T208 Series Tank Blanketing Vapor Recovery Regulators

Figure 1. *Type T208 Tank Blanketing Vapor Recovery Regulator*

Contents

Features

- **Accurate Control**—Large diaphragm area provides very accurate throttling control at low pressure settings.
- **Easy Conversion**—Changes easily from the Type T208 to the Type T208M with two O-rings and a machine screw.
- **Rugged Construction**—Heavy duty casings and internal parts are designed to reduce vibration and shock and give this regulator the ability to withstand up to 35 psig / 2.4 bar (with Nitrile (NBR) and Fluorocarbon (FKM) diaphragms) and 10 psig / 0.69 bar (with Fluorinated Ethylene Propylene (FEP) diaphragm) with no internal parts damage.
- **Simplicity**—Direct-operated, straightforward stem and lever design minimizes the number of parts while providing excellent regulation of pressure.
- **Sour Gas Service Capability**—Available construction to meet NACE MR0175-2002.
- **Arctic Temperatures**—Constructions for process temperatures as low as -76°F / -60°C available by request.
- **FDA/USP Class VI/ADI-free**—Types T208 and T208M can be used in applications requiring clean regulator solutions. Constructions available with FDA/USP Class VI approved/ADI-free elastomers.

Specifications

This section lists the specifications of the T208 Series Tank Blanketing Vapor Recovery Regulator. Factory specification, such as maximum temperature, maximum inlet and outlet pressures, spring range and seat or orifice size are stamped on the nameplate fastened on the regulator at the factory.

Available Configurations

Type T208: Tank Blanketing Vapor Recovery regulator with control pressure range of 2 in.w.c. to 7 psig / 5 mbar to 0.48 bar in six different spring ranges and has internal pressure registration requiring no control line.
Type T208M: Similar to Type T208 but has a blocked throat and a control line connection for external pressure registration.

Body Sizes and End Connection Styles
See Table 1

Maximum Allowable Inlet (Casing) Pressure(1)
See Table 1

Maximum Outlet Pressure(1)
35 psig / 2.4 bar

Maximum Emergency Inlet Pressure to Avoid Internal Parts Damage(1)
See Table 1

Control Pressure Ranges(1)
See Table 3

Flow and Sizing Coefficients
See Table 4

C_v Coefficients and Flow Capacities
See Table 5

Orifice Size
7/16 in. / 11 mm

Body and Casing Materials
Gray Cast iron, WCC Carbon steel, LCC Carbon steel and CF8M/CF3M Stainless steel(2)

Trim Materials
See Table 2

Material Temperature Capabilities(1)(3)(4)

Elastomer Parts

Nitrile (NBR): -40 to 180°F / -40 to 82°C
Fluorinated Ethylene Propylene (FEP): -20 to 180°F / -29 to 82°C
Fluorocarbon (FKM): 40 to 300°F / 4 to 149°C
Ethylene Propylene Diene (EPDM): -20 to 225°F / -29 to 107°C
Perfluoroelastomer (FFKM): 0 to 300°F / -18 to 149°C

Body Materials

Gray Cast Iron: -20 to 300°F / -29 to 149°C
WCC Carbon Steel: -20 to 300°F / -29 to 149°C
LCC Carbon Steel: -40 to 300°F / -40 to 149°C
CF8M/CF3M Stainless Steel: -40 to 300°F / -40 to 149°C

Spring Case Vent Connection
1/4 NPT

Diaphragm Case Control Line Connection (Type T208M)
1/2 NPT

Approximate Weight
17.7 lbs / 8 kg

1. The pressure/temperature limits in this Bulletin and any applicable standard or code limitation should not be exceeded.
2. Pipe nipples and flanges are 316 Stainless steel for flanged body assemblies.
3. See Table 2 for operating temperature ranges for available trim combinations.
4. Special low temperature constructions for process temperatures between -76 to 180°F / -60 to 82°C are available by request. The low temperature construction passed Emerson laboratory testing for lockup and external leakage down to -76°F / -60°C.

Table 1. *Body Sizes, End Connection Styles and Maximum Allowable Inlet (Casing) Pressures*

BODY SIZE	BODY MATERIAL	END CONNECTION STYLE(1)	MAXIMUM ALLOWABLE INLET (CASING) PRESSURE,	MAXIMUM ALLOWABLE EMERGENCY INLET PRESSURE TO AVOID CASING DAMAGE(1)	MAXIMUM INLET PRESSURE TO AVOID INTERNAL PARTS DAMAGE(1)
3/4 or 1 in / DN 20 or 25	Gray cast iron	NPT	35 psig / 2.4 bar	35 psig / 2.4 bar	With Nitrile (NBR), EPDM or Fluorocarbon (FKM) diaphragm: 35 psig / 2.4 bar With Fluorinated Ethylene Propylene (FEP) diaphragm: 10 psig / 0.69 bar
	WCC Carbon steel	NPT, CL150 RF, CL300 RF or PN 16/25/40 RF	75 psig / 5.2 bar	75 psig / 5.2 bar	
	LCC Carbon steel				
	CF8M/CF3M Stainless steel(2)				

1. All flanges are welded. Weld-on flange dimension is 14 in. / 356 mm face-to-face.
2. Pipe nipples and flanges are 316 Stainless steel for flanged body assemblies.

Introduction

The T208 Series are direct-operated tank blanketing vapor recovery regulators. These regulators are used to sense an increase in vessel pressure and vent excessive internal tank pressure to an appropriate vapor recovery disposal or reclamation system. T208 Series may also be used as backpressure regulators or relief valves.

Principle of Operation

Type T208 Vapor Recovery Regulator senses the change in tank pressure internally (see Figure 2), while Type T208M regulator senses the change in tank pressure through a 1/2 NPT control line tapped in its lower casing (see Figure 3).

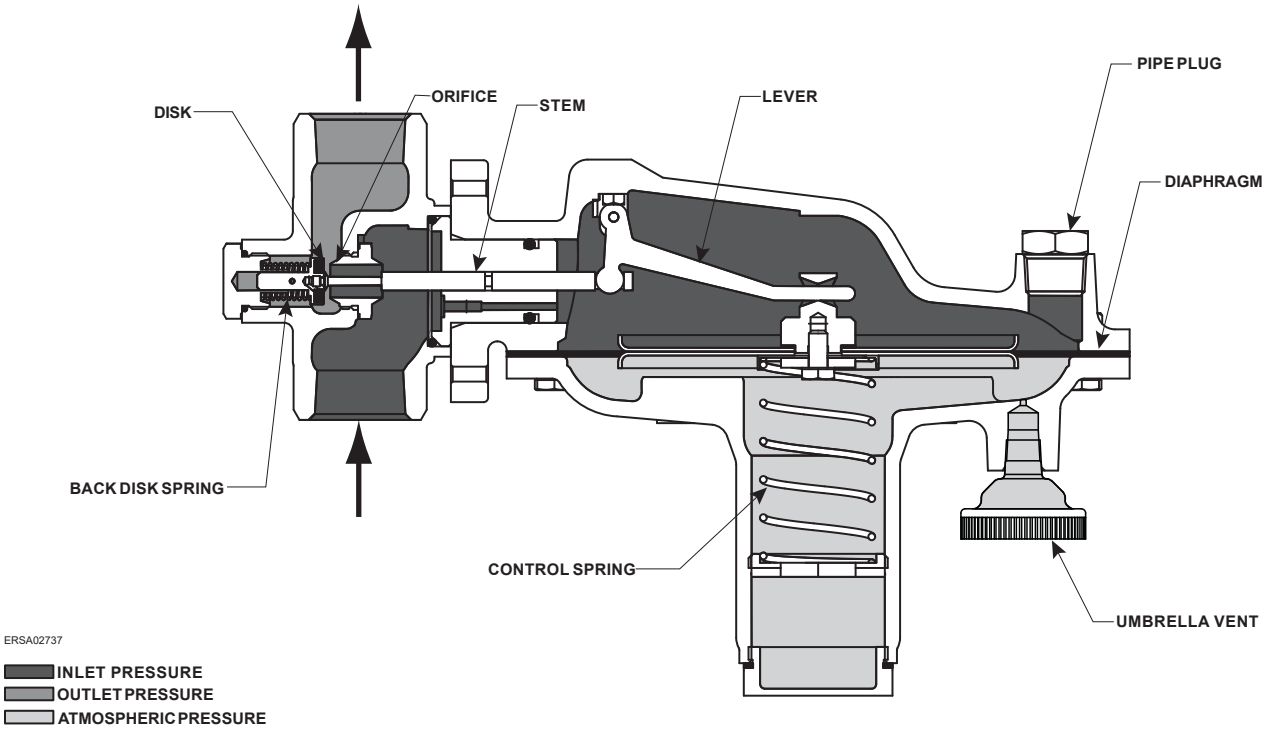

Figure 2. *Type T208 with Internal Pressure Registration Operational Schematics*

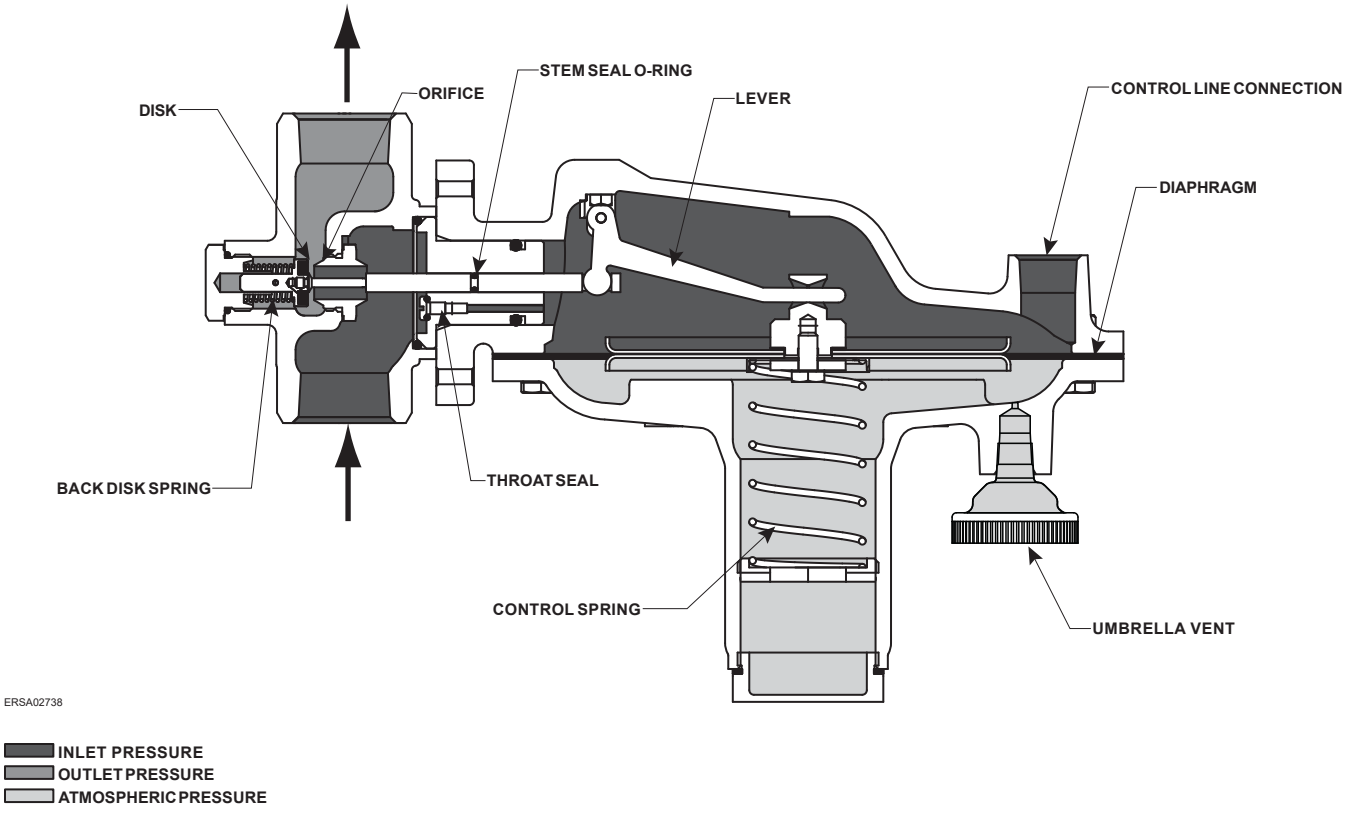

Figure 3. *Type T208M with External Pressure Registration Operational Schematics*

Table 2. *Available Construction and Trim Materials*

AVAILABLE CONSTRUCTION MATERIAL				AVAILABLE TRIM OPTION			
Body and Casing	**Guide Insert, Stem and Pusher Post**	**Diaphragm Head**	**Lever Assembly**	**Trim Option Code**	**Diaphragm Material**	**Disk and O-ring Material**	**Operating Temperature Range[2]**
Gray cast iron, WCC Carbon steel, LCC Carbon steel or CF8M/CF3M Stainless steel[1]	316 Stainless steel	304 Stainless steel	302 Stainless steel	Standard	Nitrile (NBR)	Nitrile (NBR)	-40 to 180°F / -40 to 82°C
				EE	EPDM	EPDM	-20 to 225°F / -29 to 107°C
				FDA[3]	EPDM	EPDM	-20 to 225°F / -29 to 107°C
				VV	Fluorocarbon (FKM)	Fluorocarbon (FKM)	40 to 300°F / 4 to 149°C
				TV	Fluorinated Ethylene Propylene (FEP)	Fluorocarbon (FKM)	40 to 180°F / 4 to 82°C
				TN	Fluorinated Ethylene Propylene (FEP)	Nitrile (NBR)	-20 to 180°F / -29 to 82°C
				TK	Fluorinated Ethylene Propylene (FEP)	Perfluoroelastomer (FFKM)	0 to 180°F / -18 to 82°C
				TE	Fluorinated Ethylene Propylene (FEP)	EPDM	-20 to 180°F / -29 to 82°C

1. Pipe nipples and flanges are 316 Stainless steel for flanged body assemblies.
2. Special low temperature constructions for process temperatures between -76 to 180°F / -60 to 82°C are available by request. The low temperature construction passed Emerson laboratory testing for lockup and external leakage down to -76°F / -60°C.
3. EPDM option available with FDA/USP Class VI approved/ADI-free elastomers (wetted components only).

Table 3. *Control Pressure Ranges and Spring Information*

CONTROL PRESSURE RANGE		SPRING COLOR	SPRING WIRE DIAMETER		SPRING FREE LENGTH	
In. w.c.	**mbar**		**In.**	**mm**	**In.**	**mm**
2.0 to 7.0[1][2]	5 to 17[1][2]	Red	0.085	2.2	3.63	92.2
3.0 to 13.0[1][2]	7 to 32[1][2]	Unpainted	0.105	2.7	3.75	95.3
10.0 to 26.0	25 to 65	Yellow	0.114	2.9	4.31	109
0.9 to 2.5 psig	62 to 172	Green	0.156	4.0	4.06	103
1.3 to 4.5 psig	90 to 310	Light Blue	0.187	4.8	3.94	100
3.8 to 7.0 psig	0.26 to 0.48 bar	Black	0.218	5.5	3.98	101

1. To achieve the published control pressure range the spring case must be installed pointing down.
2. Do not use Fluorocarbon (FKM) diaphragm with these springs at diaphragm temperatures lower than 60°F / 16°C.

Table 4. *Flow and Sizing Coefficients*

ORIFICE SIZE		REGULATING			WIDE-OPEN		
In.	**mm**	**C_g**	**C_v**	**C_1**	**C_g**	**C_v**	**C_1**
7/16	11	94	2.7	35.0	97	2.8	35.0

Table 5. *T208 Series C_v Coefficient and Flow Capacity*

CONTROL PRESSURE RANGE AND SPRING COLOR	SET PRESSURE		MINIMUM BUILDUP TO WIDE-OPEN		VACUUM OUTLET PRESSURE		C_V COEFFICIENT	CAPACITIES OF AIR	
	In. w.c.	**mbar**	**In. w.c.**	**mbar**	**psig**	**bar g**		**SCFH**	**Nm^3/h**
2.0 to 7.0 in. w.c. / 5 to 17 mbar, Red	2.0	5.0	4.02	10	0	0	3.1	192	5.1
					2.5	0.17	3.5	1161	31.1
					5	0.34	3.5	1488	39.9
	4.0	10.0	3.62	9	0	0	2.6	226	6.1
					2.5	0.17	3.5	1178	31.6
					5	0.34	3.5	1500	40.2
3.0 to 13.0 in. w.c. / 7 to 32 mbar, Unpainted	10.0	25	5.99	15	0	0	2.0	268	7.2
					2.5	0.17	3.5	1232	33.0
					5	0.34	3.5	1539	41.2
10.0 to 26.0 in. w.c. / 25 to 65 mbar, Yellow	15	37	8.89	22.1	0	0	2.0	331	8.9
					2.5	0.17	3.5	1279	34.3
					5	0.34	3.5	1574	42.2
0.9 to 2.5 psig / 62 to 172 mbar, Green	1 psig	70	0.78 psig	54	0	0	2.2	499	13.4
					2.5	0.17	3.6	1426	38.2
					5	0.34	3.6	1687	45.2
1.3 to 4.5 psig / 90 to 310 mbar, Light Blue	2 psig	140	1.49 psig	103	0	0	2.3	752	20.2
					2.5	0.17	3.8	1694	45.4
					5	0.34	3.7	1904	51.0
3.8 to 7.0 psig / 0.26 to 0.48 bar, Black	5 psig	340	2.79 psig	192	0	0	2.2	1139	30.5
					2.5	0.17	3.8	2286	61.3
					5	0.34	3.8	2242	60.1

When vessel pressure increases above the setpoint of the regulator due to thermal heating or pump-in of the product, the pressure on the diaphragm overcomes the force of the control spring. The disk moves away from the orifice, allowing gas to flow from the vessel to the vapor recovery system.

As vessel pressure is reduced, the force of the back disk spring causes the disk to move toward the orifice, decreasing the flow of gas out of the vessel. As vessel pressure drops below the setpoint of the regulator, the disk will seat against the orifice, shutting off the gas flow.

Installation

Install the T208 Series Regulator using a straight run pipe of the same size or larger as the regulator body. Flow through the regulator body is indicated by the flow arrow attached to the body. If a block valve is required, install a full flow valve between the regulator and the blanketed vessel. To achieve the established regulator capacities, the regulators should be installed with the spring case barrel pointed down (See Figure 1).

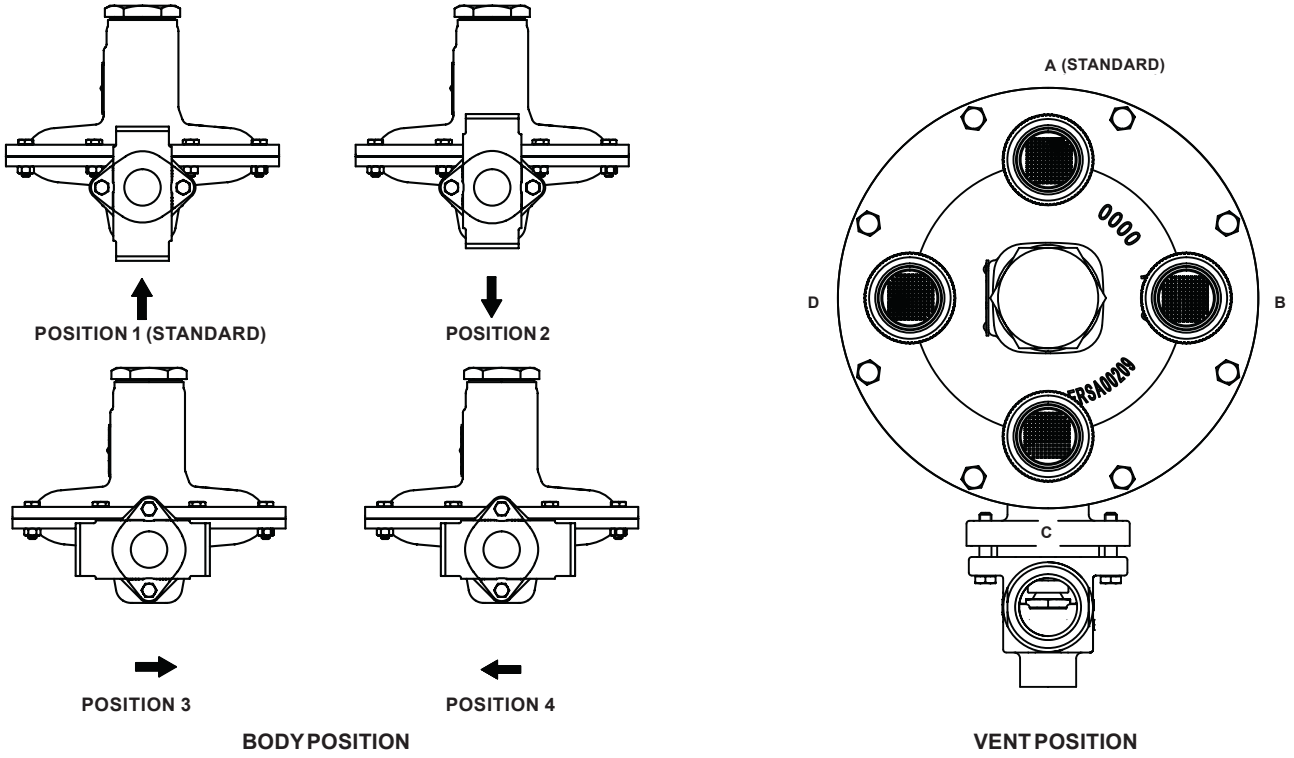

Figure 4. *Body and Vent Position*

Emerson Process Management Regulator Technologies, Inc. (Emerson) provides an instruction manual with every regulator shipped. Refer to this for complete installation, operation and maintenance instructions. Included is a complete listing of individual parts and recommended spare parts.

Overpressure Protection

Vapor recovery regulators are used to maintain a constant inlet (blanket) pressure with the outlet flowing to a system whose pressure is lower than that at the inlet. The recovery regulators are not intended to be used as an ASME certified relief device for overpressure protection on a tank. They are to be used as part of a gas blanketing system to control outflow of blanketing gas under normal conditions and collect tank vapors for the vapor disposal or reclamation system. Provide alternate methods of emergency overpressure protection.

Universal NACE Compliance

Optional materials are available for applications handling sour gases. These constructions comply with the recommendations of National Association of Corrosion Engineers (NACE) sour service standards.

The manufacturing processes and materials used by Emerson assure that all products specified for sour gas service comply with the chemical, physical and metallurgical requirements of NACE MR0175-2002. Customers have the responsibility to specify correct materials. Environmental limitations may apply and shall be determined by the user.

Sizing Blanketing Systems

When sizing a gas vapor recovery regulator system, consider the volume of blanketing gas that must be displaced from the vessel when either filling the vessel with liquid (pump-in) or the expansion of vapors inside the vessel during atmospheric thermal heating.

Using the established procedures from American Petroleum Institute Standard 2000 (API 2000), determine the flow rate for outbreathing:

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

where,

Q_{total}: Required Flow Rate
Q_{pump}: Required Flow Rate due to pump in
$Q_{thermal}$: Required Flow Rate due to thermal heating

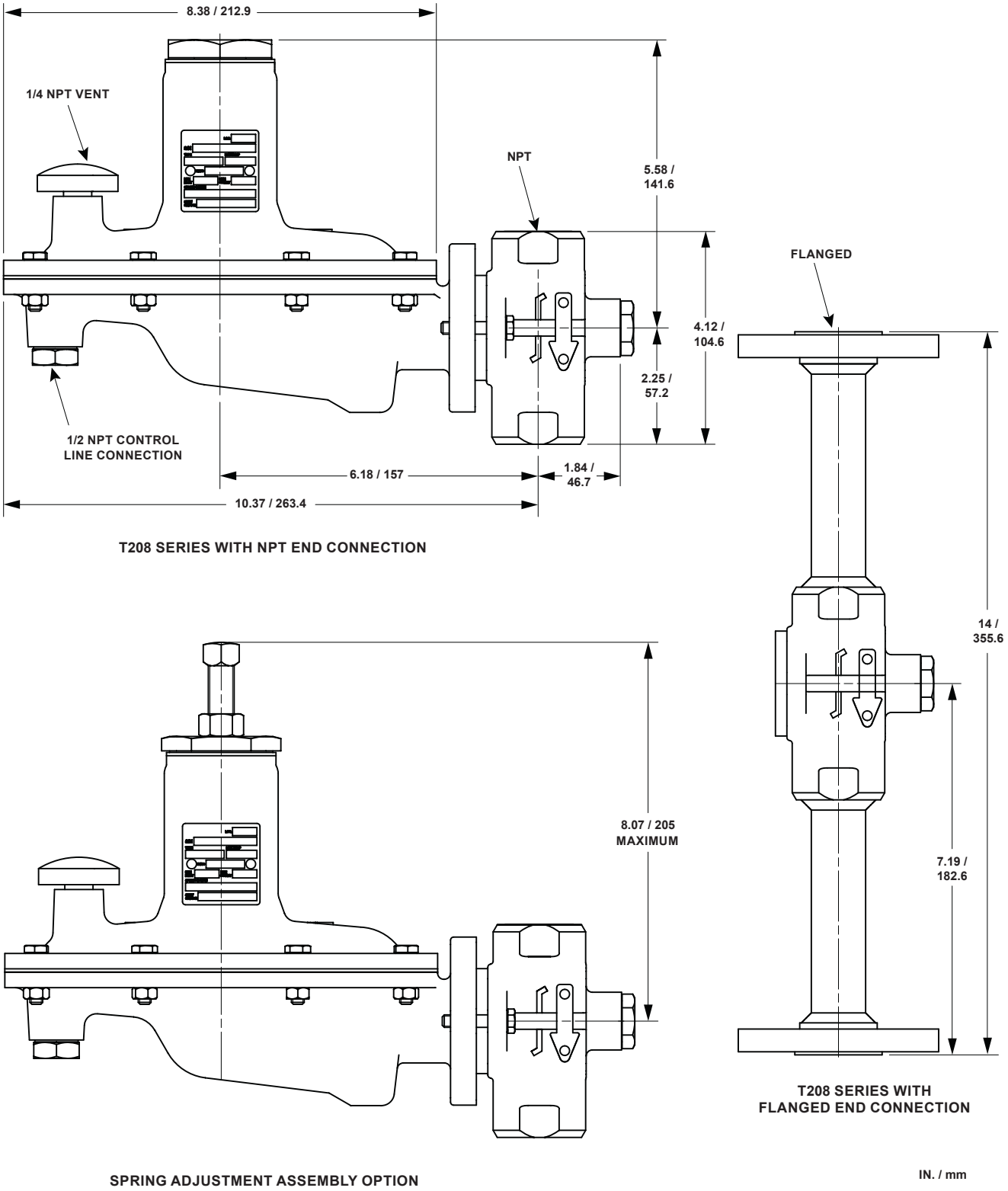

Figure 5. *Dimension*

Capacity Information

Table 5 shows the T208 Series C_v coefficient and flow capacities of air at selected set pressure. Flows are in SCFH (at 60°F and 14.7 psia) and Nm^3/h (at 0°C and 1.01325 bar) of 1.0 specific gravity air. For gases of other specific gravities, divide the given capacity of air by the square root of the appropriate specific gravity of the gas required. To determine regulating capacities at pressure settings not given or to determine wide-open flow capacities, use the following formula:

$$Q = \sqrt{\frac{520}{GT}}\, C_g P_1 SIN \left(\frac{3417}{C_1} \sqrt{\frac{\Delta P}{P_1}} \right) DEG$$

where:

Q = flow rate, SCFH
G = gas specific gravity
T = absolute temperature of gas at inlet, °Rankine
C_g = gas sizing coefficient, Table 4
P_1 = absolute inlet pressure, psia
C_1 = C_g/C_v, flow coefficient, Table 4
ΔP = pressure drop across the regulator, psi

Ordering Information

When ordering, complete the ordering guide on this page. Refer to the Specifications section on page 2. Review the description to the right of each specification and the information in each referenced table or figure. Specify your choice whenever a selection is offered.

Ordering Guide

Type (Select One)
- ☐ T208, Internal pressure registration***
- ☐ T208M, External pressure registration***

Body Size (Select One)
- ☐ 3/4 in. / DN 20***
- ☐ 1 in. / DN 25***

Body Material and End Connection Style (Select One)

Gray Cast Iron
- ☐ NPT***

WCC Carbon Steel
- ☐ NPT***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ PN 16/25/40 RF*** specify rating _____

LCC Carbon Steel
- ☐ NPT**
- ☐ CL150*
- ☐ CL300*
- ☐ PN 16/25/40 RF* specify rating _____

CF8M/CF3M Stainless Steel(1)
- ☐ NPT***
- ☐ CL150 RF***
- ☐ CL300 RF***
- ☐ PN 16/25/40 RF*** specify rating _____

1. Pipe nipples and flanges are 316 Stainless steel for flanged body assemblies.

Control Pressure Range (Select One)
- ☐ 2.0 to 7.0 in. w.c. / 5 to 17 mbar, Red***
- ☐ 3.0 to 13.0 in. w.c. / 7 to 32 mbar, Unpainted***
- ☐ 10.0 to 26.0 in. w.c. / 25 to 65 mbar, Yellow***
- ☐ 0.9 to 2.5 psig / 62 to 172 mbar, Green***
- ☐ 1.3 to 4.5 psig / 90 to 310 bar, Light Blue***
- ☐ 3.8 to 7 psig / 0.26 to 0.48 bar, Black***

Trim Material (See Table 2, Select One)
- ☐ Standard***
- ☐ VV***
- ☐ TV***
- ☐ TN***
- ☐ TK***
- ☐ TE***
- ☐ EE***
- ☐ FDA***

Adjusting Screw (Select One)
- ☐ Internal Flat Circular **(standard)***
- ☐ External Square Head (Available for Green, Light blue and Black springs only. Steel closing cap is automatically supplied in this option)***

Closing Cap Material (Select One)
- ☐ Plastic **(standard)** (not available for Green, Light blue and Black springs)***
- ☐ Steel (**standard** for Green, Light blue and Black springs)***
- ☐ Stainless steel***

Body Position (See Figure 4, Select One)
- ☐ Position 1 **(standard)***
- ☐ Position 2***
- ☐ Position 3***
- ☐ Position 4***

Spring Case Orientation/Vent Type (Select One)
- ☐ Spring Case Down (Type Y602-1) **(standard)***
- ☐ Spring Case Up (Type Y602-11)***

Vent Position (See Figure 4) (Select One)
- ☐ Position A **(standard)***
- ☐ Position B***
- ☐ Position C***
- ☐ Position D***

NACE Standard MR0175-2002 Construction (Select One)
- ☐ Yes
- ☐ No

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

Ordering Guide (continued)

Regulators Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Specification Worksheet

Application (Please designate units):
Specific Use _____
Line Size _____
Fluid Type and Specific Gravity _____
Fluid Temperature _____

Does the Application Require Overpressure Protection?
☐ Yes ☐ No If yes, which is preferred:
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device

Is overpressure protection equipment selection assistance desired? _____

Pressure:
Maximum Inlet Pressure _____
Minimum Inlet Pressure _____
Differential Pressure _____
Set Pressure _____
Maximum Flow (Q_{max}) _____

Performance Required:
Accuracy Requirements?
Less than or Equal to:
☐ 5% ☐ 10% ☐ 20% ☐ Wide Open

Other Requirements:

_____

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