January 2009

Types ACE95 and ACE95Sr Tank Blanketing Valves

Figure 1. *Type ACE95 Tank Blanketing Valve*

Figure 2. *Type ACE95Sr Tank Blanketing Valve*

Features

- **Fully Balanced Pilot Design Reduces Inlet Pressure Sensitivity**
- **Frictionless Pilot Valve**
- **Bubble Tight Shutoff**
- **Pilot Controlled**
- **Angled or In-Line Body Option**
- **Self-Contained**
- **Highly Sensitive**
- **Diagnostics Available**
- **Vacuum Settings Available**
- **Stainless Steel Construction Available**

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Specifications

Sizes and End Connection Styles

Type ACE95

Angled Body[1]*:* NPS 3/4, NPT
NPS 1, NPT
NPS 1 (DN 25), CL150 RF
NPS 1 (DN 25), CL300 RF
NPS 1 (DN 25), PN 16/25/40 RF
NPS 1 (DN 25), Sanitary Flange

In-Line Body: NPS 3/4, NPT
NPS 1, NPT
NPS 1 (DN 25), CL150 RF
NPS 1 (DN 25), CL300 RF
NPS 1 (DN 25), PN 16/25/40 RF
NPS 1 x 2 (DN 25 x 50), CL150 RF
NPS 1 x 2 (DN 25 x 50), PN 16/25/40 RF
NPS 1 (DN 25), Sanitary Flange

Type ACE95Sr

Angled Body[1]*:* NPS 2, NPT
NPS 2 (DN 50), CL150 RF
NPS 2 (DN 50), CL300 RF

Maximum Operating Inlet Pressure
200 psig (13,8 bar)

Maximum Emergency Outlet (Casing) Pressure
20 psig (1,4 bar)

Maximum Operating Outlet Pressure
1.5 psig (0,10 bar)

Outlet Pressure Ranges
-5-inches w.c. to 1.5 psig (-12 to 0,10 bar)

Minimum and Maximum Differential Pressures
Minimum: 25 psi (1,7 bar)
Maximum: Up to 200 psi (13,8 bar) depending on main valve spring (See Table 6)

Main Valve Flow Characteristic
Linear

Pressure Registration
External

Accuracy
Typically within 0.5-inch w.c. (1 mbar) when flowing 5 to 70 percent of advertised capacities

Temperature Capabilities
Nitrile (NBR): -20° to 180°F (-29° to 82°C)
Fluorocarbon (FKM): 0° to 212°F (-18° to 100°C)
Ethylenepropylene (EPDM - FDA):
-20° to 212°F (-29° to 100°C)
Perfluoroelastomer (FFKM):
-20° to 212°F (-29° to 100°C)

IEC Sizing Coefficients

Type ACE95[2]**:**	**Type ACE95Sr:**
X_T: 0.72	X_T: 0.72
F_D: 0.40	F_D: 0.46
F_L: 0.89	F_L: 0.89
K_m: 0.79	K_m: 0.79

Flow Coefficients for Relief Valve Sizing

Type ACE95:	**Type ACE95Sr:**
C_v 1 use C_v 1.1	C_v 20 use C_v 22
C_v 2 use C_v 2.2	C_v 45 use C_v 50
C_v 4 use C_v 4.4	C_v 60 use C_v 66
C_v 7.5 use C_v 9.25	
C_v 10 use C_v 11	

Construction Materials
Body: CF3M/CF8M Stainless Steel
Trim: 304 Stainless Steel and 316 Stainless Steel
Elastomers: Nitrile (NBR), Fluorocarbon (FKM), FDA-Ethylenepropylene (FDA-EPDM), or Perfluoroelastomer (FFKM)
Diaphragm: Polytetrafluoroethylene (PTFE)
Actuator: 316 Stainless Steel or Carbon Steel

Approximate Weights (with all accessories)
Type ACE95: 40 pounds (18 kg)
Type ACE95Sr: 60 pounds (27 kg)

1. Various Single Array Manifold (SAM) tank connections are also available. Contact your local Sales Office for more information.
2. For NPS 1 (DN 25) body size, all trims.

Introduction

Tank blanketing is the process of using a gas, such as nitrogen, to maintain a slightly positive pressure in an enclosed storage tank. Tank blanketing prevents a stored product from vaporizing into the atmosphere, reduces product combustibility, and prevents oxidation or contamination of the product by reducing its exposure to air. Tank blanketing is utilized with various products, including: adhesives, pharmaceuticals, pesticides, fertilizers, fuels, inks, photographic chemicals, and food additives.

Types ACE95 and ACE95Sr valves are self-contained, fully balanced, pilot-operated, and are used for accurate pressure control on tank blanketing systems. These valves help control emissions and provide protection against atmospheric contamination. Types ACE95 and ACE95Sr valves maintain a positive tank pressure which reduces the possibility of tank wall collapse during pump out operations, prevents stored product from vaporizing to atmosphere.

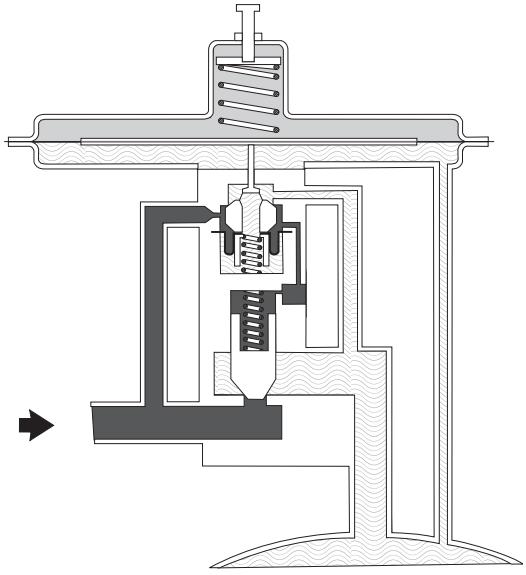
Principle of Operation

Types ACE95 and ACE95Sr tank blanketing valves control the vapor space pressure over a stored liquid. When liquid is pumped out of the tank or vapors in the tank condense, the pressure in the tank decreases. Tank pressure is sensed by the large actuator diaphragm. When tank pressure is less than the valve set pressure, spring force moves the actuator diaphragm downward.

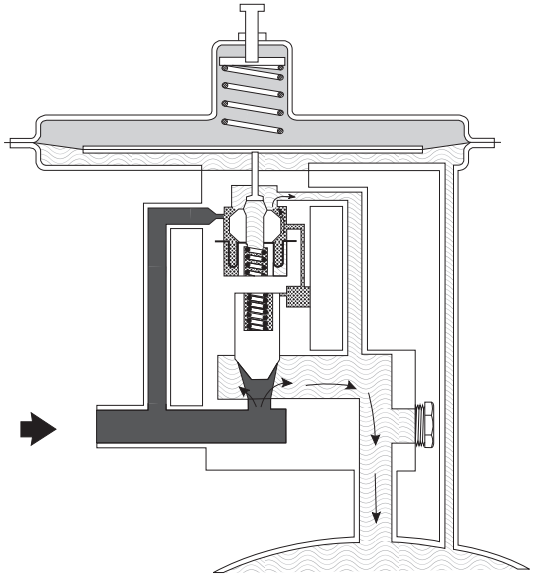
When the actuator moves downward, it pushes open the pilot valve which allows loading pressure to flow into the tank. As loading pressure decreases, inlet pressure is able to overcome the force of the main valve spring, opening the main valve. See Figure 3.

When pressure in the tank increases above setpoint, the large actuator diaphragm is pushed upward, allowing the pilot to close. Loading pressure equalizes with inlet pressure closing the main valve.

The pilot valve is balanced (inlet pressure creates equal upward and downward force on these components); therefore, the outlet pressure of the unit is not affected by fluctuating inlet pressure.



VALVE CLOSED



VALVE OPEN

INLET PRESSURE
TANK PRESSURE
ATMOSPHERIC PRESSURE
INLET BLEED PRESSURE

***Figure 3**. Type ACE95 Operational Schematic*

Options and Accessories

- **Inlet Pressure Gauge**—Displays pressure of blanketing gas supply to the tank blanketing valve.
- **Control Pressure Gauge**—Low pressure gauge to measure control pressure (tank pressure).
- **Purge Meter (Rotameter)**—Maintains a small amount of flow through the sensing and/or main line. Prevents corrosive tank vapors from damaging upstream equipment.
- **Pressure Switch**—Allows installation of an alarm system to indicate low or high pressure on the tank.
- **Flow Indicator**—Provides a visual indication of blanketing gas flow.
- **Outlet Check Valve**—Prevents corrosive gases and vapors from flowing back into the blanketing system through the delivery line.
- **Diagnostic Gauge**—Allows analysis of valve operation in the field, simplifying service and reliability.
- **Single Array Manifold (SAM)**—Provides sense line connection and main valve connection through a single tank nozzle. (Not compatible with In-Line end connection).

Features and Benefits

- **Pilot Controlled**—ACE95 Series valves are pilot operated which results in a high degree of accuracy and control.
- **Fully Balanced Pilot**—Eliminates setpoint changes caused by variations in inlet pressure.
- **Large Actuator**—Large actuator diaphragm increases sensitivity to tank pressure changes.
- **Rolling Pilot Diaphragm**—The rolling diaphragm balances the pilot valve and eliminates friction, resulting in extremely accurate control.

***Table 1**. Flow Rate Conversion[1]*

MULTIPLY MAXIMUM PUMP RATE OUT:	BY	TO OBTAIN[1]:
U.S. GPM	8.021	SCFH
U.S. GPH	0.1337	SCFH
m^3/hr	1.01	Nm^3/h
Barrels/hr	5.615	SCFH
Barrels/day	0.2340	SCFH

1. Gas flow of blanketing gas to replace liquid pumped out.

- **Diagnostic Port**—Allows field analysis of valve operation, simplifying maintenance and reducing service costs.

Diagnostics

Tank blanketing valves are often installed in locations that are difficult to access. Types ACE95 and ACE95Sr valves are available with a diagnostics feature that allows analysis of valve operation in the field, making maintenance easier and more reliable.

The diagnostics feature uses the relationship between pressure in the pilot and main valve chambers to analyze valve performance.

Sizing Methods

Direct Displacement

The direct displacement method should be used with extreme caution. The direct displacement method determines the amount of blanketing gas required to replace liquid pumped out of the tank. Direct displacement does not allow for fluctuating temperature or other factors that may affect pressure in the vapor space. This method is typically applied to tanks operating at constant temperature and containing non-flammable, non-volatile products.

$$\mathbf{Q_{total} = Q_{pump}}$$

where,

Q_{total} = Required Flow Rate

Q_{pump} = Required Flow Rate to replace pumped out liquid from Table 1

API 2000

The American Petroleum Institute Standard 2000 (API 2000) sizing method accounts for liquid pump-out as well as contraction of tank vapors due to cooling. When using API methods:

$$\mathbf{Q_{total} = Q_{pump} + Q_{thermal}}$$

where,

Q_{total} = Required Flow Rate

Q_{pump} = Required Flow Rate to replace pumped out liquid from Table 1

$Q_{thermal}$ = Required Flow Rate due to thermal cooling. See Thermal Equations 1 to 4 below or Table 2.

Thermal Equations

For tanks up to 840 000 gallons (3179 m^3) capacity, use one of the following equations:

Equation 1:

$$Q_{thermal}\ [\text{SCFH Air}] = V_{tank} \times 0.0238$$

Equation 2:

$$Q_{thermal}\ [\text{SCFH Nitrogen}] = V_{tank} \times 0.0238 \times 1.015$$

Equation 3:

$$Q_{thermal}\ [Nm^3/h\ \text{Air}] = V_{tank} \times 0.169$$

Equation 4:

$$Q_{thermal}\ [Nm^3/h\ \text{Nitrogen}] = V_{tank} \times 0.169 \times 1.015$$

where,

For Equations 1 and 2: V_{tank} = tank volume, gallons

For Equations 3 and 4: V_{tank} = tank volume, m^3

For tanks greater than 840 000 gallons (3179 m^3) capacity: See Table 2.

Depending on the method, there can be a significant difference in the calculated required capacity. **No matter which method is used, the tank must be equipped with supplemental venting to protect the tank, product, and personnel in cases of equipment failure, fire exposure, or other conditions that could cause the tank pressure or vacuum to exceed operating limits.**

Capacity Information

Capacity information (Tables 2, 3, 4, and 5) are based on 0.97 specific gravity Nitrogen. Nitrogen is the most common blanketing gas. Should you use a different gas, convert the tabular values as follows: For blanketing (pad) gases other than nitrogen, multiply the given Nitrogen flow rate values by the conversion factors in Table 3. For gases of other specific gravities, multiply the given Nitrogen flow rate by 0.985, and divide by the square root of the appropriate specific gravity.

***Table 2**. API 2000 Requirements for Thermal Venting Capacity for Tanks Larger than 840 000 gallons (20 000 barrels, 3179 m^3)*

TANK CAPACITY, GALLONS (m^3)	IN BREATHING (VACUUM), SCFH AIR (Nm^3/h)
1 050 000 (4000)	24 000 (643)
1 260 000 (5000)	28 000 (750)
1 470 000 (6000)	31 000 (831)
1 680 000 (7000)	34 000 (911)
1 890 000 (8000)	37 000 (992)
2 100 000 (9000)	40 000 (1072)
2 520 000 (10 000)	44 000 (1179)
2 940 000 (11 000)	48 000 (1286)
3 360 000 (13 000)	52 000 (1394)
3 780 000 (14 000)	56 000 (1501)
4 200 000 (16 000)	60 000 (1608)
5 040 000 (19 000)	68 000 (1822)
5 880 000 (22 000)	75 000 (2010)
6 720 000 (25 000)	82 000 (2198)
7 560 000 (29 000)	90 000 (2412)

Ordering Information

Refer to the Specifications section on page 2. Carefully review each specification and construction feature, then complete the Ordering Guide on pages 7 and 8.

Also, please complete the Specifications Worksheet at the bottom of the Ordering Guide on pages 7 and 8.

***Table 3**. Conversion Factors (for converting Nitrogen flow rates to other gas flow rates)*

BLANKET GAS	SPECIFIC GRAVITY	CORRECTION FACTOR
Natural Gas	0.60	1.270
Air	1.00	0.985
Dry CO_2	1.52	0.797

$$\text{Correction Factor} = \frac{0.985}{\sqrt{SG}}$$

***Table 4**. Type ACE95 Capacities*

INLET PRESSURE			CAPACITIES IN SCFH (Nm^3/h) OF NITROGEN				
Psig (bar)	kg/cm^2	kPa	$C_V = 1$	$C_V = 2$	$C_V = 4$	$C_V = 7.5$	$C_V = 10$
25 (1,7)	1,76	172	1130 (30,3)	2300 (61,6)	4440 (119)	9900 (265)	11 200 (300)
30 (2,1)	2,11	207	1280 (34,3)	2670 (71,6)	5020 (135)	11 200 (300)	13 000 (348)
40 (2,8)	2,81	276	1680 (45,0)	3440 (92,2)	6780 (182)	13 500 (362)	16 400 (440)
50 (3,5)	3,52	345	2050 (54,9)	4090 (110)	8140 (218)	17 800 (477)	20 200 (541)
60 (4,1)	4,22	414	2330 (62,4)	4800 (129)	9370 (251)	18 200 (488)	22 700 (608)
70 (4,8)	4,92	483	2670 (71,6)	5450 (146)	10 600 (284)	23 600 (632)	26 600 (713)
80 (5,5)	5,62	552	3010 (80,7)	6160 (165)	12 000 (322)	27 400 (734)	30 800 (825)
90 (6,2)	6,33	621	3410 (91,4)	6840 (183)	13 200 (354)	30 800 (825)	34 100 (914)
100 (6,9)	7,03	690	3690 (98,9)	7430 (199)	14 600 (391)	34 100 (914)	38 000 (1018)
110 (7,6)	7,73	758	4000 (107)	8110 (217)	16 000 (429)	36 800 (986)	41 300 (1107)
120 (8,3)	8,44	827	4370 (117)	8750 (235)	17 200 (461)	38 800 (1040)	44 600 (1195)
130 (8,9)	9,14	896	4590 (123)	9340 (250)	18 300 (490)	43 400 (1163)	46 300 (1241)
140 (9,6)	9,84	965	4930 (132)	10 100 (271)	19 500 (523)	46 500 (1246)	50 500 (1353)
150 (10,3)	10,55	1034	5300 (142)	10 800 (289)	21 000 (563)	49 900 (1337)	54 500 (1461)
160 (11,0)	11,25	1103	5640 (151)	11 400 (306)	21 500 (576)	53 200 (1426)	58 200 (1560)
170 (11,7)	11,95	1172	5950 (159)	12 000 (322)	23 000 (616)	55 800 (1495)	62 300 (1670)
180 (12,4)	12,65	1241	6320 (169)	12 600 (338)	24 700 (662)	59 600 (1597)	65 900 (1766)
190 (13,1)	13,36	1310	6630 (178)	13 400 (359)	25 600 (686)	62 600 (1678)	69 600 (1865)
200 (13,8)	14,06	1379	6970 (187)	14 000 (375)	27 200 (729)	65 100 (1745)	71 900 (1927)

***Table 5**. Type ACE95Sr Capacities*

INLET PRESSURE			CAPACITIES IN SCFH (Nm³/h) OF NITROGEN		
Psig (bar)	kg/cm²	kPa	C_V = 20	C_V = 45	C_V = 60
25 (1,7)	1,76	172	26 700 (716)	60 200 (1613)	80 000 (2144)
30 (2,1)	2,11	207	30 200 (809)	68 100 (1825)	90 800 (2433)
40 (2,8)	2,81	276	37 500 (1005)	84 500 (2265)	112 700 (3020)
50 (3,5)	3,52	345	45 700 (1225)	102 800 (2755)	137 100 (3674)
60 (4,1)	4,22	414	53 800 (1442)	121 000 (3243)	161 400 (4325)
70 (4,8)	4,92	483	61 800 (1656)	139 200 (3731)	185 600 (4974)
80 (5,5)	5,62	552	69 900 (1873)	154 400 (4138)	209 800 (5623)
90 (6,2)	6,33	621	78 000 (2090)	175 500 (4703)	234 000 (6271)
100 (6,9)	7,03	690	86 000 (2305)	193 600 (5188)	258 200 (6920)
125 (8,6)	8,79	862	102 100 (2736)	238 900 (6402)	306 500 (8214)
150 (10,3)	10,55	1034	126 300 (3385)	284 200 (7616)	378 900 (10 154)
175 (12,1)	12,31	1207	142 400 (3816)	329 400 (8828)	427 200 (11 449)
200 (13,8)	14,06	1379	166 500 (4462)	347 700 (9318)	499 600 (13 390)

***Table 6**. Minimum and Maximum Differential Pressures*

BODY SIZE, NPS	VALVE C_V	INLET PRESSURE RANGES, PSIG (bar)	SPRING PART NUMBER	SPRING FREE LENGTH, INCHES (mm)	SPRING WIRE DIAMETER, INCHES (mm)
3/4, 1	1 to 4	25 to 50 (1,7 to 3,4)	GC220704X22	1.500 (38,1)	0.038 (0,96)
		51 to 120 (3,5 to 8,3)	GC220705X22	1.500 (38,1)	0.051 (1,30)
		121 to 200 (8,3 to 13,8)	GC220706X22	1.500 (38,1)	0.059 (1,50)
1	7.5 to 10	25 to 50 (1,7 to 3,4)	GC220705X22	1.500 (38,1)	0.051 (1,30)
		51 to 120 (3,5 to 8,3)	GC220706X22	1.500 (38,1)	0.059 (1,50)
		121 to 200 (8,3 to 13,8)	GC220709X22	1.500 (38,1)	0.072 (1,83)
2	20 to 60	25 to 50 (1,7 to 3,4)	GC220714X22	4.575 (116)	0.148 (3,76)
		51 to 120 (3,5 to 8,3)	GC220712X22	4.000 (102)	0.177 (4,50)
		121 to 200 (8,3 to 13,8)	GC220713X22	4.000 (102)	0.218 (5,54)

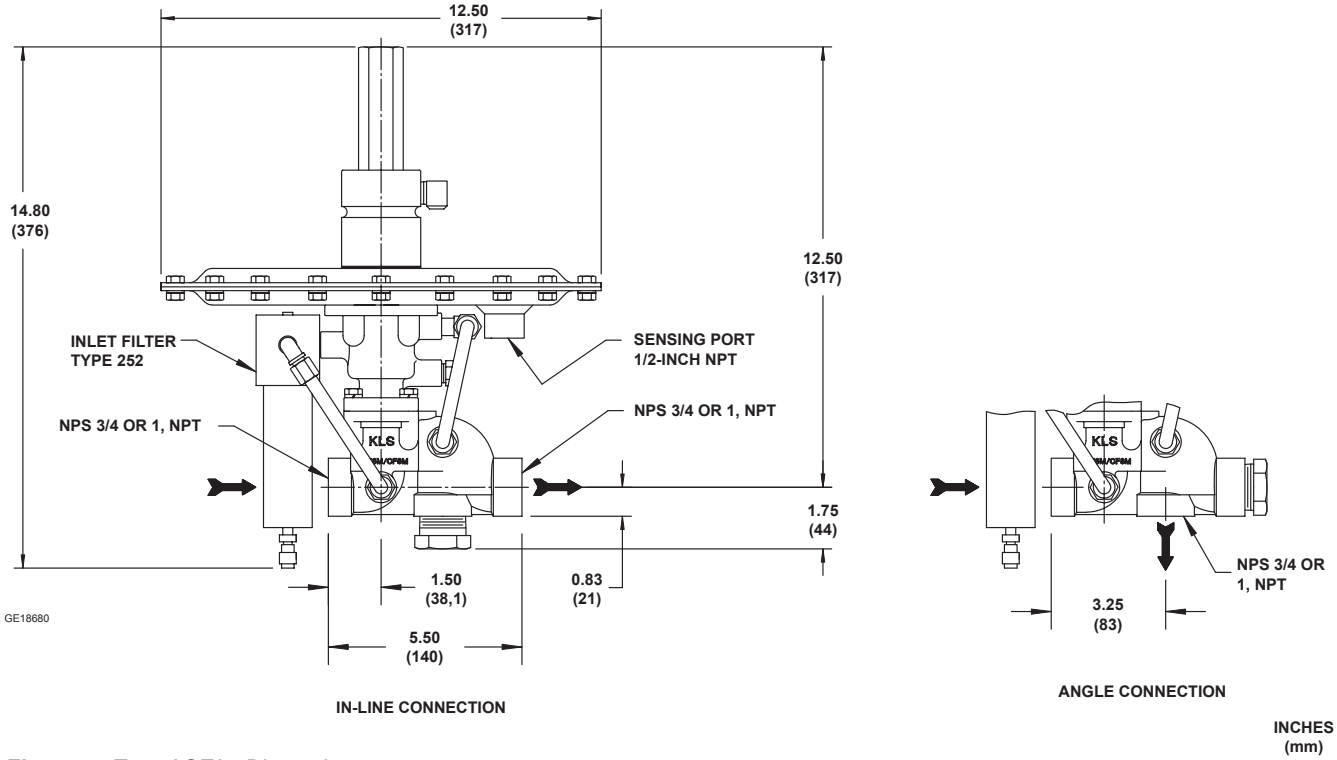


***Figure 4.** Type ACE95 Dimensions*

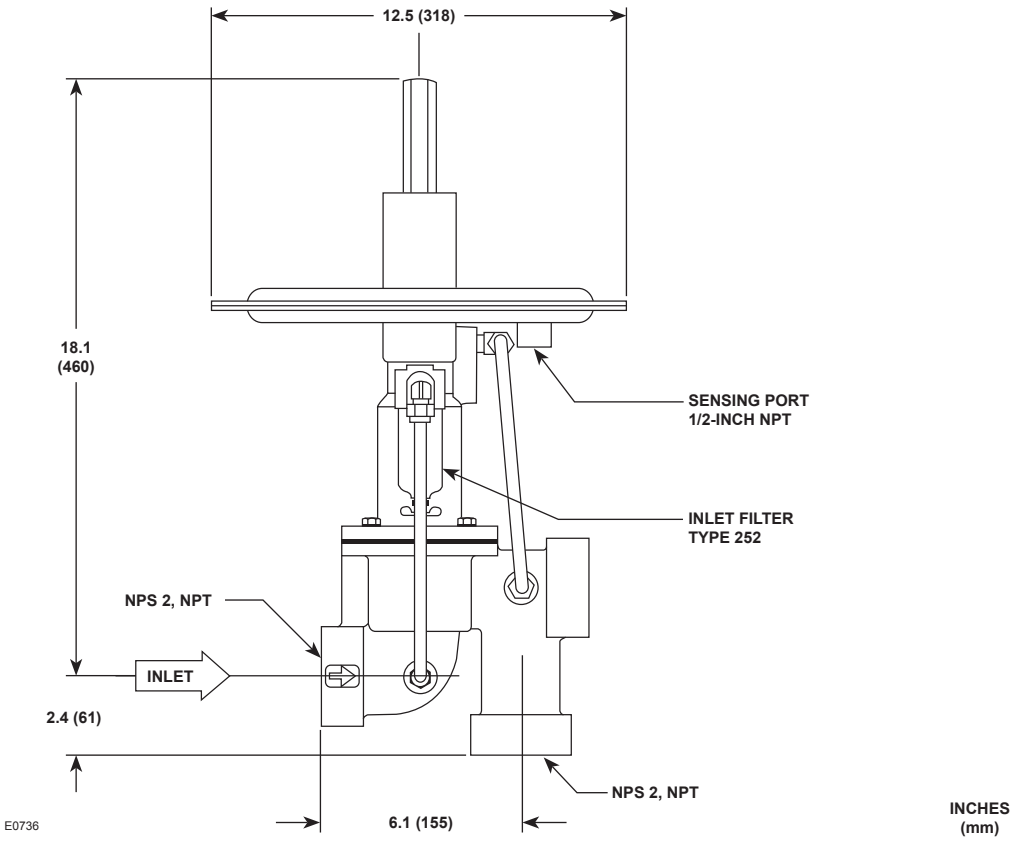


Figure 5. *Type ACE95Sr Dimensions*

Ordering Guide

Type (Select One)
- ☐ ACE95
- ☐ ACE95Sr

Body Size and Inlet Connection Style (Select One)

Type ACE95 (Angled Body)
- ☐ NPS 3/4, NPT
- ☐ NPS 1, NPT
- ☐ NPS 1 (DN 25), CL150 RF
- ☐ NPS 1 (DN 25), CL300 RF
- ☐ NPS 1 (DN 25), PN 16/25/40 RF
- ☐ NPS 1 (DN 25), Sanitary Flange

Type ACE95 (In-Line Body)
- ☐ NPS 3/4, NPT
- ☐ NPS 1, NPT
- ☐ NPS 1 (DN 25), CL150 RF
- ☐ NPS 1 (DN 25), CL300 RF
- ☐ NPS 1 (DN 25), PN 16/25/40 RF
- ☐ NPS 1 x 2 (DN 25 x 50), CL150 RF
- ☐ NPS 1 x 2 (DN 25 x 50), PN 16/25/40 RF
- ☐ NPS 1 (DN 25), Sanitary Flange

Type ACE95Sr (Angled Body)
- ☐ NPS 2, NPT
- ☐ NPS 2 (DN 50), CL150 RF
- ☐ NPS 2 (DN 50), CL300 RF

Actuator/Diaphragm (Select One)
- ☐ Carbon Steel with PTFE diaphragm
- ☐ 316 SST with PTFE diaphragm

Elastomers (Select One)
- ☐ Nitrile (NBR)
- ☐ Fluorocarbon (FKM)
- ☐ Ethylenepropylene (EPDM - FDA)
- ☐ Perfluoroelastomer (FFKM)

Main Valve Coefficient (Select One)

Type ACE95
- ☐ C_V – 10 (not available in NPS 3/4, NPT)
- ☐ C_V – 7.5 (not available in NPS 3/4, NPT)
- ☐ C_V – 4
- ☐ C_V – 2
- ☐ C_V – 1

Type ACE95Sr
- ☐ C_V – 60
- ☐ C_V – 45
- ☐ C_V – 20

Control Pressure Range (Select One)
- ☐ 0.5 to 5-inches w.c. (1 to 12 mbar)
- ☐ 4 to 10-inches w.c. (10 to 25 mbar)
- ☐ 8 to 15-inches w.c. (20 to 37 mbar)
- ☐ 0.5 to 1.5 psig (0,03 to 0,10 bar)
- ☐ -1 to 1-inch w.c. (-2 to 2 mbar)
- ☐ -0.5 to -5-inches w.c. (-1 to -12 mbar)

-continued-

Ordering Guide (continued)

Inlet Operating Range (Select One)
- ☐ 25 to 50 psig (1,7 to 3,5 bar)
- ☐ 51 to 120 psig (3,5 to 8,3 bar)
- ☐ 121 to 200 psig (8,3 to 13,8 bar)

Options (Select Desired Options)
- ☐ Stainless Steel Filter in lieu of standard Aluminum/Zinc
- ☐ Inlet Pressure Gauge, Stainless Steel
- ☐ Control Pressure Gauge, Dwyer
- ☐ Control Gauge, SST, for setpoint below 2-inches w.c. (5 mbar)
- ☐ Control Gauge, SST, for setpoint above 2-inches w.c. (5 mbar)
- ☐ Sensing Line Purge, Acrylic
- ☐ Sensing Line Purge, Stainless Steel
- ☐ Main Line Purge, Acrylic
- ☐ Main Line Purge, Stainless Steel
- ☐ Pressure Switch, X-Proof
- ☐ Main Line Check Valve, Stainless Steel
- ☐ Diagnostic and Inlet Gauges, Stainless Steel

Single Array Manifold (Optional)
- ☐ Yes, please add a SAM unit to my order. Please specify tank connection size and style [i.e. NPS 2 (DN 50), CL150 RF]. Not available for In-Line bodies.

_____

Parts Kit (Optional)
- ☐ Yes, please send one parts kit to match this order.

Specification Worksheet

Application Specifications:

Product in Tank _____
Tank Size _____
Pump In Rate _____
Pump Out Rate _____
Blanketing Gas (Type and Specific Gravity) _____
Conservation Vent Setpoints: _____ Pressure _____ Vacuum

Pressure Requirements (Please Designate Units):

Maximum Inlet Pressure (P_{1max}) _____
Minimum Inlet Pressure (P_{1min}) _____
Control Pressure Setting (P_2) _____
Maximum Flow (Q_{max}) _____

Other Specifications:

Is a vapor recovery regulator required? ☐ Yes ☐ No

Other Requirements: _____
_____
_____

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