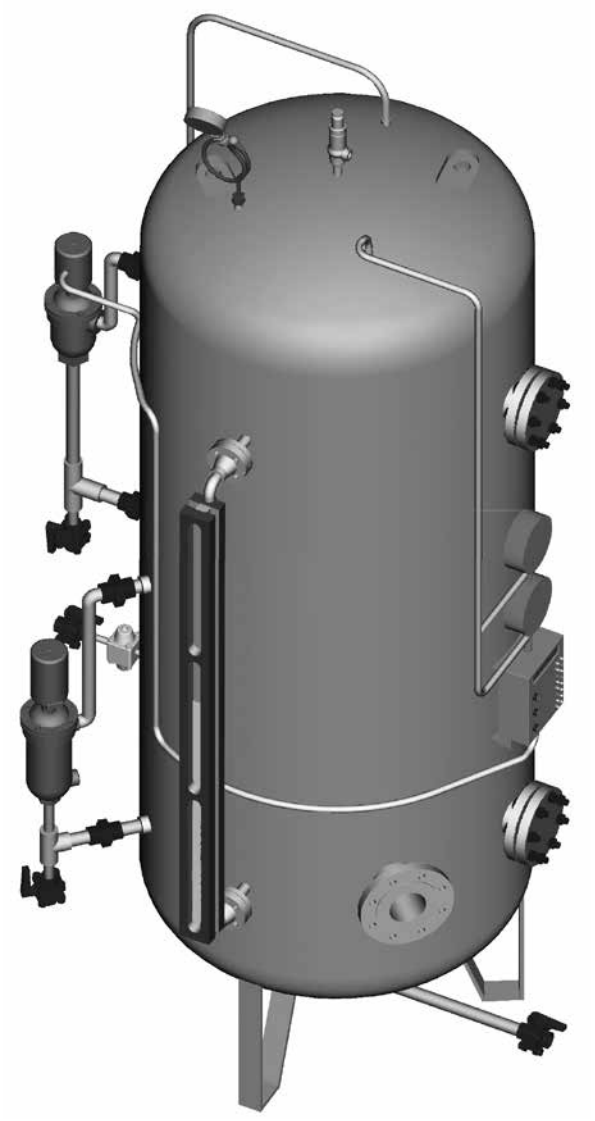
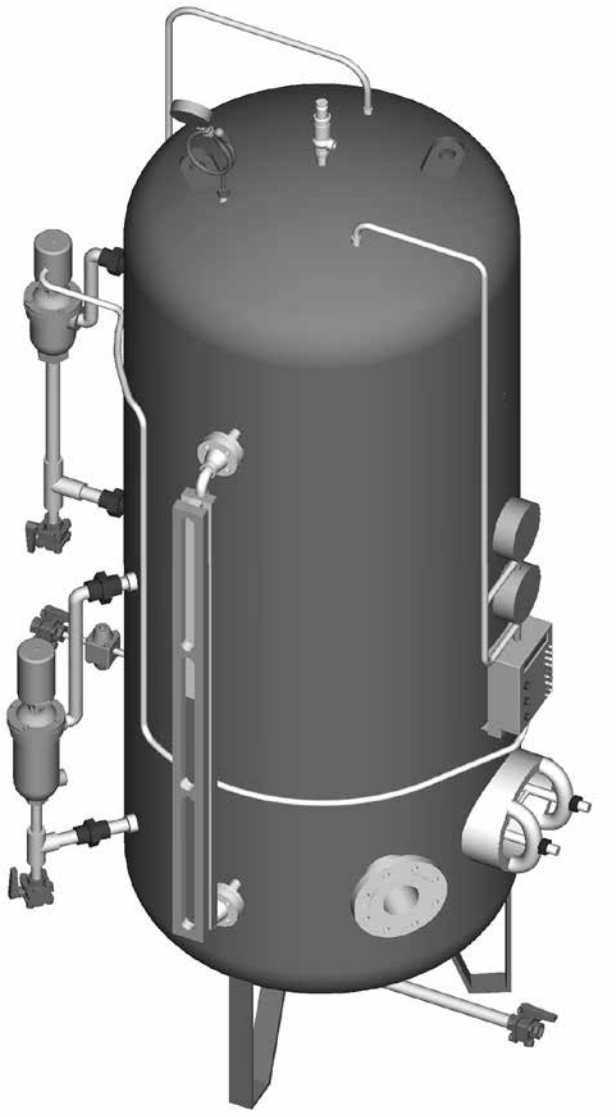
5B.135-E
Issue 7 - 2015

AUTROL 217
Expansion and pressurization Systems

Autrol 217 - 8/12 Models
Capacity 500 ÷ 1500 litres



AUTROL 217 - 6/8/12 Models
Capacity 2000 ÷ 5000 litres



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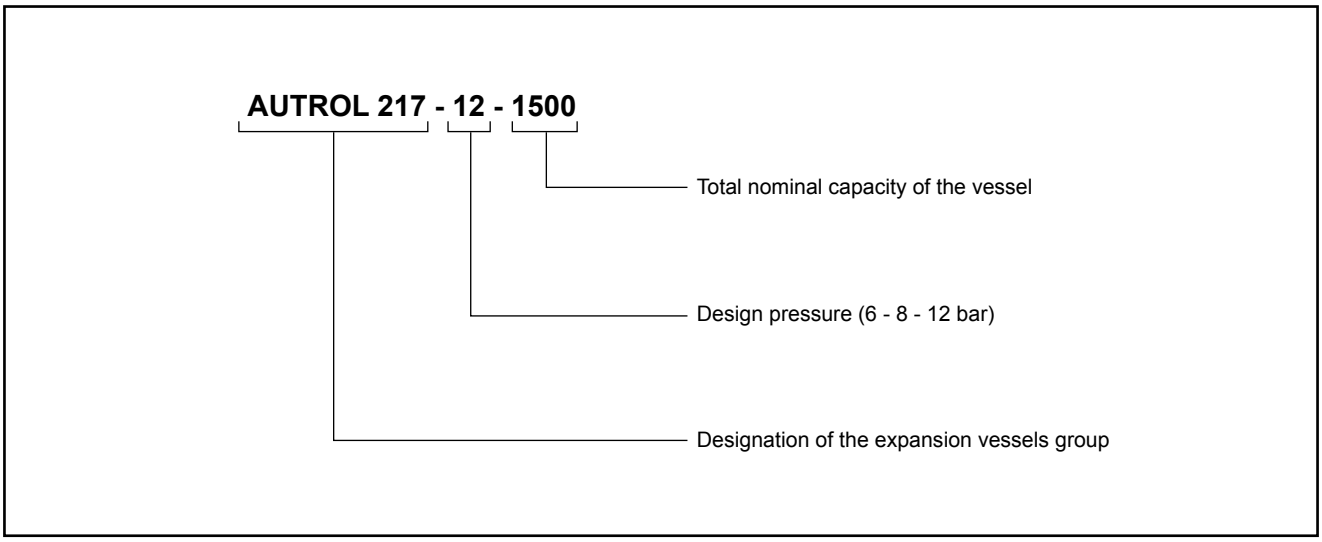
Autrol vessel type designation is to identify its characteristics:



Autrol Systems

Autrol Expansion system is employed in hot and superheated water closed circuit systems to absorb the increased volume of water contained in the system whilst ensuring the necessary pressurisation in order to avoid formations of steam even in the most critical conditions.
Depending on the adopted type of control, this pressurization systems are differentiated into three types:

1) Variable pressure and volume Systems, recommended for systems with limited water content;

2) Constant pressure and variable volume Systems (gas vent) recommended for systems with large water content with the purpose of limiting the size of the expansion vessel;

3) Constant pressure and volume Systems (water overflow and optionally also gas overflow) used for systems with extremely high water conten

The three expansion systems are sized and adjusted in different ways from each other.

1) Variable pressure and volume System

This is the most commonly used system for small and medium installations, for both hot and superheated water, in accordance with Collections "R" and "H".

The formula used for the calculation is as follows:

$$V = \frac{E}{1 - \frac{Pi}{Pf}} + C_i = \text{Volume Autrol}$$

where:

V: Volume of the expansion vessel in litres

E: Expansion volume in litres

Pi: Initial absolute pressure in absolute bar

Pf: Final absolute operating pressure (equal to the set pressure of the safety valve/s, in absolute bar)

E: H_2O total plant content x H2O expansion coefficient to expected temperature of calculation.

Ci: 30% approximately of initial volume in the vessel, corresponding to the minimum level when the system is cold; however, for the exact value, see Table 4.

The core component of the system is a vessel of adequate capacity, dimensioned with the above formula, that is pressurized with air or nitrogen when the system is cold. Increasing the temperature of the water contained in the plant, therefore also its volume, the bearing of the existing gas in the vessel is gradually compressed, until it reaches the design pressure when the water has reached the maximum temperature provided by the calculation. When the water temperature decreases, its volume decreases too, and then inside the vessel cushion gas expands, reducing its pressure. when the system is completely cold, pressure returns to the initial pressurization.

For superheated water systems initial pressurization of the pressure is determined as follows:

Pi = pressure of saturated steam water (corresponding to the maximum operating temperature of hot H2O)

+ pressure due to static height

+ the differential of the minimum pressure gauge, all expressed in absolute bar.

For **hot water** systems initial pressurization of the pressure is determined as follows:

Pi = Static height

+ 0,3 bar approximately
(to be certain that the whole plant has been water filled)

All expressed in absolute bar.

The expansion vessel must have the design pressure not lower than the heat generator design pressure (boiler or heat exchanger); must also be fitted with a safety valve designed to discharge the gas relative to the maximum load of the pressurizing gas inlet valve, in addition to all the equipment required to operate the system. See Scheme 1.

2) System variable volume and constant pressure (Gas vent)

The calculation must be executed as if it were an open expansion vessel, but taking into account the initial contents (minimum = 30%) + 20% to assume a pressure gas cushion to prevent the vessel is completely empty by pressurizing gas when the plant is fully operational.

The formula is as follows:

$V = C \times e + Ci + Cg = \text{Autrol Volume}$

where:

V: Volume of the expansion vessel in litres
C: Total water content of the plant
e: H_2O expansion coefficient at the maximum allowable temperature
C_i: Minimum water level inside the vessel with cold system
C_g: Space in the vessel for a gas pressurized cushion with plant at full load, to avoid it to empty completely by the pressurizing gas.

The system consists of the vessel equipped by instrumentation as Scheme 2.

3) System operating at constant pressure and volume (water overflow)

In this case, the effective volume of the expansion vessel shall be adequate to contain the excursions necessary for the operation of exhaust systems and for topping up with water.

System accessories and settings for variable pressure and volume systems (Scheme 1)

a) Model 1102B/212/1S One contact SPDT Level Limit Switch : when in maximum level, it activates the alarm and stops the heat input (ref. LS-1).

b) Model 1102B/222/1S Two sequentially contacts SPDT Level Limit Switch: when in minimum level, actuates the make-up water supply system (pump or solenoid valve) and when at super minimum level, triggers the alarm and locks the heat input (ref. LS-2).

c) Model C3 P506H Low pressure limit switch: when the pressure is less than the initial pressurization, actuates the alarm and stops the heat input (ref. PS-1).

d) Model C3 P506H High pressure limit switch: when the pressure is higher than the design one with hot plant, activates the alarm and stops the heat input (ref. PS-2).

e) Sight glass with superior visibility compared to the excursion of the maximum water level in the vessel (ref. LG).

f) 3-port Cock gauge (rif. M).

g) Mod. FR-S Pressure reducing valve, for air or nitrogen pressurisation, calibrated to initial pressurization pressure (ref. PCV).

h) Safety valve sized according to INAIL standards, only for expansion vessel protection (it does not replace the valve required for the heat generator) (ref. SV). The valve, according to current legislation, is sized for the maximum flow rate to be adduced to Autrol by the pressurization system, and is therefore proportional to the maximum range of the FR_S reducing filter as supplied for Autrol.
The valve shall be calibrated at the same pressure provided for the generator, and will be higher than the setting pressure of the high pressure gauge and lower than the boiling pressure prescribed for the expansion vessel.

i) Check valve for gases (ref. CV).

j) Different types and diameters manually operated valves (n. 8) to operate the exclusion for level switches drainage, pressurizing gas shutoff and venting, and vessel draining.

Safety devices (min and max levels witches and high and low pressure gauges) should be electrically connected so as to achieve an intrinsically safe circuitsuch as to require manual intervention for its reset after the occurrence of any of the four alarm conditions (low pressure / high pressure - high level / low level).
A dedicated pre-wired electrical panel is available, supplied together with the complete accessories set. The consumption is therefore in proportion to the intermittence of operation of the plant and is minimum in the plants operating at continuous use.

Sizing

For the selection of vessel design to be used, must be use the formula above indicated.

The necessary data for the selection shall be:
- Heat output transferred to the water (Kcal/h o W).
- Total charge of the system (litres).
- Maximum static height of the plant, that is the height difference between the Autrol highest point and its support surface (m).
- Maximum design temperature (°C).
- Maximum operating pressure acceptable with hot plant (bar) (final pressure = Pressure Setting of the safety valve/s).
- Heat generator design pressure (boiler or heat exchanger) (bar).

Examples of calculation for a hot and superheated water circuit system with variables pressure and volume

A) Hot water system

-	Heating capacity	550.000 Kcal/h
-	Temperature	85°C
-	Plant total storage capacity	20 m^3
-	Static height	18 m approximately
-	Final pressure of the system	4,7 bar
-	Generator design pressure	10 bar

The chosen water vessel will be constructed according to current standards PED, with design pressure of 12 bar (pressure not less than the design pressure of the generator);

$$V = \frac{0{,}035 \cdot 20.000}{1 - \frac{3{,}1}{5{,}7}} = \frac{700}{0{,}456} = 1.535 \text{ l}$$ (Volume of the vessel, net of the initial cold content)

$$V = \frac{1.535}{0{,}7} = 2.192 \text{ l}$$ (Actual volume of the vessel)

Not having a vessel with a capacity of 2,192 l, the water vessel with a capacity of **2,000 l** is selected, which falls within the constraints imposed by the legislation in force ±10%.
The model shall therefore be: **AU 217-12-2000**.

B) Superheated water system

-	Heating capacity	700.000 Kcal/h
-	Temperature	135°C
-	Plant total storage capacity	14.000 l
-	Static height	20 m. approximately
-	Final pressure of the system	7 bar
-	Generator design pressure	12 bar

$$V = \frac{0{,}0695 \cdot 14.000}{1 - \frac{5{,}6}{8{,}0}} = \frac{973}{0{,}3} = 3.243 \text{ l}$$ (Volume of the vessel, net of the initial cold content)

$$V = \frac{3.243}{0{,}7} = 4.633 \text{ l}$$ (Actual volume of the vessel)

Not having a vessel with a capacity of 4.633 l the water vessel with a capacity of **5,000 l** is selected, which falls within the constraints imposed by the legislation in force ±10%.
The model shall therefore be: **AU 217-12-5000**.

Verify: For superheated water systems, it is essential to check if the vessel is large enough to contain the expansion of the water, even in the case when the water temperature reaches the temperature of saturated steam (corresponding to the design pressure of the generator).

Design pressure 12 bar = 191,7°C

14.000 • 0,136 = 1.904 l (expansion to 191,7°C)

3.243 - 973 = 2.270 l
(vessel volume available to the pressurization gas)

1.904 < 2.270 then the test is satisfactory.

Table 1 - Water expansion Factors

Initial temperature / Final temperature	10°C	20°C
10°C	-	-
15°C	0.0004	-
20°C	0.0011	-
25°C	0.0021	0.0010
30°C	0.0033	0.0022
35°C	0.0048	0.0037
40°C	0.0065	0.0053
45°C	0.0083	0.0072
50°C	0.0103	0.0092
55°C	0.0126	0.0114
60°C	0.0149	0.0138
65°C	0.0175	0.0145
70°C	0.0202	0.0191
75°C	0.0230	0.0219
80°C	0.0262	0.0250
85°C	0.0293	0.0282
90°C	0.0327	0.0316
95°C	0.0362	0.0351
100°C	0.0399	0.0387
105°C	0.0437	0.0426
110°C	0.0476	0.0464
115°C	0.0517	0.0505
120°C	0.0558	0.0547
125°C	0.0602	0.0591
130°C	0.0645	0.0635
135°C	0.0695	0.0684
140°C	0.0744	0.0732
145°C	0.0796	0.0785
150°C	0.0484	0.0837
160°C	0.0961	
170°C	0.1084	
180°C	0.1214	
190°C	0.1360	
200°C	0.1517	
210°C	0.1694	
220°C	0.1876	
230°C	0.2066	

Table 2 - Content of water in the pipeline

Diameter	Content l/m
3/8"	0.118
½"	0.195
¾"	0.355
1"	0.573
1¼"	1.000
1½"	1.330
2"	2.080
57/63	2.550
64/70	3.220
70/76	3.850
82/89	5.280
88/95	6.080
100/108	7.850
113/121	10.000
125/133	12.300
137/146	14.700
150/159	17.700
168/178	22.200
207.2/210	32.7

Table 3 - Volume and specific weight of water

Temperature °C	Specific Volume l/kg	Specific Weight kg/l
0	1.00013	0.99987
10	1.00027	0.99973
20	1.00177	0.99823
30	1.00435	0.99567
40	1.00782	0.99224
50	1.0121	0.9880
60	1.0171	0.9832
70	1.0227	0.9778
80	1.0290	0.9718
90	1.0359	0.9653
100	1.0434	0.9584
110	1.0515	0.9510
120	1.0600	0.9434
130	1.0694	0.9351
140	1.0795	0.9264
150	1.0903	0.9172
160	1.1018	0.9076
170	1.1105	0.8973
180	1.1279	0.8866

Pressurization system

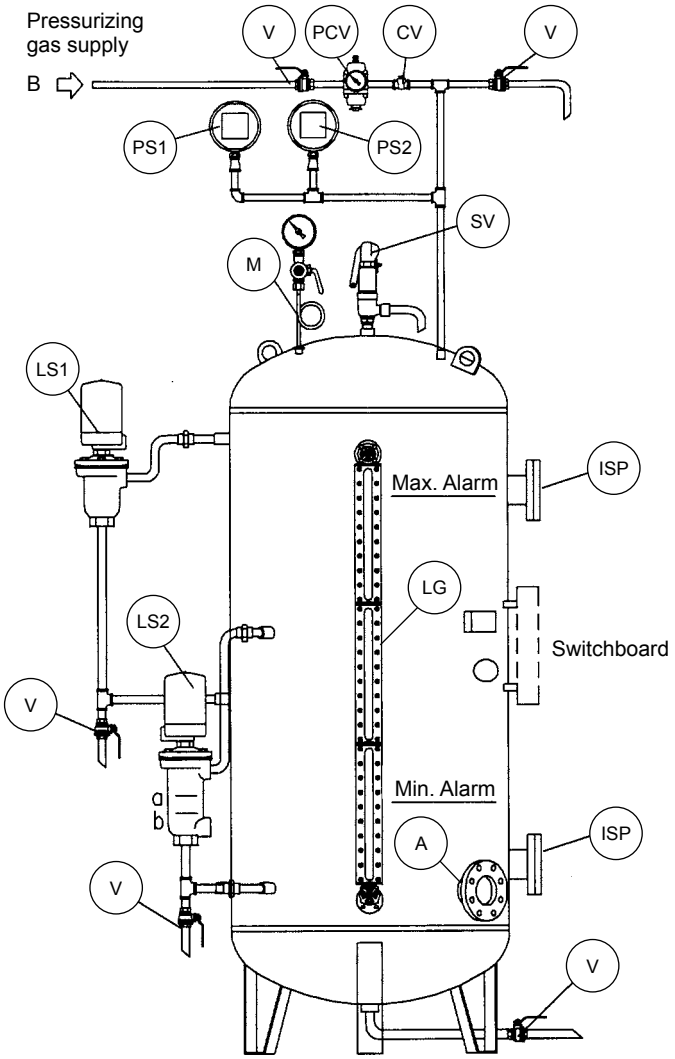
The gas bearing required from Autrol system, can consists of compressed air (for temperatures not exceeding 140°C) or nitrogen. In the first case it shall be used an air compressor of adequate capacity, while in the second case it will have to use two or more cylinders connected in parallel to a manifold. Cylinders must be fitted with pressure reducing valve to bring the pressure from the value of cylinder (150-200 bar) to about 10-15 bar, which is the supply pressure recommended for the pressure reducer mod. FR-S provided with the system.
To determine the scope of the compressor or the number of cylinders of nitrogen necessary, you can take advantage of the table below, which indicates the minimum values recommended with the following observations:

- **Air compressor.** When calculating the sizing, account was taken of a initial filling time of between 30 ‘and 90’ passing from the lower to the higher measure of Autrol. Filling times shorter can be obtained by varying proportionately the flow rate of the compressor.
- **Nitrogen cylinders.** Values in the table refer to cylinders with content of 10,000 N litres of nitrogen at 150 bar. The minimum number suggested is 2 cylinders.

Dimensionamento sistema di pressurizzazione

<table>
<tr><th rowspan="2">Initial Pressure bar</th><th colspan="9">AUTROL model</th></tr>
<tr><td>500</td><td>800</td><td>1000</td><td>1500</td><td>2000</td><td>2500</td><td>3000</td><td>4000</td><td>5000</td></tr>
<tr><td colspan="10">Pressurization with air compressor - Minimum flow in N litres / 1 '</td></tr>
<tr><td>1</td><td>25</td><td>35</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td><td>95</td><td>115</td></tr>
<tr><td>2</td><td>40</td><td>50</td><td>55</td><td>70</td><td>85</td><td>100</td><td>110</td><td>140</td><td>170</td></tr>
<tr><td>3</td><td>50</td><td>65</td><td>70</td><td>90</td><td>110</td><td>130</td><td>150</td><td>190</td><td>220</td></tr>
<tr><td>4</td><td>65</td><td>80</td><td>90</td><td>115</td><td>140</td><td>165</td><td>185</td><td>235</td><td>275</td></tr>
<tr><td>5</td><td>75</td><td>100</td><td>110</td><td>140</td><td>170</td><td>200</td><td>220</td><td>280</td><td>330</td></tr>
<tr><td>6</td><td>90</td><td>115</td><td>130</td><td>160</td><td>200</td><td>235</td><td>260</td><td>330</td><td>390</td></tr>
<tr><td>7</td><td>100</td><td>130</td><td>145</td><td>180</td><td>230</td><td>270</td><td>300</td><td>380</td><td>450</td></tr>
<tr><td>8</td><td>115</td><td>145</td><td>165</td><td>205</td><td>255</td><td>300</td><td>335</td><td>425</td><td>500</td></tr>
<tr><td>9</td><td>125</td><td>160</td><td>185</td><td>230</td><td>280</td><td>330</td><td>370</td><td>470</td><td>550</td></tr>
<tr><td>10</td><td>140</td><td>180</td><td>200</td><td>250</td><td>310</td><td>370</td><td>410</td><td>520</td><td>610</td></tr>
<tr><td colspan="10">Pressurization with nitrogen tanks - Minimum number of tanks</td></tr>
<tr><td>1</td><td rowspan="10">2</td><td rowspan="10">2</td><td rowspan="10">2</td><td rowspan="7">2</td><td rowspan="5">2</td><td rowspan="3">2</td><td rowspan="2">2</td><td>2</td></tr>
<tr><td>2</td><td rowspan="2">2</td><td rowspan="2">3</td></tr>
<tr><td>3</td><td rowspan="2">3</td></tr>
<tr><td>4</td><td rowspan="2">3</td><td>4</td></tr>
<tr><td>5</td><td rowspan="3">3</td><td>4</td><td>5</td></tr>
<tr><td>6</td><td rowspan="2">4</td><td rowspan="2">5</td><td rowspan="2">6</td></tr>
<tr><td>7</td><td rowspan="4">3</td></tr>
<tr><td>8</td><td rowspan="3">3</td><td rowspan="2">4</td><td rowspan="3">5</td><td rowspan="2">6</td><td>7</td></tr>
<tr><td>9</td><td>8</td></tr>
<tr><td>10</td><td>4</td><td>5</td><td>7</td><td>9</td></tr>
</table>

Scheme 1 - Variable pressure and volume Systems



Accessories installation scheme:

LS1 - Model 5501/212/1 One contact Level Limit Switch

LS2 - Model 5511/222/1 Two sequentially contacts Level Limit Switch

PS1 - Model C3 P506H Low pressure limit switch

PS2 - Model C3 P506H High pressure limit switch

LG - Level gauge

M - Pressure gauge with three-port valve and test flange

SV - Spring safety valve

CV - Check valve for air

V - Manually operated valves

PCV - Pressure reducing valve mod. FR-S

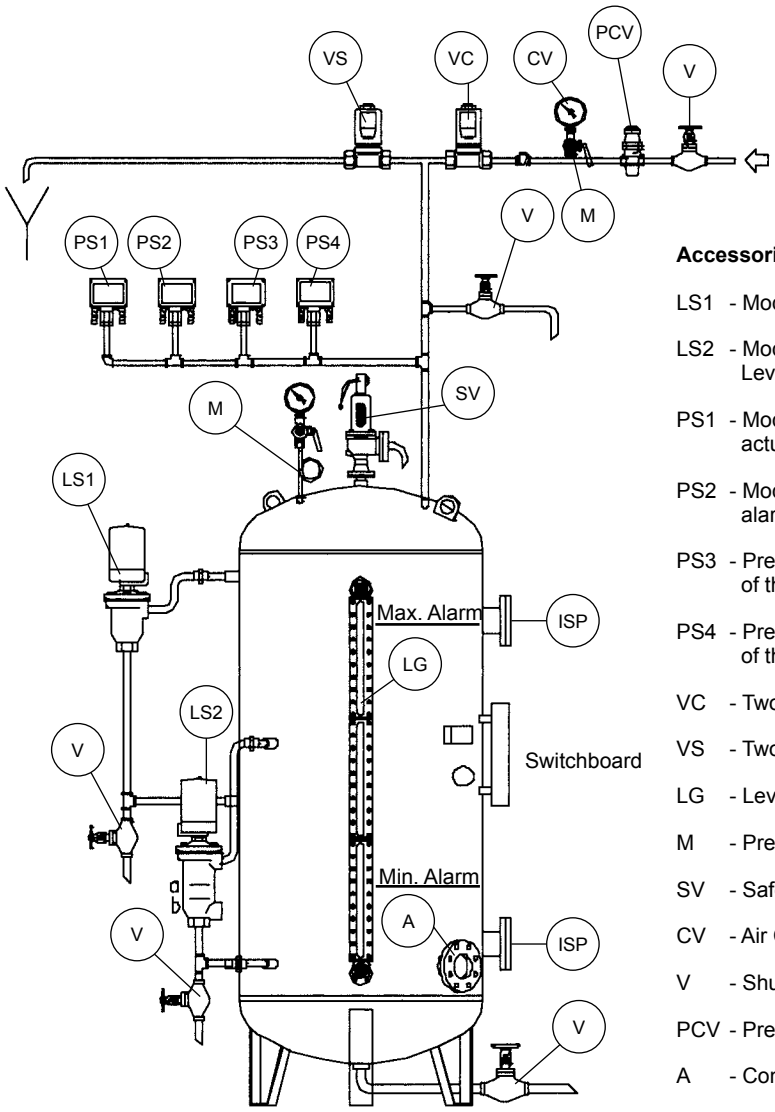
A - Connection to the system

B - Pressurizing gas supply

ISP - Inspections (step hand or manhole)

Note: The safety valve is sized to protect the only expansion vessel. Under the current regulation, the heat generator (boiler or heat exchanger) must be provided with its own safety valve sized according to potential.

Scheme 2 - Constant pressure and variable volume Systems (gas vent)



Accessories installation scheme:

LS1 - Model 5501/212/1 One contact Level Limit Switch

LS2 - Model 5511/222/1 Two sequentially contacts Level Limit Switch

PS1 - Model C3 P506H Low pressure limit switch: actuates the alarm and stops the heat input

PS2 - Model C3 P506H High pressure limit switch: actuates the alarm and stops the heat input

PS3 - Pressure switch Mod. C3 P506H: drives the opening of the VC inlet valve of the gas pressurization.

PS4 - Pressure switch Mod. C3 P506H drives the opening of the VS gas relief valve.

VC - Two-port solenoid valve for gas pressurization input.

VS - Two-port solenoid valve for pressurization gas relief valve.

LG - Level gauge

M - Pressure gauge

SV - Safety relief valve

CV - Air Check valve

V - Shut-off valves

PCV - Pressure reducing valve mod. FR-S

A - Connection to the plant

B - Pressurization gas inlet

ISP - Inspections (step by hand or manhole)

Note: The safety valve is sized to protect the only expansion vessel. Under the current regulation, the heat generator (boiler or heat exchanger) must be provided with its own safety valve sized according to potential.

Sizing

To select the correct variable volume and constant pressure system vessel, proceed as for an open expansion vessel, but starting with a initial water content of approximately 30% (C_i) as shown in Table 4, and making sure that the level at the maximum temperature (with the maximum expansion) is still visible even at the highest point of the vessel; on the level indicator LG must therefore remain a volume available where there remains a certain amount of gas pressurization(C_g).

E = e • C (Expansion of the water at achievement of operating temperature)

The total volume of the vessel should be:

V = E + Ci + Cg = total volume of the vessel in liters

E = e x C (expansion volume of the water from cold to the maximum operating temperature)

Ci = Initial water content inside the vessel, at the minimum level

Cg = Residual volume for pressurizing gas during plant operation, over the maximum level

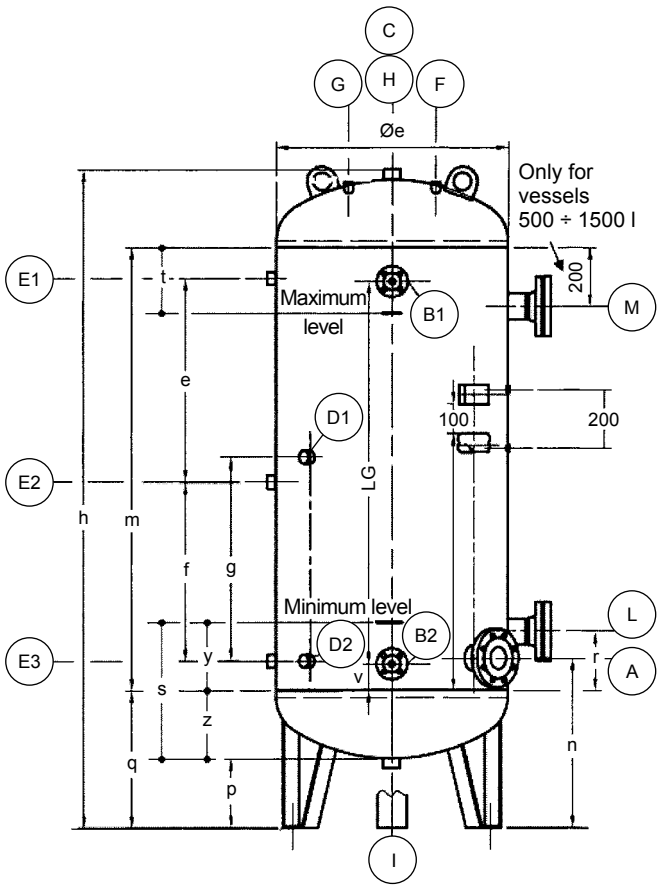
Calculation example for a constant pressure and variable volume system

Hot water plant

- Thermal output 550.000 Kcal/h
- Temperature 85°C
- Total content of the system 20 m3
- Static height 18 m.c.a.
- Final pressure of the plant 4,7 bar
- Generator Design Pressure 10 bar

E = 0,035 x 20000 = 700 l (Expansion)

Observing the following table, it is clear that the reservoir adapted to contain the expansion of 700 litres is a vessel of **1500 litres**; then the suitable Autrol model is: **AU 217-12-1500**.



Mod. AU 217	Level maximum range	Volume available for expansion	Vessel increase
500	803	268	45%
800	785	416	48%
1000	1085	548	38%
1500	1050	881	40%
2000	1340	1136	44%
3000	1328	1661	44%
4000	1290	2180	47%
5000	1825	3057	38%

Only for constant pressure and variable volume vessels

Table 4 - Dimensions and water content

Mod. AU 217	Total capacity	Cylinder capacity	Funds capacity	Vessel ó	Cylinder height in meters	Water content in litres per mm	H Total including legs h	H legs p	q	H vessel including funds	H of each fund z	n	s	Connection to plant	y	LG	v	Initial minimum content	t	%
500	486	417	68	650	1250	0,3336	1829	166	356	1663	190	456	423	65	233	1000	85	112	215	23%
800	798	662	127	790	1250	0,5296	1979	235	465	1744	230	575	480	80	250	1000	85	196	215	25%
1000	885	758	127	790	1500	0,5053	2229	235	465	1994	230	575	480	80	250	1295	90	190	165	21%
1500	1473	1258	215	1000	1500	0,8387	2245	189	467	2056	278	612	573	100	295	1295	100	355	155	24%
2000	2029	1695	334	1000	2000	0,8475	2745	189	467	2556	278	617	578	100	300	1590	100	421	360	21%
3000	2990	2503	487	1200	2000	1,2515	2891	229	560	2662	331	735	669	125	338	1590	125	666	335	22%
4000	4143	3380	763	1450	2000	1,6900	3020	180	600	2840	420	815	810	150	390	1590	140	1041	320	25%
5000	4951	4188	763	1450	2500	1,6752	3520	180	600	3340	420	815	810	150	390	2125	140	1035	285	21%

Table 5 - Design features

Series		AUTROL 6	AUTROL 8	AUTROL 12
Model		9 measures with different capacities (see table)		
Fluid		Water - Superheated water - Air		
Design conditions	Pressure	6 bar*	8 bar	12 bar (°)
	Temperature -10°C ÷	+ 99°C	+ 175,4°C	+ 191,7°C
Pressure test		9 bar	12 bar	17 bar (°°)
Marking		CE cat. IV per tutti i modelli		
Materials		Steel P 275 NH externally painted RAL 5015 Blue flanged PN		
Connections	**A** Connection to the plant	40 UNI 6084-67/2229-67 (see table)		
	LG Level gauge			
	SV Safety valve	Joke sleeve gas UNI 339-66 (see table)		
	S Vent			
	B Pressurizing gas	Joke sleeve DN⅜" gas UNI 339-66		
	PS ½ Pressure switches			
	M Pressure gauge	Joke sleeve DN⅜" gas UNI 339-66		
	LS ½ Level switches	Joke sleeve DN1" NPT ANSI B16.11		

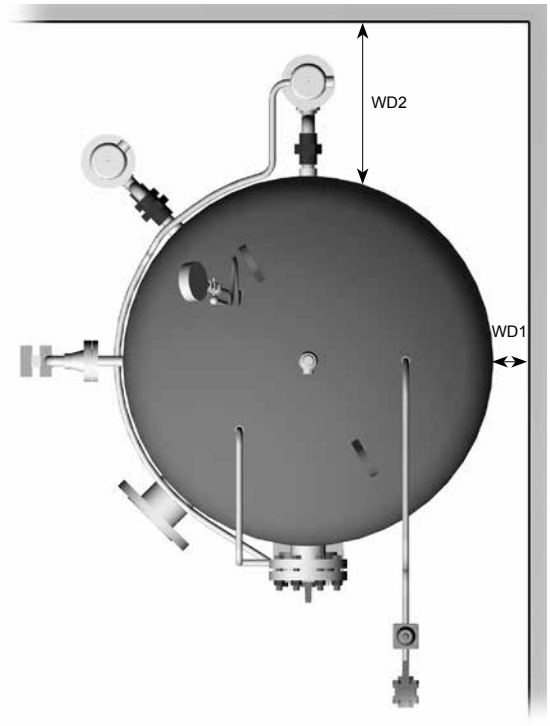
* Measures with a capacity of 500, 800, 1000 and 1500 litres are not available. For these, use Autrol 8 bar.
(°) 11,76 - (°°) 16,66 bar, only for 500 litres.

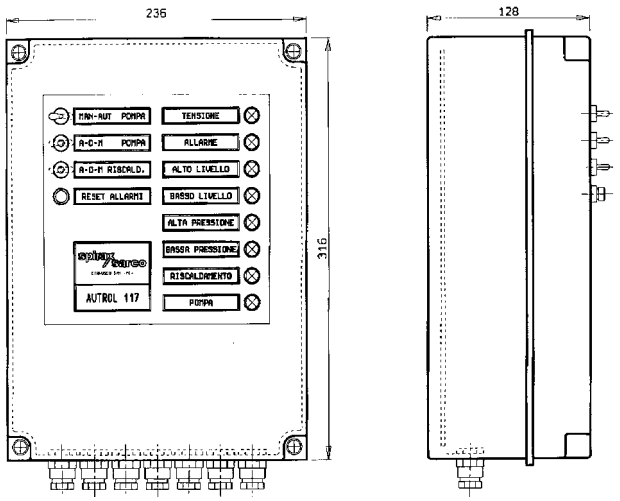
Table 6 - Dimensions (mm) and connections

Model Autrol 217	**Øe** (mm)	**H** (mm)	**Connections**			**Unlade weight** (kg)	**Inspections**	**LG** (mm) DN20
			A (DN)	**SV** (" gas)	**Vent** (" gas)			
6-500	650	1829	65	1¼" x ¾"	1¼"	110	N° 2 Braids DN80	1000
8-500						110		
12-500						130		
6-800	790	1979	80	1¼" x ¾"	1¼"	150	N° 2 Braids DN80	1000
8-800						182		
12-800						210		
6-1000	790	2229	80	1¼" x ¾"	1¼"	160	N° 2 Braids DN80	1295
8-1000						194		
12-1000						225		
6-1500	1000	2245	100	1¼" x ¾"	1¼"	227	N° 2 Braids DN80	1295
8-1500						290		
12-1500						396		
6-2000	1000	2745	100	1¼" x ¾"	1¼"	360	Manhole 300x400	1590
8-2000						434		
12-2000						588		
6-3000	1200	2891	125	1¼" x ¾"	1¼"	490	Manhole 300x400	1590
8-3000						590		
12-3000						884		
6-4000	1450	3020	150	1¼" x ¾"	1¼"	723	Manhole 300x400	1590
8-4000						840		
12-4000						1235		
6-5000	1450	3520	150	1¼" x ¾"	1¼"	817	Manhole 300x400	2125
8-5000						960		
12-5000						1426		

Installation

Autrol 217 can be installed both close to a wall or even in a corner of the thermal power plant. Currently we are not aware of current regulations that impose mandatory withdrawal distances between the vessel and the walls. Therefore apply those best practices for which the WD1 can be reduced up to a few centimetres and WD2 must only be proportionate to the possibility of access for inspection or maintenance. (vedi disegno a pag. 10 per modificare wd1 e 2!)





Electric board

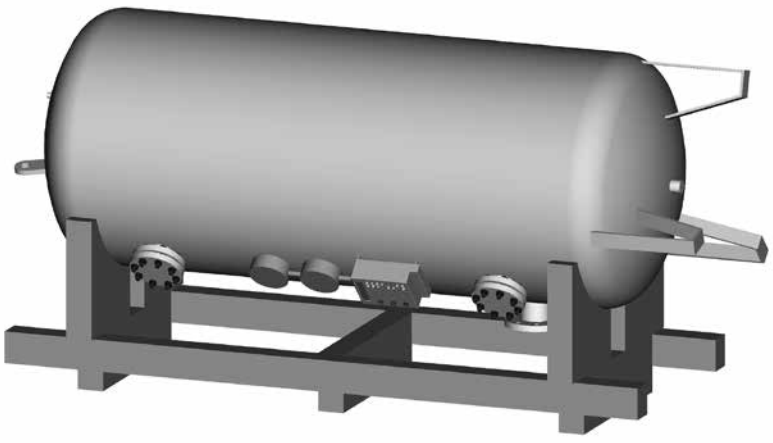
Autrol 217 vessel can also be supplied with the relevant electric board, provided to perform the filling and monitoring procedures of the plant, with latching alarms and remote warning options. This includes the pumps control pulses but not the power contactors. Electrical panel can also be pre-mounted and connected to pressure and level switches.

The control panels supplied with the Autrol can be electromechanical controlled or with PLC type:

A) Version for system with variable pressure and volume ,

B) Version for system with constant pressure and variable volume

Descriptions as indicated on the following page.



Shipment

Vessels from 500 to 1500 litres are transported in a vertical position, while the larger models (from 2000 to 5000 litres) will travel in a horizontal position, placed on special wooden supports.

Switchboards supplied with Autrol

A) Electromechanical control panels

1) Variable volume and pressure system version:

Cabinet in painted steel.
Dimensions 600 x 400 x 200.

Group of components on the front panel:

- main switch with door lock
- power on lamp indicator
- cycle lamps
- manual - automatic water fill selector
- manual selector to heating consent
- Illuminated pushbutton for driving cycle
- cycle stop button
- alarms switching button
- reset blocks button

Group of components inside the panel:

- 24 Vca power supply
- Protection Circuit Breakers
- cycle relay
- control and duplication of block signals relay
- terminal board for interface with external connection

2) Constant pressure and variable volume system version:

Cabinet in painted steel.
Dimensions 600 x 400 x 200.

Group of components on the front panel:

- main switch with door lock
- power on lamp indicator
- cycle lamps
- manual - automatic water fill selector
- manual - automatic pressure control selector
- manual gas load-unload selector
- manual selector to heating consent
- Illuminated pushbutton for driving cycle
- cycle stop button
- alarms switching button
- reset blocks button

Group of components inside the panel:

- 24 Vca power supply
- Protection Circuit Breakers
- cycle relay
- control and duplication of block signals relay
- terminal board for interface with external connection

B) Control boards with Programmable Logic Controller PLC

1) Variable volume and pressure system version:

PVC plastic cabinet with double doors.
Dimensions 610 x 298 x 140.

Group of components on the front panel:

- magnetothermic main power supply circuit breakers switch
- auxiliary magnetothermal circuit breakers switch
- Programmable Logic Controller
- power voltage lamp signalling
- General alarm lamp
- automatic - manual cycle selector
- blocks reset button

Group of components inside the panel:

- 24 Vca power supply
- control relay
- terminal board for interface with external connection

2) Constant pressure and variable volume system version:

PVC plastic cabinet with double doors.
Dimensions 610 x 298 x 140.

Group of components on the front panel:

- magnetothermic main power supply circuit breakers switch
- auxiliary magnetothermal circuit breakers switch
- Programmable Logic Controller
- power voltage lamp signalling
- General alarm lamp
- automatic - manual cycle selector
- blocks reset button

Group of components inside the panel:

- 24 Vca power supply
- control relay
- terminal board for interface with external connection

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