C to +90°C</li></ul> 
Pressure regulator, M22x1.5	375 003 000 0	<ul style="list-style-type: none"><li>▪ Diaphragm pressure regulator with secondary ventilation</li><li>▪ -30 to +70°C</li><li>▪ M22 x1.5</li><li>▪ GL approved</li><li>▪ Different sizes available</li></ul> 

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## Compressed air preparation

Product Type	Example		
Oiler G 1/2, 16 bar	R417000300	<ul style="list-style-type: none"><li>▪ Oiler with plastic tank max. +60°C</li><li>▪ max. 16 bar</li><li>▪ 1-2 drops/min</li></ul>	
Air dryer M22x1.5	432 433 209 0	<ul style="list-style-type: none"><li>▪ Granulate dryer with twin cartouch</li><li>▪ Ambient temperature 5°C to +70°C</li><li>▪ Operating pressure Max. 10 bar</li><li>▪ Flow: max. 150 NI/min Air consumption: Max. 30 NI/min</li></ul>	

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## Compressed air preparation

Product Type	Example	
Air reservoir	151 003 100	<ul style="list-style-type: none"> <li>Ambient temperature -40° to -100°C</li> <li>Operating pressure 10 bar</li> <li>Model DIN 5590, DIN EN 286 T3</li> <li>Without classification approval</li> </ul> 
Drain valve for air reservoirs	934 300 001 0	<ul style="list-style-type: none"> <li>According to DIN 74 292</li> <li>Ambient temperature -40° to +80°C</li> <li>Operating pressure Max. 22 bar</li> </ul> 

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## Maneuvering valves

Product Type	Example		
Electric control head	R417001125	<ul style="list-style-type: none"><li>• With linear characteristic line</li><li>• -20°C to +70°C</li><li>• 16...36 V DC</li></ul>	
Pneumatic control head	362 128 020 0 362 128 021 0	<ul style="list-style-type: none"><li>• With V-characteristic line</li><li>• -20° to +70°C</li><li>• max. 8 bar +20%</li><li>• 0.5 to 5.5 bar</li><li>• IP 65</li></ul>	

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## Valves

Product Type	Example		
3/2-way-valve, ND4, normally closed or normally open, G1/8	563 020 101 0	<ul style="list-style-type: none"> <li>▪ Poppet valve</li> <li>▪ Operating pressure 10 bar</li> <li>▪ Ambient temperature -25 to +80°C</li> </ul>	
3/2-way-valve, electromagnetically operated, normally closed or open, monostable, ND7, M14x1.5	372 352 222 0	<ul style="list-style-type: none"> <li>▪ Slide valve</li> <li>▪ Nominal flow rate 1100 NI/min</li> <li>Operating voltage 24 V DC</li> </ul>	
3/2-way-valve, electromagnetically operated, normally closed or open, monostable, ND12, G1/2	372 351 222 0	<ul style="list-style-type: none"> <li>• Slide valve</li> <li>• Nominal flow rate 1100 NI/min</li> <li>• Operating voltage 24 V DC</li> </ul>	

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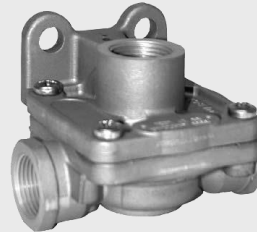
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## Valves

Product Type	Example		
Shuttle valve for oil and air	371 110 020 0	<ul style="list-style-type: none"> <li>▪ Poppet valve</li> <li>▪ Operating temperature -20°C to +70°C</li> <li>▪ For compressed air or hydraulic oil</li> </ul>	
Check valves G1/8-G3/4	534 098 100 0	<ul style="list-style-type: none"> <li>▪ Poppet valve</li> <li>▪ Ambient temperature -15°C to +80°C</li> <li>▪ Operating pressure 0.5 to 15 bar</li> </ul>	
Fast ventilation valve M22x1.5	973 500 000 0	<ul style="list-style-type: none"> <li>▪ Poppet valve</li> <li>▪ Operating pressure range 0.2 to 10 bar</li> <li>▪ ND14</li> <li>▪ Ambient temp. range -40°C to +80°C</li> </ul>	

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## Valves

Product Type	Example	
Starting valve Electrically operated, G1	371 110 020 0	<ul style="list-style-type: none"><li>▪ Poppet valve</li><li>▪ Operating pressure range 6 to 30 bar</li><li>▪ ND 25</li><li>▪ Ambient temp. range -20°C to +70°C</li></ul> 

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## Pressure regulating valves

Product Type	Example		
Controlair Valve ND 2 – ND 7, with button	361 051 050 0	<ul style="list-style-type: none"> <li>▪ Poppet valve</li> <li>▪ Operating pressure 10 bar</li> <li>▪ Ambient temp. range -25°C to +70°C</li> </ul>	
Relay valve ND 7, M14x1.5	373 017 110 0	<ul style="list-style-type: none"> <li>▪ Diaphragm poppet valve</li> <li>▪ Operating pressure 10 bar</li> <li>▪ Nominal flow rate 1050 NI/min</li> <li>▪ Ambient temp. Range -20°C to +70°C</li> </ul>	
Pressure transformer ND2, M14x1.5	375 210 000 0	<ul style="list-style-type: none"> <li>▪ Diaphragm poppet valve</li> <li>▪ Operating pressure 10 bar</li> <li>▪ Ambient temp. Range -20°C to +70°C</li> </ul>	

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## Pressure regulating valves

Product Type	Example	
Electro-pneumatic regulating valve	346 056 550 0	<ul style="list-style-type: none"><li>▪ Poppet valve</li><li>▪ Operating pressure max. 8 bar</li><li>▪ Nominal flow 300 NI/min</li><li>▪ Ambient temp. range -20°C to +60°C</li><li>▪ Supply voltage 24 V ± 20 %</li><li>▪ Converts an electric signal proportionally into pneumatic pressure</li></ul> 

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## Working Logic

The "Working Logic" product range combines valves in size ND 4 with components for signal processing.

- ✓ "Working Logic" permits to realize complex switching processes by means of space-saving and standardized components.
- ✓ The components are mounted on subplates with a standard hole pattern.
- ✓ Designed for the installation in control cabinets
- ✓ Simple, cost-effective, low maintenance



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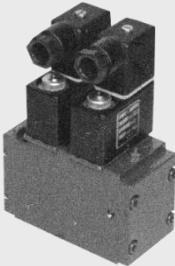
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Working Logic

Product Type	Example		
3/2-way valve, pneumatically energized, monostable	371 200 000 0	<ul style="list-style-type: none"><li>▪ Poppet valve</li><li>▪ Operating pressure 0.5 to 10 bar</li><li>▪ ND 4</li><li>▪ Ambient temp. range -20°C to +70°C</li></ul>	
3/2-way valve, electromagnetically operated, monostable	372 225 022 0	<ul style="list-style-type: none"><li>▪ Poppet valve with pressure indicator</li><li>▪ Operating pressure Max. 10 bar</li><li>▪ ND 4</li><li>▪ Ambient temp. Range -20°C to +60°C</li></ul>	
3/2-way valve, electromagnetically operated, bistable	372 242 022 0	<ul style="list-style-type: none"><li>▪ Slide valve with pressure indicator</li><li>▪ Operating pressure Max. 10 bar</li><li>▪ ND 4</li><li>▪ Ambient temp. range -20°C to +60°C</li></ul>	

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## Working Logic

Product Type	Example	
Accessory valve: Orifice check valve with adjustable time delay	334 115 000 0	<ul style="list-style-type: none"><li>▪ Operating pressure 0.4 to 10 bar</li><li>▪ ND 4</li><li>▪ Ambient temp. range - 20°C to + 70°C</li></ul> 
Accessory valve: Shuttle valve	334 018 100 0	<ul style="list-style-type: none"><li>▪ Operating pressure 0.5 to 10 bar</li><li>▪ ND 4</li><li>▪ Ambient temp. range - 20°C to + 70°C</li></ul> 
Timing valve	371 209 000 0	<ul style="list-style-type: none"><li>▪ Operating pressure 2 to 10 bar</li><li>▪ ND 4</li><li>▪ 20°C to + 70°C</li></ul> 

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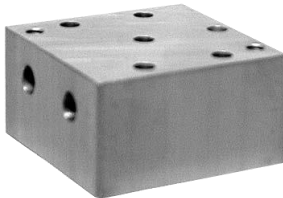

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## Working Logic

Product Type	Example	
Accessory device: Pressure switch	341 040 000 0	<ul style="list-style-type: none"><li>Operating pressure Max. 10 bar</li><li>Ambient temp. range - 20°C to + 70°C</li><li>Admissible load 30 V DC, 3 A (Inductive) 30 V DC, 5 A (Ohmic)</li></ul> 
Accessory device: Single subplate	333 725 100 4	<ul style="list-style-type: none"><li>With seals and plugs</li></ul> 
Accessory device: Multiple subplate	333 720 100 4	<ul style="list-style-type: none"><li>For 4 valves</li><li>With seals and plugs</li></ul> 

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## Cylinders

Product Type	Example	
Tie-rod cylinder Series 322/521	322 060 601 0	<ul style="list-style-type: none"> <li>▪ Double-acting</li> <li>▪ With solenoid piston and adjustable cushioning</li> <li>▪ Ø 32-250 mm</li> <li>▪ Operating pressure 10 bar</li> <li>▪ Stroke 50 – 500 mm</li> </ul> 
Special tie-rod cylinder	322 061 190 0	<ul style="list-style-type: none"> <li>▪ Double-acting</li> <li>▪ With solenoid piston amplified version</li> <li>▪ Ø 40-160 mm</li> <li>▪ Operating pressure Max. 10 bar</li> <li>▪ Stroke 50 – 195 mm</li> </ul> 
Three-position-cylinder	322 157 010 0	<ul style="list-style-type: none"> <li>▪ Piston rod cylinder with spring-held center position</li> <li>▪ Operating pressure Max. 8 bar</li> <li>▪ Stroke 2 x 25.4 mm</li> </ul> 

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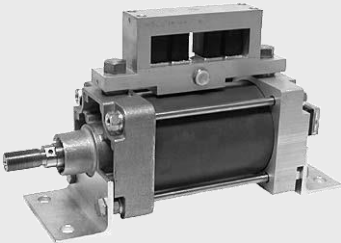

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## Positioners and Actuators

Product Type	Example	
Positioning unit	R417002734	<ul style="list-style-type: none"><li>▪ With integrated distance sensor</li><li>▪ Operating pressure Max. 8 bar</li><li>▪ Stroke 99 mm</li></ul> 
Servo actuator	R417000184	<ul style="list-style-type: none"><li>▪ Operating pressure Max. 7 bar</li><li>▪ Control pressure 0.5 to 5 bar</li><li>▪ Max. force 890 N</li></ul> 

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## Accessories

Product Type	Example		
Pressure switch M12 x1.5	441 014 017 0	<ul style="list-style-type: none"><li>▪ Spring-loaded diaphragm pressure switch</li><li>▪ Operating pressure Max. 10 bar</li><li>▪ Ambient temp. range -40°C to +80°C</li></ul>	
Cut-off-cock 1/4-rotation	352 034 110 0	<ul style="list-style-type: none"><li>▪ Ball valve</li><li>▪ Operating pressure Max. 40 bar</li><li>▪ Ambient temp. range -20°C to +80°C</li></ul>	
Pressure gauge	353 019 010 0	<ul style="list-style-type: none"><li>▪ Ambient temp. range -5°C to +50°C</li></ul>	

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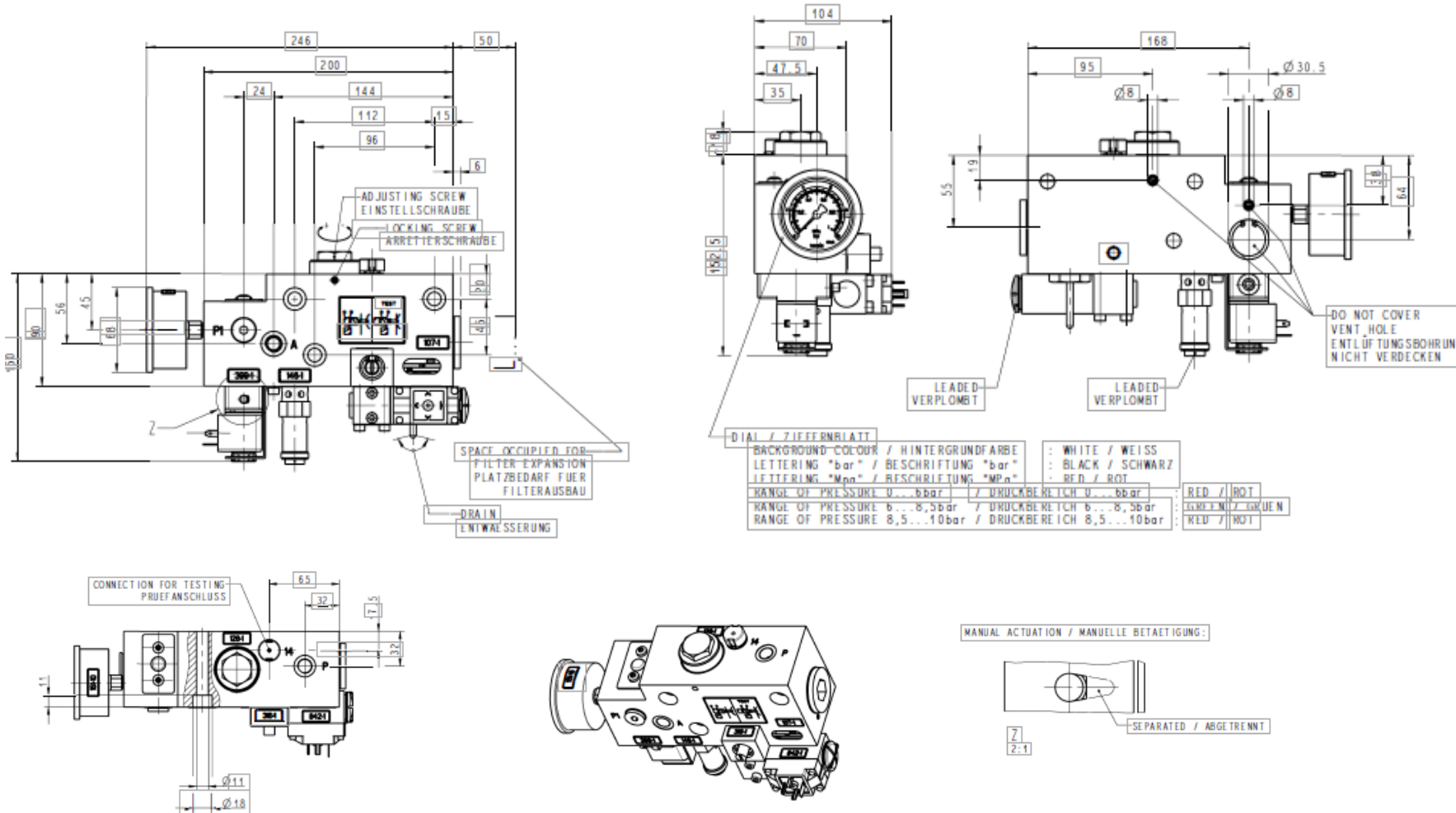
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## Custom-specific pressure reducing unit R417000845 Customer: Caterpillar, Germany



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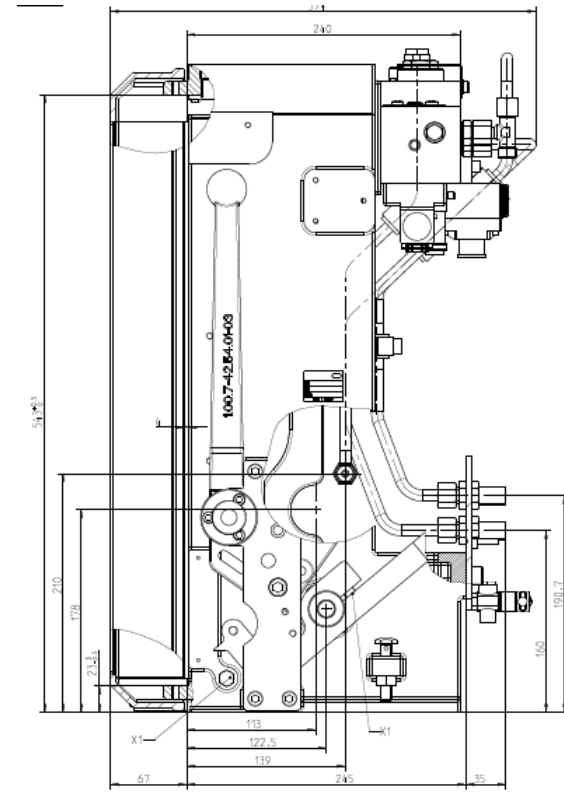
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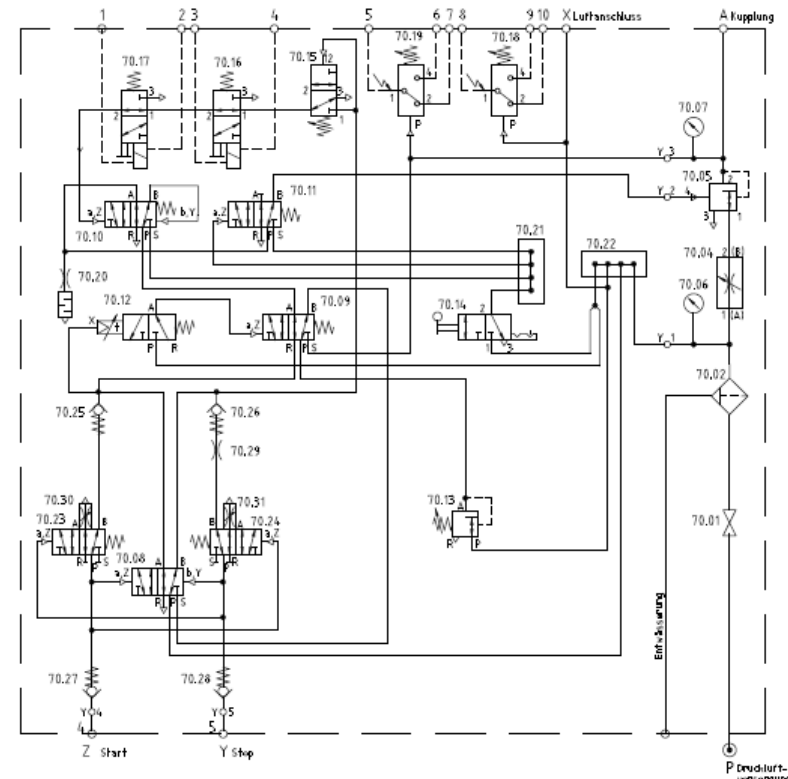
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## Engine control applications



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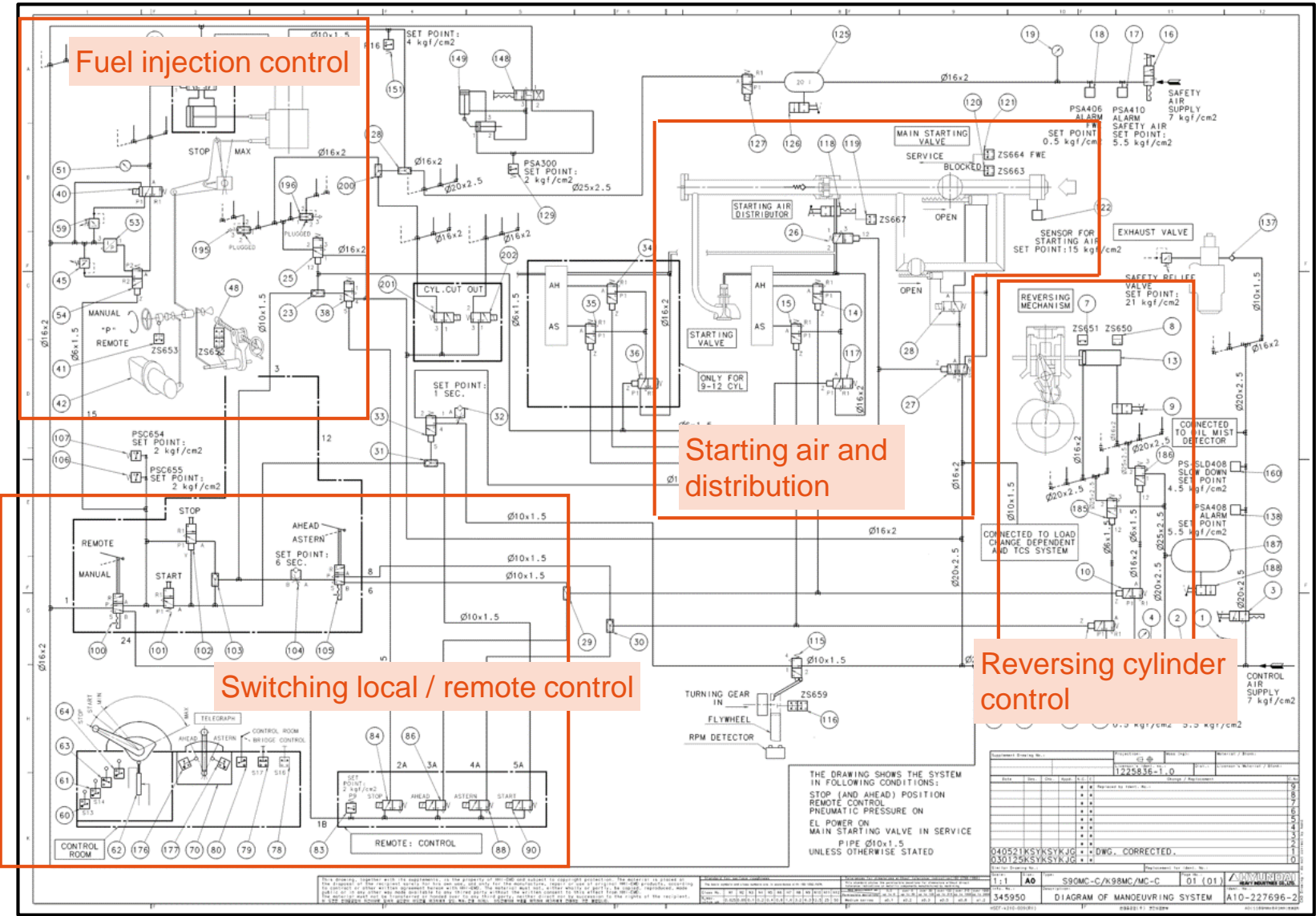
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Example: MAN B&W engine 12 K98 MC-C





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## Local control of a 2-stroke low-speed marine engine (MAK/Caterpillar)

- ✓ Pneumatic start and stop function
- ✓ Acceleration and deceleration of engine RPM
- ✓ Start interlock function
- ✓ Pressure monitoring

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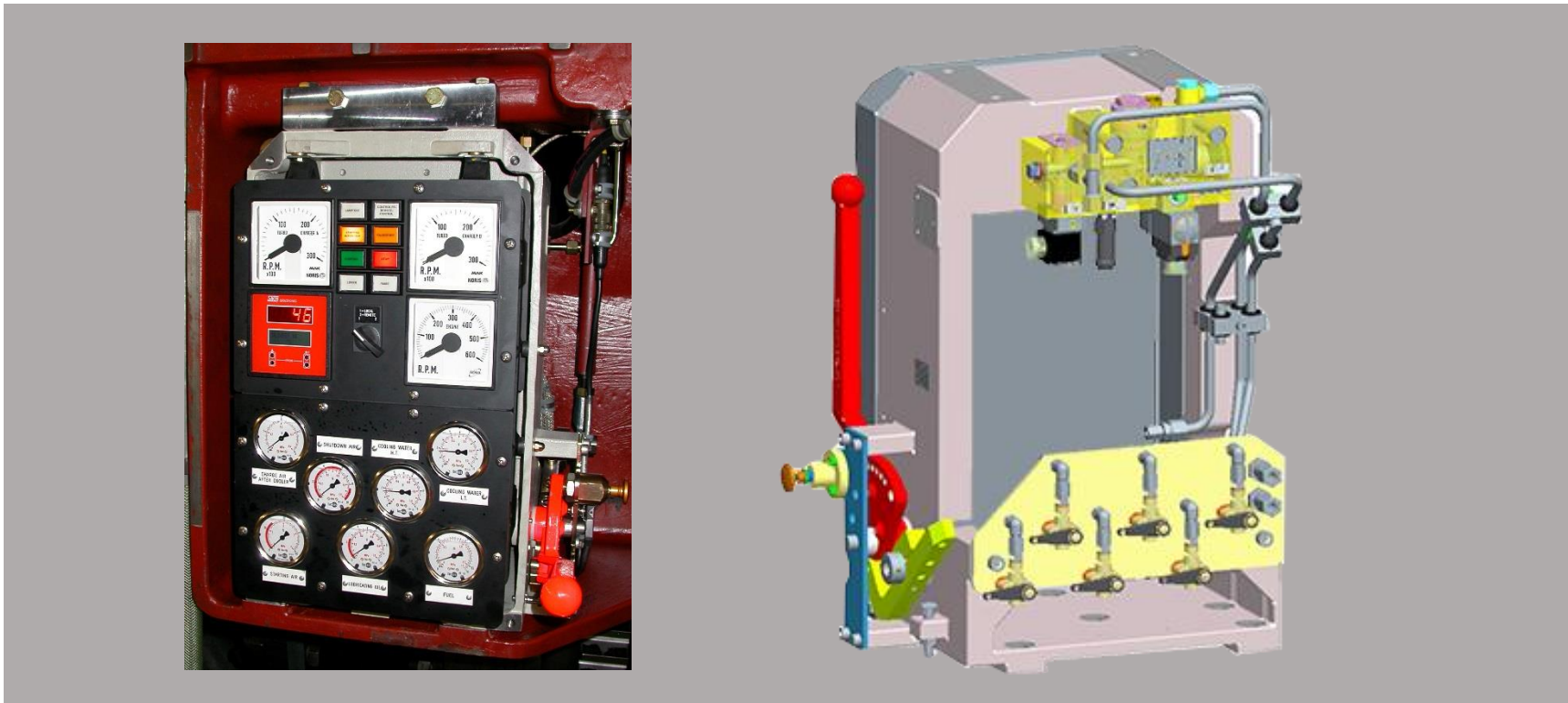
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## Pneumatic remote control for OEM marine clutch units

- ✓ Remote operation via a 3/2-way valve.
- ✓ Time delay for smooth operation via integrated check-choke valve.
- ✓ Safety function of automatic clutch exhaust in case of pressure drop to prevent unintentional slip.
- ✓ Including air filter, dryer, pressure control valve and gauge.

➤ Introduction

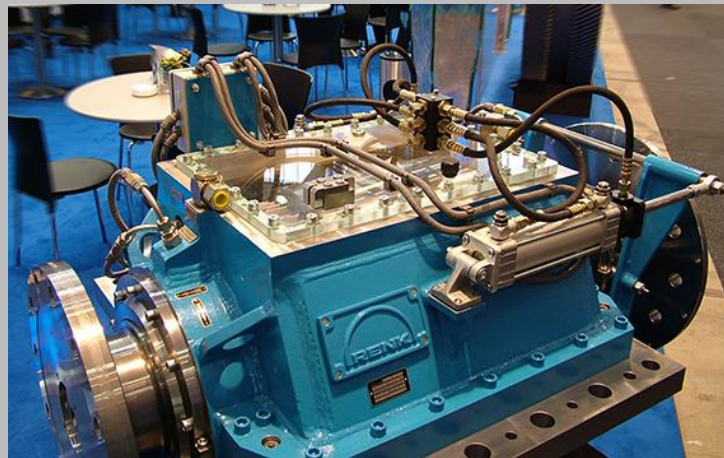
➤ Products

✓ Applications

➤ Local engine control

✓ Clutch remote control

➤ Maintenance Service





## Maintenance

The following table gives an overview on the service intervals which are recommended for optimal operation of the products under European climatic conditions.

Device	Action	Day (1)	Week (1)	Month (1)	1	2	Years 4	8
Cylinders	Inspect						x	
	Repair							x
Filters	Drain	x						
	Clean		x		x			
	Repair							x
Antifreezers	Refill	x						
	Empty and clean				x			
	Replace wick						x	
Check/Choke valves	Inspect						x	
	Repair							x
Air reservoirs	Drain	x						
Drain valves	Operate	x						
	Repair							x

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➤ Products

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✓ Maintenance Service

Maintenance

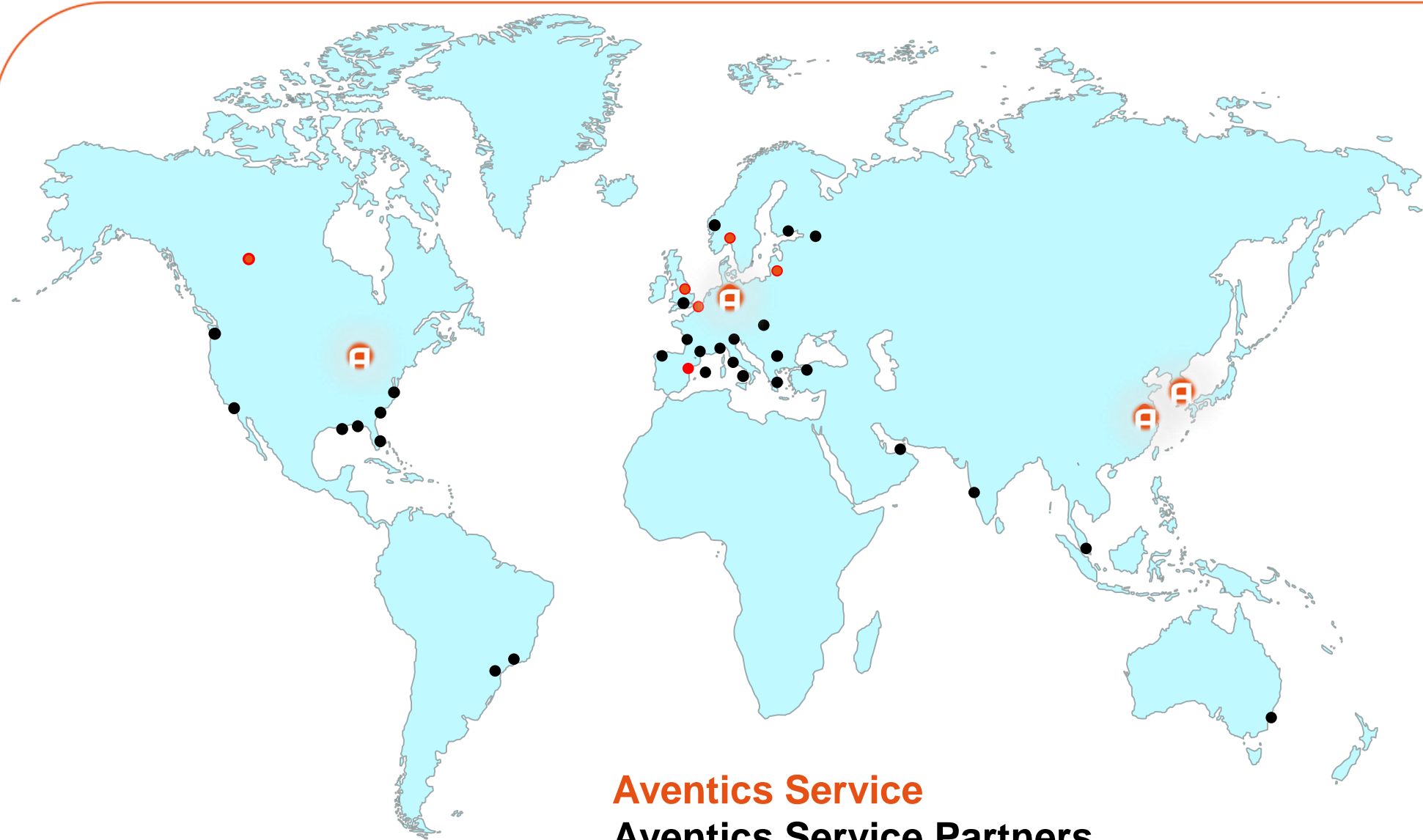
Device	Action	Day (1)	Week (1)	Month (1)	1	2	Years 4	8
Safety valves	Repair							x
Change over valves	Inspect						x	
	Repair							x
Cut-off cocks	Repair							x
Controlair valves	Inspect						x	
	Repair							x
Maneuvering valves	Inspect						x	
	Repair							x
E/P-converters	Inspect						x	
	Repair							x
Way-valve 10 bar	Inspect						x	
	Repair							x
Way-valve 30 bar	Inspect					x		
	Repair						x	
Pressure regulators	Inspect						x	

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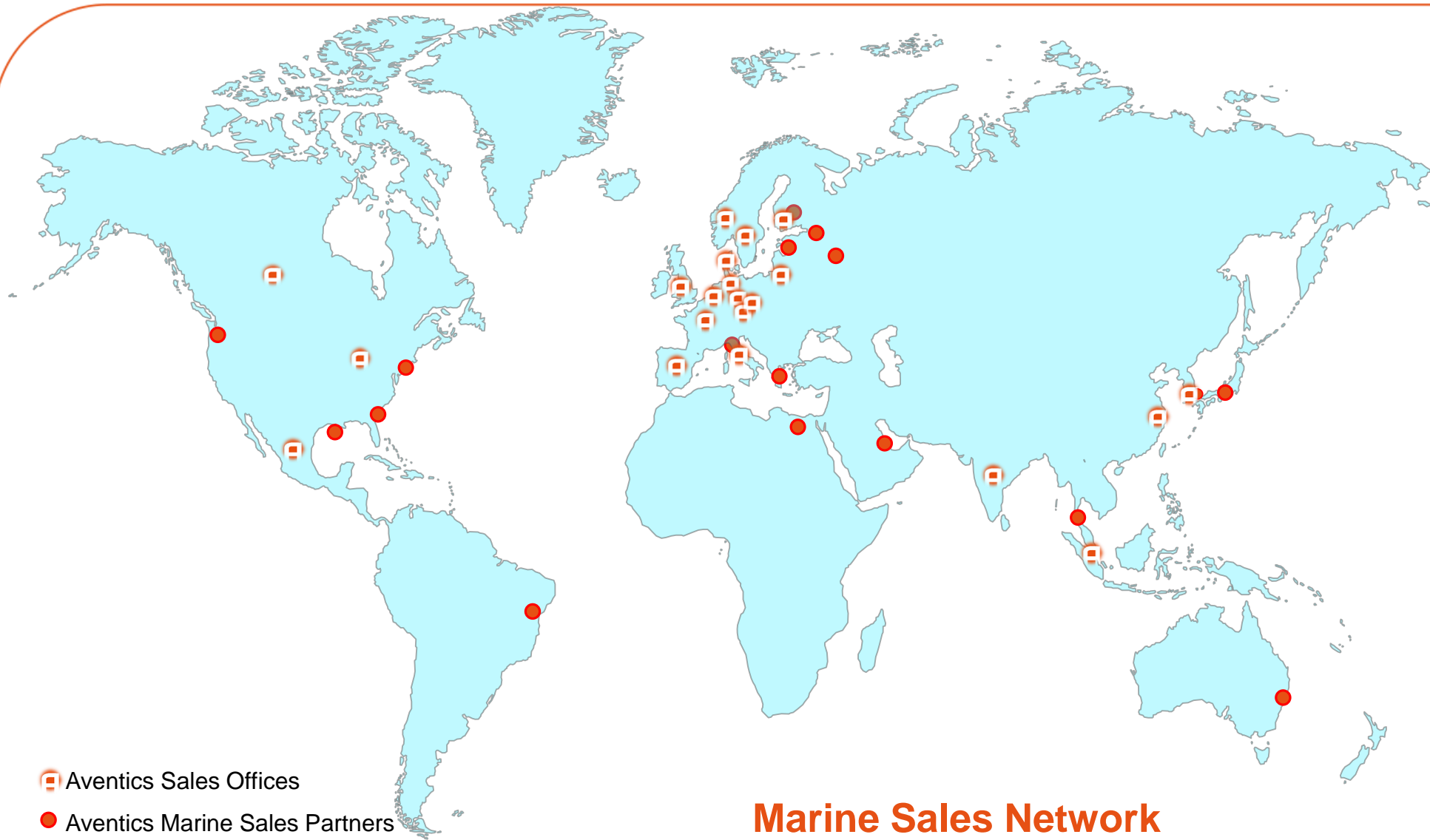
➤ Introduction

➤ Products

➤ Applications

✓ Maintenance Service

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**Aventics Service Partners**



➤ Introduction

➤ Products

➤ Applications

✓ Maintenance  
Service

**Marine Sales Network**

Thank you for your attention!

