

# 2500-249 Series Pneumatic Controllers and Transmitters

Typical caged and cageless sensor/instrument configurations are shown in figures 1 and 2. Caged sensors (figure 3) provide more stable operation than do cageless sensors (figure 4) for vessels with internal obstructions or considerable internal turbulence. Cageless sensors are generally used on specific gravity and interface control applications requiring large displacers that are more easily accommodated by flange connections up to NPS 8. The availability of many different displacer stem lengths permits lowering the displacer down to the

most advantageous depth in the vessel.

Fisher® pneumatic controllers and transmitters are used wherever rugged, dependable, and simply constructed displacer-style pneumatic instrumentation is required in liquid level, interface level, or density service. The ruggedness of these products is demonstrated by their use in many kinds of demanding applications, including those in the power, chemical process, oil and gas production, and petrochemical industries.

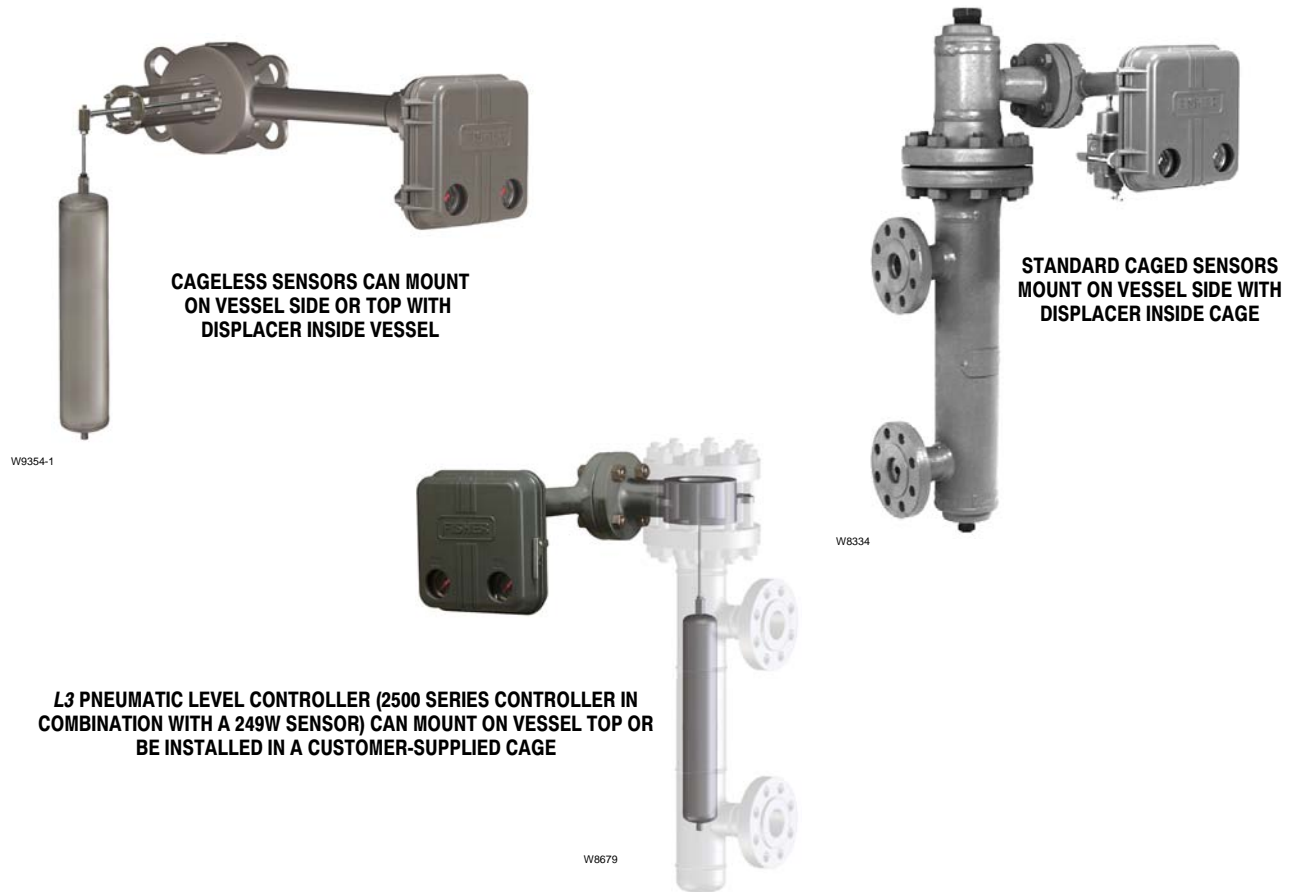


Figure 1. Typical Configurations



## Specifications

### Available Configurations

See tables 1, 5, and 6

### Input Signal

**Fluid Level or Fluid-to-Fluid Interface Level:** From 0 to 100 percent of displacer length—standard lengths for all sensors are ■ 356 mm (14 inches) or ■ 813 mm (32 inches); other lengths available depending on sensor construction

**Fluid Density:** From 0 to 100 percent of displacement force change obtained with given displacer volume—standard volumes are ■ 980 cm<sup>3</sup> (60 inches<sup>3</sup>) for 249C and 249CP sensors or ■ 1640 cm<sup>3</sup> (100 inches<sup>3</sup>) for most other sensors; other volumes available depending upon sensor construction

### Allowable Specific Gravity

Specific gravity with standard volume displacers and standard wall torque tubes:

**Fluid Level and Fluid-to-Fluid Interface:**  
2500 Series, except 2503 and 2503R—Specific gravity range, 0.20 to 1.10  
2503 and 2503R—Specific gravity range, 0.25 to 1.10

**Fluid Density:**  
2500 Series, except 2503 and 2503R—Minimum change in specific gravity, 0.20  
2503 and 2503R—Minimum change in specific gravity, 0.25

Contact your Emerson Process Management sales office for information on non-standard applications

### Output Signal

See table 1

### Output Action

- Direct (increasing fluid or interface level or specific gravity increases output pressure) or
- Reverse (increasing fluid or interface level or specific gravity decreases output pressure)

### Area Ratio of Relay Diaphragms

3:1

### Supply Pressure<sup>(1)</sup>

**Normal Operation:** See table 4

**Maximum to Prevent Internal Part Rupture<sup>(2)</sup>:**  
3 bar (45 psig)

### Steady-State Air Consumption

See table 4

### Proportional Band, Differential Gap, or Span

See table 1

### Set Point (Controllers Only)

Continuously adjustable to position control point or differential gap of less than 100 percent anywhere within displacer length (fluid or interface level) or displacement force change (density)

### Zero Adjustment (Transmitters Only)

Continuously adjustable to position span of less than 100 percent anywhere within displacer length (fluid or interface level) or displacement force change (density)

### Performance

**Independent Linearity (Transmitters Only):** 1 percent of output pressure change at span of 100 percent

**Hysteresis:** 0.6 percent of output pressure change at 100 percent of proportional band, differential gap, or span

**Repeatability:** 0.2 percent of displacer length or displacement force change

**Deadband (Except Differential Gap Controllers<sup>(3)</sup>):** 0.05 percent of proportional band or span

**Typical Frequency Response:** 4 Hz and 90-degree phase shift at 100 percent of proportional band, differential gap, or span with output piped to typical instrument bellows using 6.1 meters (20 feet) of 6.4 mm (1/4-inch) tubing  
**Ambient Temperature Error:** ±1.5 percent of output pressure change per 28°C (50°F) of temperature change at 100 percent of proportional band, differential gap, or span when using sensor with standard wall N05500 torque tube

**Reset (Proportional-Plus-Reset Controllers Only):** Continuously adjustable from 0.005 to over 0.9 minutes per repeat (from 200 to under 1.1 repeats per minute)

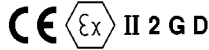
**Anti-Reset Differential Relief (2502F and 2502FR Controllers Only):** Continuously adjustable from 0.14 to 0.48 bar (2 to 7 psi) differential to relieve excessive difference between proportional and reset pressures

### Standard Tubing Connections

1/4 NPT internal

-continued-

**Specifications (Continued)**

<p><b>Sensor Connection Sizes</b> See tables 5 and 6</p> <p><b>Maximum Working Pressures (Sensors Only)<sup>(1)</sup></b> Consistent with applicable ASME pressure/temperature ratings for the specific sensor constructions shown in tables 5 and 6</p> <p><b>Operative Ambient Temperatures<sup>(1)</sup></b> <b>Controller</b>  <ul style="list-style-type: none"> <li>■ Standard -40 to 71°C (-40 to 160°F)</li> <li>■ High Temperature -18 to 104°C (0 to 220°F)</li> </ul> <b>Sensor</b> See table 2 For ambient temperature ranges, guidelines, and use of optional heat insulator, see figure 5</p> <p><b>Standard Supply and Output Pressure Gauge Indications</b> See table 4</p> <p><b>Allowable Process Temperatures<sup>(1)</sup></b> See table 2</p>	<p><b>Hazardous Area Classification</b>  2500 Series controllers comply with the requirements of ATEX Group II Category 2 Gas and Dust  </p> <p><b>Construction Materials</b> See tables 2, 3, and 7</p> <p><b>Mounting Positions</b> See figure 10</p> <p><b>Caged Sensor Connection Styles</b> See figure 11</p> <p><b>Options</b> See Options section</p>
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NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 – Process Instrument Terminology.  
 1. The pressure/temperature limits in this document and any applicable code or standard should not be exceeded.  
 2. Also see Supply Pressure Overpressure Protection section.  
 3. For 2500S, 2500SC, and 2503 adjusting the differential gap is equivalent to adjusting the deadband.

**Features**

- **Easy Adjustment**—Set point, proportional valve opening, and reset changes are made with simple dial-knob controls.
- **Simple, Durable Construction**—Few moving parts are used. Knife-edged driver bearing in sensor and plated brass instrument case ball bearing for torque tube rotary shaft help provide low-friction operation. Sensors are available in ratings up to CL2500.
- **Mounting Versatility**—Caged sensors are available in a variety of orientations and connection styles, and all sensors can be either right- or left-hand mounted.
- **Sensitive to Small Changes**—Displacer reaction to small specific gravity changes allows these instruments to be used for density applications

and in other applications where a response to low levels of input signal change is required.

- **Easy Reversibility**—Action is field reversible from direct to reverse or vice versa without additional parts.
- **Reduced Maintenance Costs**—Spring-out wire provides for in-service cleaning of relay orifice (figure 2). Torque tube can be replaced without removing torque tube arm.
- **Reduced Operating Costs**—Supply pressure conservation is enhanced in all constructions because relay exhaust opens only when output pressure is being reduced.
- **Smaller Vessel Sizes Required for Stable Control**—Caged 249 Series sensors come standard with a liquid damping orifice in the lower equalizing connection that helps stability where vessel capacitance is small and permits narrower proportional valve settings.

## 2500-249 Controllers and Transmitters

Table 1. Additional Specifications for Selected 2500 Series Configurations

CONTROL OR TRANSMISSION MODE		TYPE NUMBER <sup>(1)</sup>	FULL OUTPUT SIGNAL CHANGE OBTAINABLE OVER INPUT OF:	OUTPUT SIGNAL
Proportional control		2500, 2500C <sup>(2)</sup>	Proportional band of 0 to 100 percent of displacer length or displacement force change (10 to 100 percent recommended)	0.2 to 1.0 bar (3 to 15 psig) or 0.4 to 2.0 bar (6 to 30 psig)
Proportional-plus-reset control		2502, 2502C <sup>(2)</sup>	Proportional band of 0 to 200 percent of displacer length or displacement force change (20 to 200 percent recommended)	
Proportional-plus-reset control with anti-reset windup		2502F		
Differential Gap (On-off) Control	With proportional valve and full differential gap adjustment	2500S, 2500SC <sup>(2)</sup>	Differential gap of 0 to 100 percent of displacer length	0 and 1.4 bar (0 and 20 psig) or 0 and 2.4 bar (0 and 35 psig)
	Without proportional valve—has limited differential gap adjustment	2503	Differential gap of approximately 25 to 40 percent of displacer length, when a 356 millimeter (14-inch) ideal-volume displacer is used on 1.0 specific gravity liquid level service and a standard 1.4 bar (20 psig) supply regulator setting is varied between 1.0 and 1.7 bar (15 and 25 psig) <sup>(3)</sup>	0 and full supply pressure <sup>(4)</sup>
Proportional transmission		2500T, 2500TC <sup>(2)</sup>	Span of 0 to 100 percent of displacer length or displacement force change (20 to 100 percent recommended)	0.2 and 1.0 bar (3 to 15 psig) or 0.4 to 2.0 bar (6 to 30 psig)

1. The suffix R is added to the type number for reverse action, and all types have a 67CFR supply regulator mounted as standard.  
2. The suffix C is added to the type number for indicator assembly.  
3. Other displacer lengths and volumes, or service conditions, will result in other differential gaps.  
4. 1.4 bar (20 psig) and 2.4 bar (35 psig) are the standard factory-set supply regulator pressures, but these values will vary whenever the supply pressure is changed to adjust the differential gap.

Table 2. Allowable Process Temperatures for Common 249 Sensor Component Materials

MATERIAL	PROCESS TEMPERATURE	
	Minimum	Maximum
Cast Iron <sup>(1)</sup>	-29°C (-20°F)	232°C (450°F)
Steel	-29°C (-20°F)	427°C (800°F)
Stainless Steel	-198°C (-325°F)	427°C (800°F)
N04400	-198°C (-325°F)	427°C (800°F)
Aluminum	-195°C (-320°F)	99°C (210°F)
Soft Iron Gasket	-29°C (-20°F)	427°C (800°F)
Gaskets Composition and SST/composition		
Graphite	-29°C (-20°F)	150°C (302°F)
Laminate/SST	-198°C (-325°F)	427°C (800°F)
N04400/PTFE	-73°C (-100°F)	204°C (400°F)
Bolting		
B7 steel	-46°C (-50°F)	427°C (800°F)
B7M steel	-29°C (-20°F)	427°C (800°F)
B8M stainless steel	-198°C (-325°F)	427°C (800°F)

1. Cast iron may be used to -73°C (-100°F) provided a heat insulator is used below -18°C (0°F) and stainless steel studs and nuts are used below -46°C (-50°F).

Table 3. Displacer and Torque Tube Materials

PART	STANDARD MATERIAL	OTHER MATERIAL
Displacer	304 Stainless Steel	316 Stainless Steel, N10276, N04400, Plastic, and Special Alloys
Displacer Stem, Driver Bearing, Displacer Rod and Driver	316 Stainless Steel	N10276, N04400, other Austenitic Stainless Steels, and Special Alloys
Torque Tube	N05500 <sup>(1)</sup>	316 Stainless Steel, N06600, N10276

1. N05500 is not recommended for spring applications above 232°C (450°F). Contact your Emerson Process Management sales office or application engineer if temperatures exceeding this limit are required.

Table 4. Supply Pressure Data

OUTPUT SIGNAL	STANDARD SUPPLY AND OUTPUT PRESSURE GAUGE INDICATIONS <sup>(1)</sup>	NORMAL OPERATING SUPPLY PRESSURE <sup>(2)</sup>		AIR CONSUMPTION AT NORMAL OPERATING SUPPLY PRESSURE <sup>(3)</sup>			
		Bar	Psig	Normal m <sup>3</sup> /h <sup>(6)</sup>		Scfh <sup>(6)</sup>	
				Min <sup>(4)</sup>	Max <sup>(5)</sup>	Min <sup>(4)</sup>	Max <sup>(5)</sup>
0.2 to 1.0 bar (3 to 15 psig), except 0 and 1.4 bar (0 and 20 psig) <sup>(2)</sup> for on-off controllers	0 to 30 psig	1.4	20	0.11	0.72	4.2	27
0.4 to 2.0 bar (6 to 30 psig), except 0 and 2.4 bar (0 and 35 psig) <sup>(2)</sup> for on-off controllers	0 to 60 psig	2.4	35	0.19	1.1	7	42

1. Consult your Emerson Process Management sales office about gauges in other units.  
 2. Control and stability may be impaired if this pressure is exceeded (except 2503 or 2503R controller without proportional valve).  
 3. Except 2503 or 2503R controller, which bleeds only when relay is open at exhaust position.  
 4. At zero or maximum proportional band or span setting.  
 5. At setting in middle of proportional band or span range.  
 6. Normal m<sup>3</sup>/hr=normal cubic meters per hour at 0°C and 1.01325 bar. Scfh=standard cubic foot per hour at 60°F and 14.7 psia.

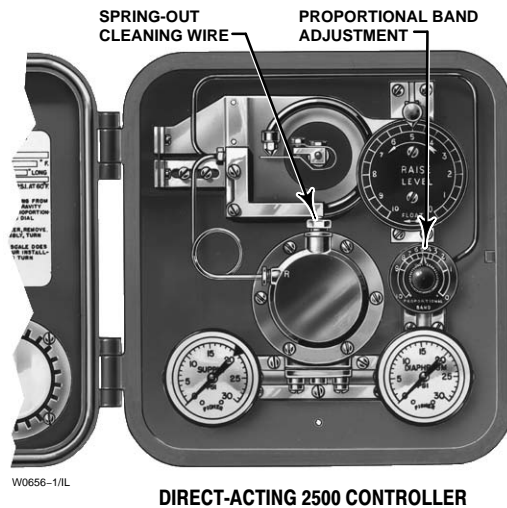
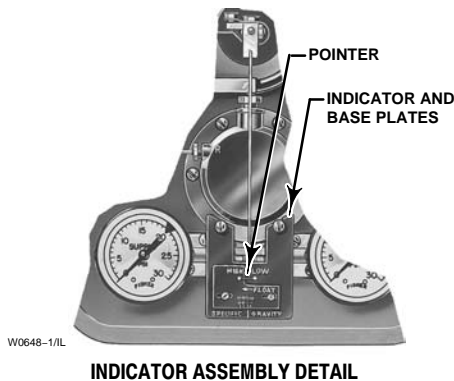
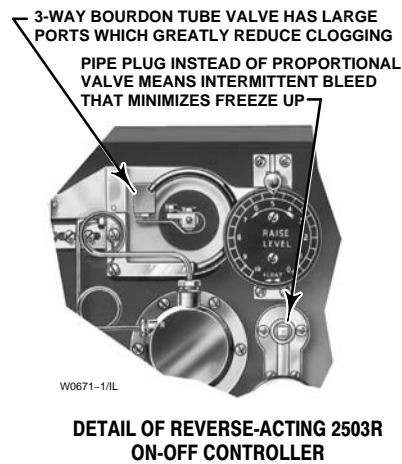


Figure 2. Typical 2500 Series Constructions with Right-Hand Mounting Shown

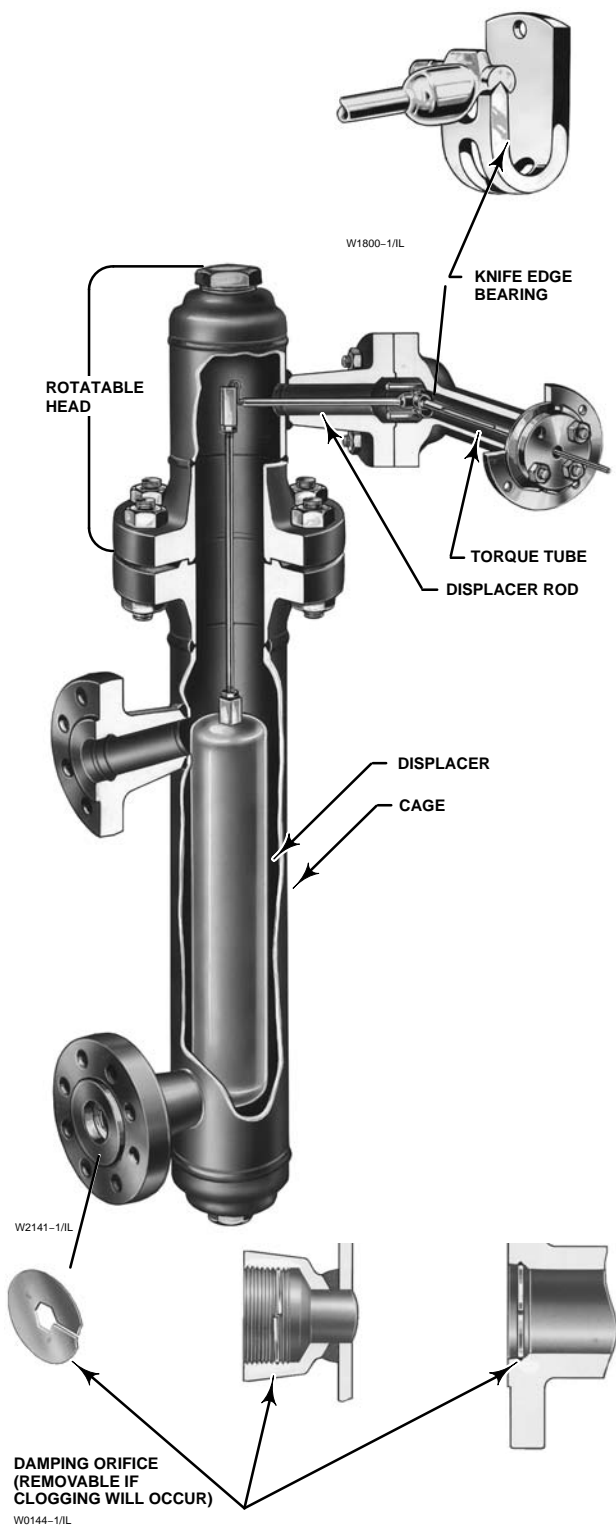
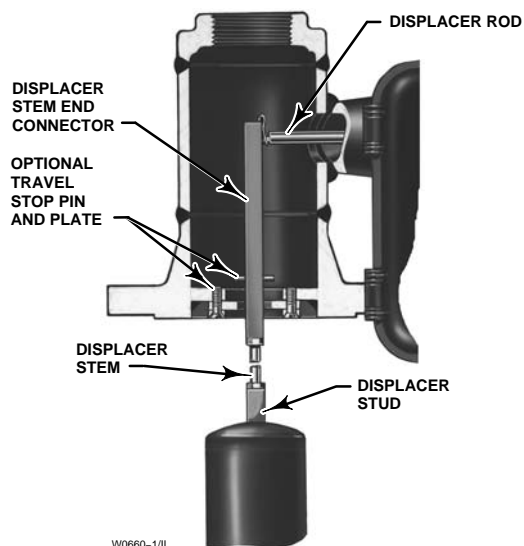
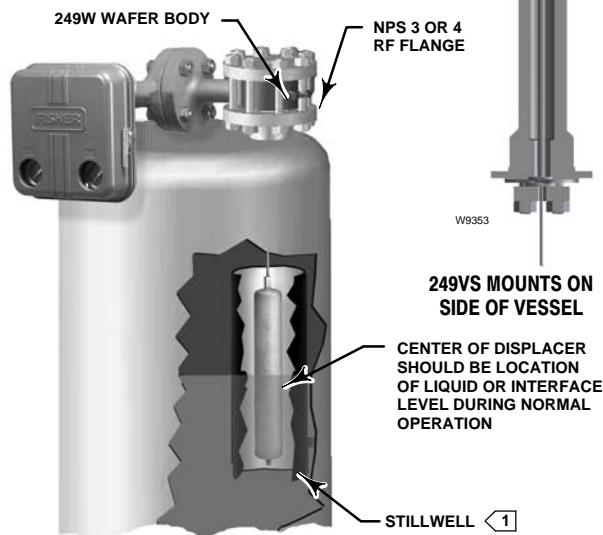
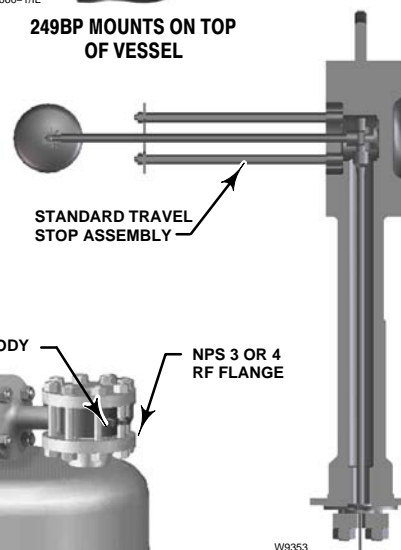


Figure 3. 249B Caged Sensor (Typical of all Rotatable-Head Caged Sensors)



W0660-1/L  
249BP MOUNTS ON TOP OF VESSEL



W8252  
249W MOUNTS ON TOP OF VESSEL AS SHOWN OR CAN MOUNT IN CUSTOMER FABRICATED CAGE

NOTE:  
1 STILLWELL REQUIRED AROUND DISPLACER IF THE FLUID IS IN A STATE OF CONTINUOUS AGITATION

Figure 4. Typical Cageless Sensors

*Table 5. Caged Displacer Sensors<sup>(1)</sup>*

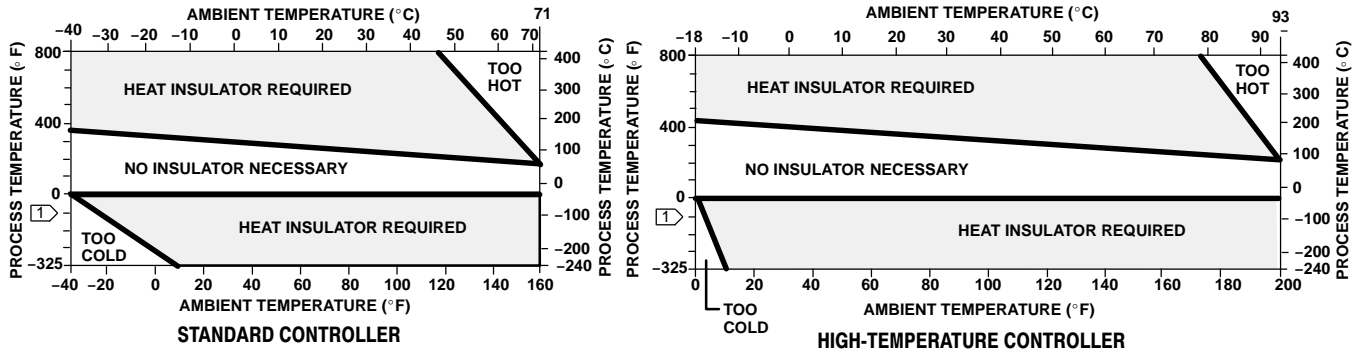
	TYPE NUMBER	EQUALIZING CONNECTION		PRESSURE RATING <sup>(2)</sup>
		Style	Size (NPS)	
Torque tube arm rotatable with respect to equalizing connections	249 <sup>(3)</sup>	Screwed	1-1/2 or 2	CL125 or 250
		Flanged	2	
	249B or 249BF <sup>(4)</sup>	Screwed or optional socket weld	1-1/2 or 2	CL600
		Raised face or optional ring-type joint flanged	1-1/2	CL150, 300, or 600
			2	CL150, 300, or 600
	249C <sup>(2)</sup>	Screwed	1-1/2 or 2	CL600
		Raised face	1-1/2	CL150, 300, or 600
			2	CL150, 300, or 600
	249K	Raised face or optional ring-type joint flanged	1-1/2 or 2	CL1500
	249L	Ring-type joint flanged	2 <sup>(5)</sup>	CL2500

1. Standard displacer lengths for all styles (except 249) are 14, 32, 48, 60, 72, 84, 96, 108, and 120 inches. The 249 uses a displacer with a length of either 14 or 32 inches.  
 2. PN flange connections available in EMA (Europe, Middle East, and Africa).  
 3. Not available in EMA.  
 4. 249BF available in EMA only. Also available in EN size DN 40 with PN 10 to PN 100 flanges and size DN 50 with PN 10 to PN 63 flanges.  
 5. Top connection is NPS 1 ring-type joint flanged for connection styles F1 and F2.

*Table 6. Cageless Displacer Sensors<sup>(1)</sup>*

MOUNTING	TYPE NUMBER	FLANGE CONNECTION (SIZE)	PRESSURE RATING <sup>(2)</sup>
Mounts on top of vessel	249BP <sup>(3)</sup>	NPS 4 raised face or optional ring-type joint	CL150, 300, or 600
		NPS 6 or 8 raised face	CL150 or 300
	249CP	NPS 3 raised face	CL150, 300, or 600
Mounts on top of vessel	249P <sup>(4)</sup>	NPS 4 raised face or optional ring-type joint	CL900 or 1500 (EN PN 10 to DIN PN 250)
		NPS 6 or 8 raised face	CL150, 300, 600, 900, 1500, or 2500
Mounts on side of vessel	249VS	NPS 4 raised face or flat face	CL125, 150, 250, 300, 900, or 1500 (EN PN 10 to DIN PN 160)
		NPS 4 butt weld end, XXS	CL2500
Mounts on top of vessel or on customer supplied cage	249W	NPS 3 or 4 raised face	CL150, 300, or 600

1. Standard displacer lengths are 14, 32, 48, 60, 72, 84, 96, 108, and 120 inches.  
 2. PN flange connections available in EMA (Europe, Middle East, and Africa).  
 3. Not available in EMA.  
 4. 249P with NPS 6 and 8 flanges and PN flanges are available in EMA only.



**NOTE:**  
IF AMBIENT DEWPOINT IS ABOVE PROCESS TEMPERATURE, ICE FORMATION MIGHT CAUSE INSTRUMENT MALFUNCTION AND REDUCE INSULATOR EFFECTIVENESS.

① FOR PROCESS TEMPERATURES BELOW  $-29^{\circ}\text{C}$  ( $-20^{\circ}\text{F}$ ) AND ABOVE  $204^{\circ}\text{C}$  ( $400^{\circ}\text{F}$ )  
SENSOR MATERIALS MUST BE APPROPRIATE FOR THE PROCESS - SEE TABLE 2.

B1413-1A/LL

Figure 5. Guidelines for Use of Optional Heat Insulator Assembly



Table 7. Construction Materials

	PART	TYPE NUMBER	MATERIAL
In contact with process	Cage, head, torque tube arm	249	Cast iron
		249B, 249BF <sup>(1)</sup>	Carbon steel
		249C and 249CP	CF8M (316 stainless steel) standard, CF3M (316L stainless steel), CF8 (304 stainless steel), CF3 (304L stainless steel), LCC (steel), C5 (steel), LC3 (3.5 percent nickel steel), M35-1, CN7M (Alloy 20)
		249K	Steel standard, CF8, CF8M, CF3M, LCC, C5, LC3, WC1 (chrome moly steel), M35-1, CN7M optional
		249L	Steel standard, CF8M, C5, WC1, LCC
		249BP	Carbon Steel
		249P	Carbon Steel
		249VS	LCC, WCC (steel), CF8M
	Wafer body, torque tube arm	249W NPS 3 NPS 4	WCC, CF8M LCC, CF8M
	Torque tube	249, 249B, 249BF <sup>(1)</sup> , 249K, 249L, 249P, 249VS, 249W	N05500 standard
		249C, 249CP, stainless steel 249VS, 249W	S31600 (316 stainless steel) standard
		All	S30403 (304L stainless steel), S31603 (316L stainless steel), N06600, N08020 (Alloy 20) optional
	Displacer	249, 249B, 249BF <sup>(1)</sup> , 249K, 249VS, 249W	S30400 (304 stainless steel) standard
		249C, 249CP, 249W	S31600 (316 stainless steel) standard
		249L	A91100F (solid aluminum) standard
		All	Solid PTFE, N04400 or other special materials
	Standard trim <sup>(2)</sup>	All	S31600
	Bolting	All	Steel grade B7 studs or cap screws and grade 2H nuts (standard), steel grade B7M studs and grade 2M nuts optional on 249B and WCC 249W sensor
	Standard torque tube end gasket	All	316 stainless steel/graphite laminate, except 304 stainless steel/graphite laminate for 249K sensor
	Standard torque tube arm and cage gasket, if used	All	Composition, except soft iron for the 249L sensor
Optional trim and gasketing	All	316 stainless steel trim with 316L stainless steel gasketing or soft iron gasketing; 317 stainless steel or N06600 trim with composition gasketing; 304, 304L or 316L stainless steel, N04400 or N08020 trim and gasketing	
In contact with supply pressure	Bourdon tube or bellows		Brass, plus SST 3-way valve for 2503 or 2503R controller
	Tubing		Stainless steel
	Relay diaphragms		Nitrile (standard) or polyacrylate (high-temperature)
	Relay O-ring		Nitrile
	Gasketing		Chloroprene (standard) or rubber (high-temperature)
	Seal ring O-rings (and reset relief valve O-rings if used)		Nitrile (standard) or fluorocarbon (high-temperature)
Other	Case		Aluminum
	Cover		Aluminum with glass gauge windows and nitrile cover gasket
	Retaining flange		Steel

1. Available only in EMA.

2. Trim parts include displacer rod, driver bearing; displacer stem parts, and stem connection parts.

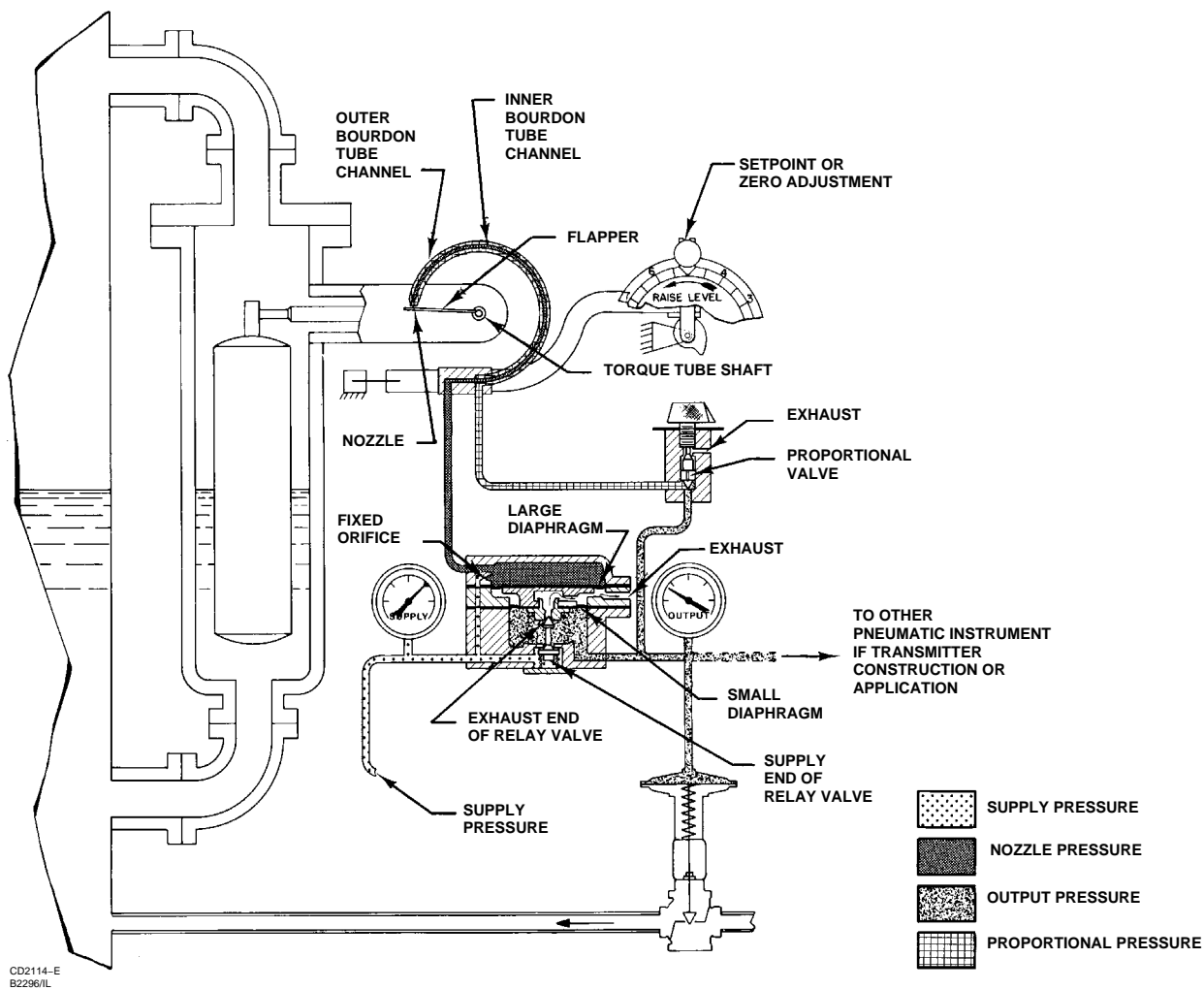


Figure 6. Schematic of Direct-Acting 2500-249 Series Proportional Controller (or Transmitter) Shown with Right-Hand Mounting

## Supply Pressure Overpressure Protection

Applying excessive pressure to any portion of a controller, transmitter or connected equipment may cause leakage, part damage, or personal injury due to bursting of pressure-containing parts. Although the standard 67CFR supply regulator for 2500 Series instruments has internal relief to provide very limited overpressure protection, complete overpressure protection between the supply regulator outlet and the instrument case is needed if a malfunctioning supply regulator can deliver a supply pressure that exceeds 3.4 bar (50 psig).

## Principle of Operation

All 2500 Series controllers and transmitters use the same basic pressure-balanced relay with a yoked double-diaphragm assembly. Supply pressure either passes through the fixed orifice and bleeds out the nozzle (figure 6 or 7) or directly enters the Bourdon tube valve (figure 8). Nozzle pressure registers on the large relay diaphragm, and output pressure on the small relay diaphragm.

The following descriptions show how the various controller and transmitter constructions work in conjunction with displacer action.

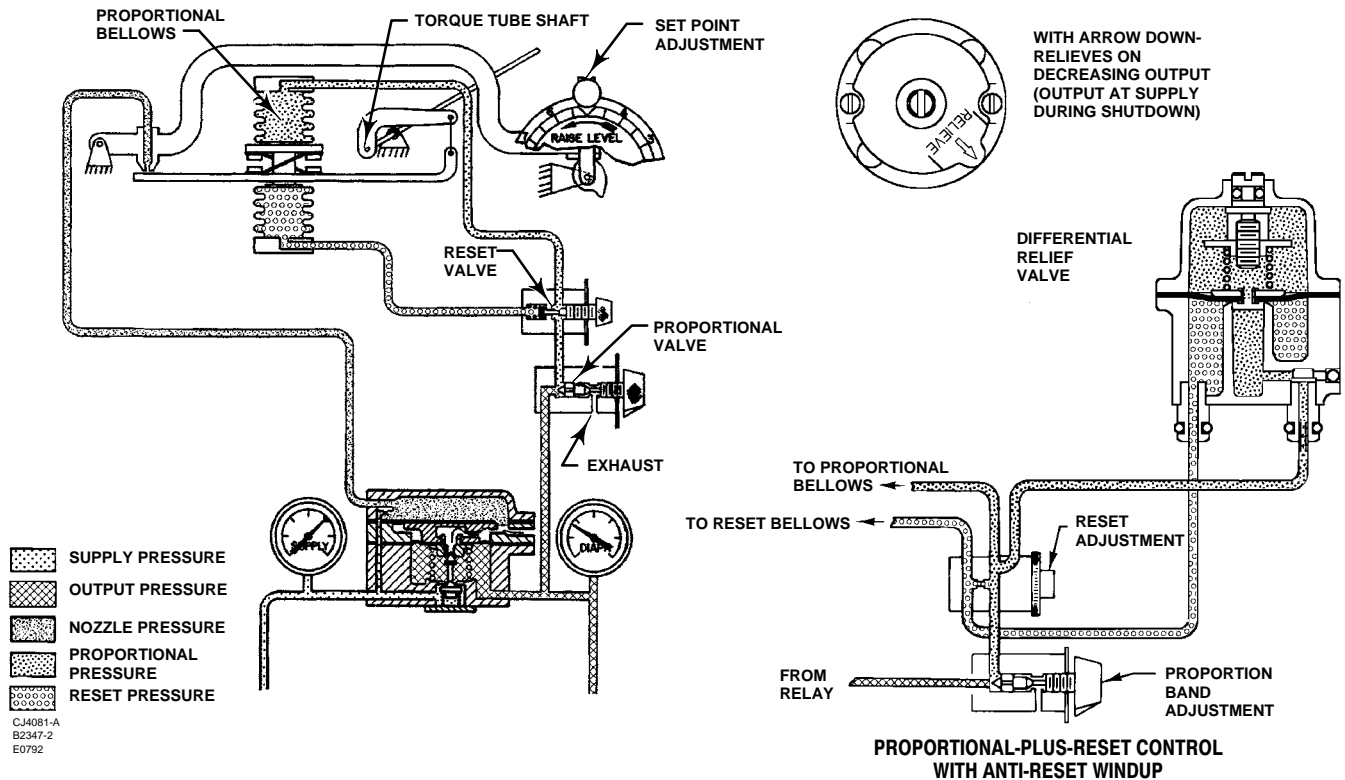


Figure 7. Schematic of Direct-Acting Proportional-Plus-Reset Controller

**Proportional Controller or Transmitter**

As long as the process remains constant, the displacer will hold the torque tube shaft and attached flapper steady in relation to the nozzle. The nozzle-flapper opening will be such as to permit pressure to bleed from the nozzle as fast as it enters through the fixed orifice of the relay, keeping the pressure loading on the large relay diaphragm at the amount necessary to balance the output pressure loading on the small relay diaphragm.

A process variable change (such as a variation in downstream demand that affects liquid outflow and thus the level of the tank shown in figure 6) changes the buoyant force acting on the displacer and moves the flapper with respect to the nozzle. An increasing buoyant force with direct action, or decreasing buoyant force with reverse action, produces a nozzle-flapper restriction that increases nozzle pressure on the large relay diaphragm. This opens the supply end of the relay valve and increases relay output pressure. But a decreasing buoyant force with direct action, or increasing buoyant force with reverse action, produces a nozzle-flapper opening that bleeds off nozzle pressure on the large relay

diaphragm and opens the exhaust end of the relay valve to let output pressure (and thus actuator loading pressure) bleed away. The relay diaphragm pressure differential equalizes and a new output pressure is maintained according to the change in displacer position.

**Proportional-Plus-Reset Controller**

All 2502 Series controllers (figure 7) have a two-way reset restriction valve that channels proportional pressure into a reset bellows to oppose proportional bellows action. This automatically slows the canceling effect of any proportional action by a set amount per time interval, as long as there is a deviation from the control point. Action of this reset pressure occurs on a delayed basis, and the reset valve can be adjusted to vary the time of delay.

If a prolonged difference exists between the set point and the process variable, output pressure with a proportional-plus-reset controller will either drop to zero or rise to the maximum delivered by the supply regulator. This condition is called reset windup.

# 2500-249 Controllers and Transmitters

## Anti-Reset Windup

2502F and 2502FR controllers additionally have anti-reset windup to minimize the delay in returning the controlled variable to the set point. This capability is provided by a reversible differential relief valve with adjustable spring. As shown in figure 7, proportional pressure registers rapidly on the spring side of the relief valve diaphragm as well as in the proportional bellows. Reset pressure registers slowly on the opposite side of the diaphragm. As long as the output pressure changes are slow enough for normal proportional and reset action, the relief valve spring prevents opening of the relief valve diaphragm.

A large or rapid decrease in controller output pressure decreases the pressure in the proportional system, and on the spring side of the relief diaphragm. If the decrease on the spring side of the diaphragm is greater than the relief valve spring setting, the diaphragm moves off the relief valve orifice and permits reset pressure on the opposite side of the relief valve diaphragm to bleed rapidly into the proportional system. The differential relief valve can also be reversed to relieve with an increasing output pressure.

## On-Off Controller With Proportional Valve

This construction has the same flapper, relay, and proportional valve responses to a level or density change as does a proportional 2500 Series controller. However, the Bourdon tube is constructed (figure 2) so that output pressure change feedback moves the nozzle in the opposite direction from the way the flapper is moving. This reinforcement completely opens the relay valve either to full supply pressure or to full exhaust of output pressure, allowing no in-between throttling.

## On-Off Controller Without Proportional Valve

As long as vessel level or density remains above the lower snapping point on a direct-acting controller (or below the upper snapping point on a reverse-acting controller), the flapper remains far enough away to keep the exhaust port of the Bourdon tube valve closed and prevent any pressure escape from the Bourdon tube. The relay valve remains closed at the exhaust end and open at the supply end, allowing full output pressure into the control valve actuator.

When level or density sufficiently decreases with direct action or increases with reverse action, the

flapper pushes the Bourdon tube valve in enough to seal the inner Bourdon tube channel (figure 8). This opens the exhaust port of the valve and permits exhaust of pressure from the actuator, initiating the appropriate control action. This control action continues until the level or density change again moves the flapper away enough to permit closing of the Bourdon tube valve exhaust port and the full application of output pressure to the actuator.

## Options

- **Stainless Steel Heat Insulator**

**Assembly**—Refer to figure 9. Available for mounting between the torque tube arm of any 249 Series sensor and the instrument. Recommended for applications where combination of process and environmental temperatures would result in controller temperatures in excess of safe limits (figure 5).

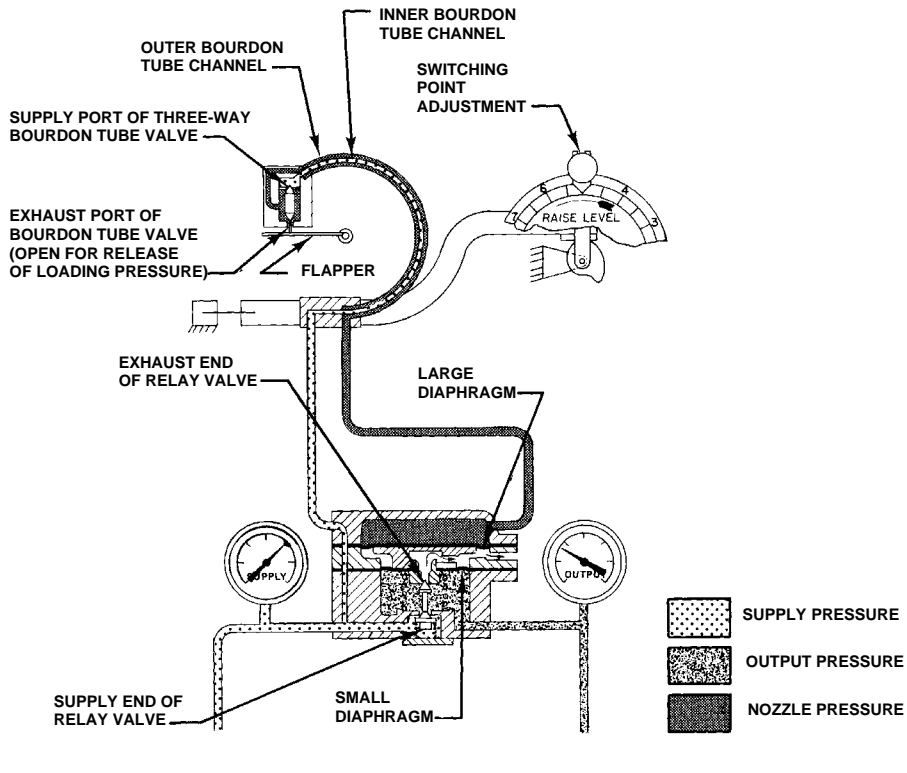
- **Jerguson® Gages**—Permit direct observation of process level and other relevant characteristics. These gages are described in the Jerguson Gages supplement. The 249 sensor cage comes standard with suitable bosses that can be tapped for gage installation. All other sensors require the gages to be installed at the factory. When specified, the bosses will be tapped 1/2 NPT on the CL125 249 sensor, and 3/4 NPT on the CL250 249.

## Installation

Although it can be shipped alone for separate installation, a 249 Series sensor usually is shipped with a controller or transmitter installed. During shipment, displacers are detached from cageless sensors and optional tubular gauge glasses are detached from caged sensors.

Equalizing piping, stillwells, or other equipment may be required for installation. Emerson Process Management does not provide this equipment.

Complete dimensions and case connection information for all 2500-249 Series constructions appears in the separate Level-Trol Dimensions bulletin supplement.



B04466-E  
A2546-1/L

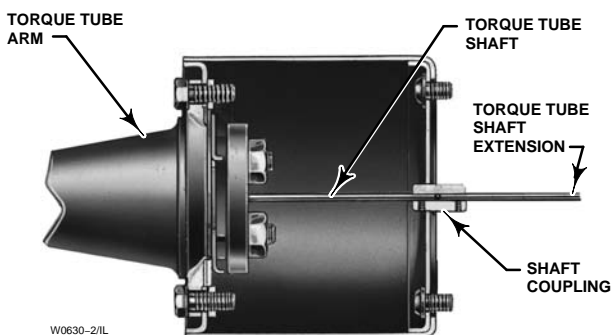
Figure 8. Schematic of Reverse-Acting 2503R Controller

## Ordering Information

### Application

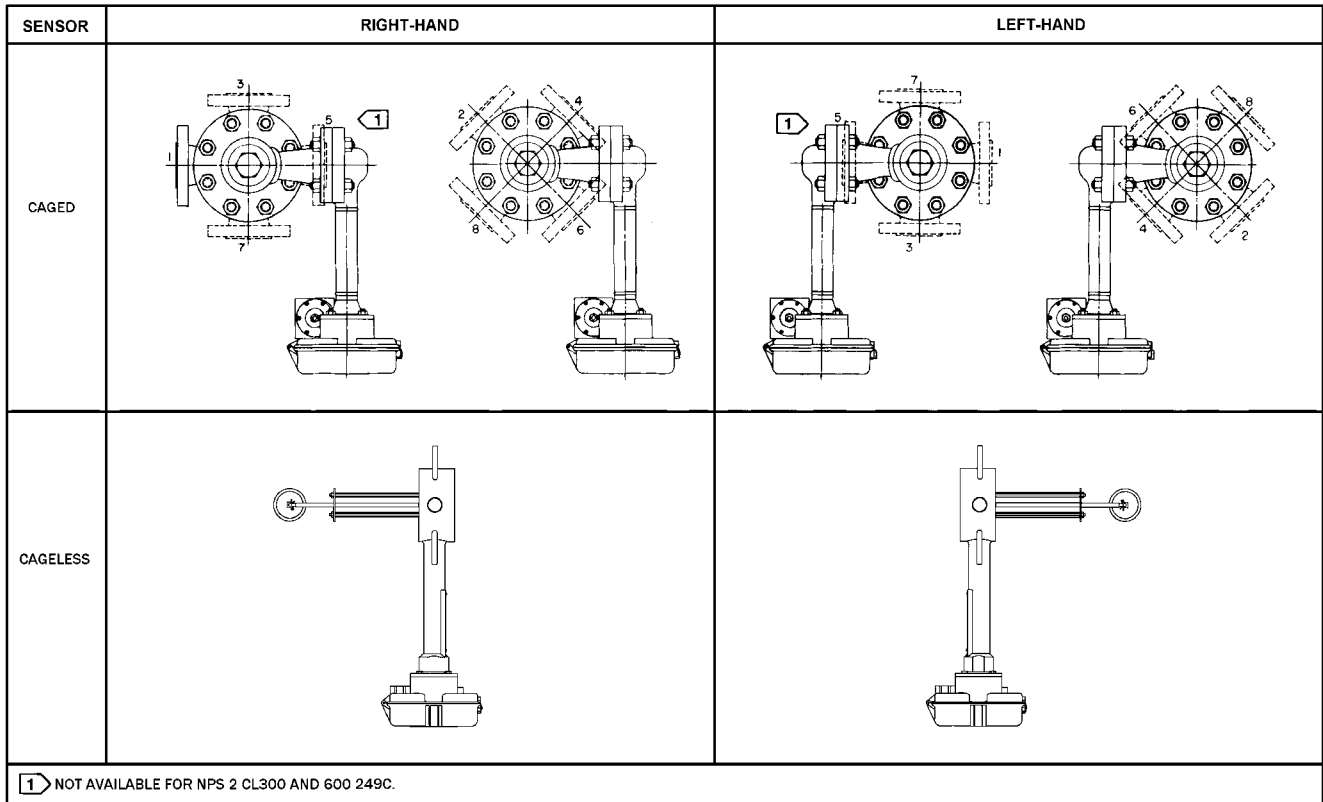
When ordering, specify:

- Control (proportional, proportional-plus-reset, or on-off), or transmission mode
- Liquid level service (give type, pressure, temperature and specific gravity)
- Interface level service (give specific gravity of both liquids and minimum proportional band, differential gap, or span required)
- Density service (give minimum and maximum specific gravity required)



W0630-2/L

Figure 9. Optional Heat Insulator Assembly



E1051

Figure 10. Torque Tube Arm Mounting Positions

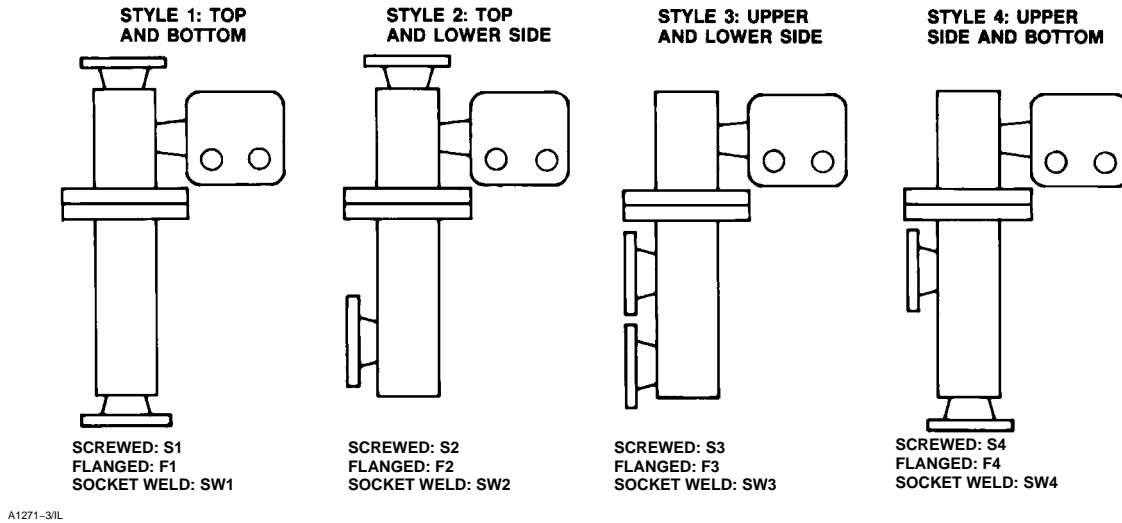


Figure 11. Cage Connection Styles

## Construction

Refer to the specifications and the Options section. Review the descriptions for each specification, under each option, and in the referenced tables and figures; specify the desired selection whenever there is a choice to be made. Right-hand mounting (with position 1 if appropriate) will be supplied automatically unless some other mounting method is specified. Unless another length is specified, 305 millimeters (12 inches) will be used as the standard cageless sensor length from flange face—or displacer rod—to displacer top.

Always specify the complete type number (including the R suffix for reverse action) of the controller or transmitter, sensor, supply pressure regulator, and other desired equipment. On differential relief

controllers, specify whether relief is to occur with excessive proportional or with excessive reset pressure.

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