Product Data Sheet
PDS 71-200series/rev.E
March 2005

Toroidal Conductivity Sensors

- NON-CONTACTING (TOROIDAL) SENSORS resist corrosion and fouling.
- SENSORS ARE IDEAL for measuring concentrations of acid, base, and salt solutions.
- A VARIETY OF MOUNTING CONFIGURATIONS ARE AVAILABLE: submersion, immersion, and flow-through.
- SENSORS ARE COMPATIBLE with most Rosemount Analytical toroidal conductivity analyzers.
- MODEL 225 SENSOR AVAILABLE in unfilled PEEK and USP Class VI unfilled PEEK. Sensor meets 3A sanitary standards.

FEATURES AND APPLICATIONS

Use Rosemount Analytical Toroidal Conductivity Sensors in liquids where sensors with metal electrodes would corrode or become fouled.

The Model 225, 226, and 228 toroidal (inductive) conductivity sensors consist of a pair of wire-wound metal toroids overmolded with corrosion-resistant PEEK or Tefzel. One coil is the transmitter, and the other coil is the receiver. When the sensor is immersed in a conductive liquid and the transmitter coil is energized, the coil induces a current in the solution. The solution current induces another current in the receiver coil, which the analyzer measures. The current in the receiver coil is directly proportional to the conductivity of the solution.

The Model 222 sensor has a slightly different configuration. It has elements of both an inductive and contacting sensor. The drive and receive coils enclose a Teflon-lined pipe through with the liquid flows. Because the toroids are not immersed in the liquid, external wiring is required to complete the circuit. The external circuit consists of two metal rings connected with a shorting strap. The metal rings are on either side of the toroids and contact the process liquid. The shorting strap passes outside the toroids. In the case of the 222 sensor, the contact rings are the metal flanges used to bolt the sensor into the process line.

Toroidal sensors are ideal for highly conductive liquids, up to 2 S/cm (2,000,000 uS/cm). The minimum conductivity depends on the size of the toroids and the number of windings in each toroid. Generally, the minimum conductivity is between 50 and 500 uS/cm. The measurement is not sensitive to flow rate or direction of flow. The hole through the toroids must remain open.

Model 200 sensors are compatible with most Rosemount Analytical instruments. All sensors have an integral RTD to allow temperature-compensated conductivity measurements.

A mechanical or manual valve insertion assembly is available for use with the Model 228. Refer to Product Data Sheet 71-228 Valve Insertion Assemblies.

[1] Tefzel is a registered trademark of E.I. du Pont de Nemours and Co.

200 SERIES TOROIDAL CONDUCTIVITY SENSORS

MODEL 222 FLOW THROUGH SENSOR

The Model 222 sensor is constructed of Teflon lined carbon steel pipe and is available in one-inch and two-inch pipe sizes with a choice of 150 pound or 300 pound ANSI flanges. The sensor includes a separate temperature element suitable for mounting in a thermowell.

The Model 222 is ideal for high pressure, high temperature, fibrous, and corrosive liquids.

MODEL 226 SUBMERSION/INSERTION SENSOR

The Model 226 is a large bore sensor molded in PEEK (polyetheretherketone). The sensor has a rugged design similar to the Model 228. The Model 226 sensor performs better than the 228 sensor in applications containing high levels of suspended solids — solids tend to plug the smaller opening in the 228 sensor. The large toroids used in the 226 sensor also allow it to measure lower conductivities.

MODEL 228 SUBMERSION/INSERTION SENSOR

The Model 228 is available in glass-filled polyetheretherketone (PEEK) and Tefzel. PEEK provides excellent corrosion resistance. PEEK 228 sensors are available in standard temperature (120°C) and high temperature (200°C) versions. The Tefzel 228 is ideal for use in highly concentrated oxidizing acids (H_2SO_4, HNO_3) and hydrofluoric acid (HF). Note: PEEK and EPDM are not suitable for these acids.

The Model 228 has rigid construction thatl stands up to high vibration applications such as drilling mud shaker trays. A single piece 304 SS tube supports the toroid coils and reinforces the threaded mounting shaft. This subassembly is then over-molded in chemically resistant plastic. There are no seams or welds to crack and cause leakage and subsequent failure.

MODEL 225 CLEAN-IN-PLACE (CIP) CONDUCTIVITY SENSOR

The Model 225 CIP Sensor is designed for the pharmaceutical and food & beverage industries. The sensor is available with a two-inch Tri-Clamp® fitting.

The Model 225 sensor is available in glass-filled PEEK, unfilled PEEK, and USP Class VI unfilled PEEK. The unfilled PEEK sensors with Tri-Clamp fittings conform to 3-A sanitary standards for sensor, sensor fittings, and connections used on milk and milk products equipment.

Tri-Clamp is a registered trademark of Alfa-Laval Inc.

TOROIDAL CONDUCTIVITY APPLICATIONS BY INDUSTRY

CHEMICALS	Sulfuric acid and oleum
	Chlorine-alkali plants
	Sodium chloride, sodium hydroxide
	Hydrochloric acid
	Superphosphate
	Phosphoric acid
	Nitric acid
	Glycerine
	Fertilizer
	Detergents
	Waste water
	Moisture detection in HF
	Scrubbers
STEAM GENERATION	Boiler blowdown
	Flue gas scrubbers
FOODS	Brines - concentration
	Sugar: First carbonation
	Clean-in-place (CIP) applications
	Saturation control
	Cooker control
	Desalting of food products
	Cheese souring
	Evaporation control - dried milk, etc.
	Glucose
	Lye peeling of fruits and vegetables
	Rinsing water
	Waste water
	Pickle making
HYDROCARBON PROCESSING	Mud logging
	Interface monitoring and control
	Leak detection
	HF alkylation
	Scrubbers
METAL AND MINING	Caustic/Alumina ratio control
	Continuous steel pickling
	Plating solution monitoring/control
	Alkaline/caustic metal cleaning process
	Copper flotation
	Heavy metal recovery
STREAMS AND LAKE WATER	Water pollution
	Salt intrusion
SEA WATER	Salinity
TEXTILES	Water quality surveys
	Scouring baths
	Rinsing water
	Carbonizing baths
	Mercerizing baths
	Boiler water systems
	Acid washing
PULP AND PAPER	White liquor
	Cooking liquor
	Black liquor
	Green liquor
	Weak wash liquor
	Brown stock washing
	Steam generation
	Heat exchangers
	Waste water
	Cl_2 / ClO_2 scrubbers
WATER TREATMENT	Ion exchange regenerants
	Reverse osmosis
	Scrubbing towers (HCl gas in water)
	Softener regeneration

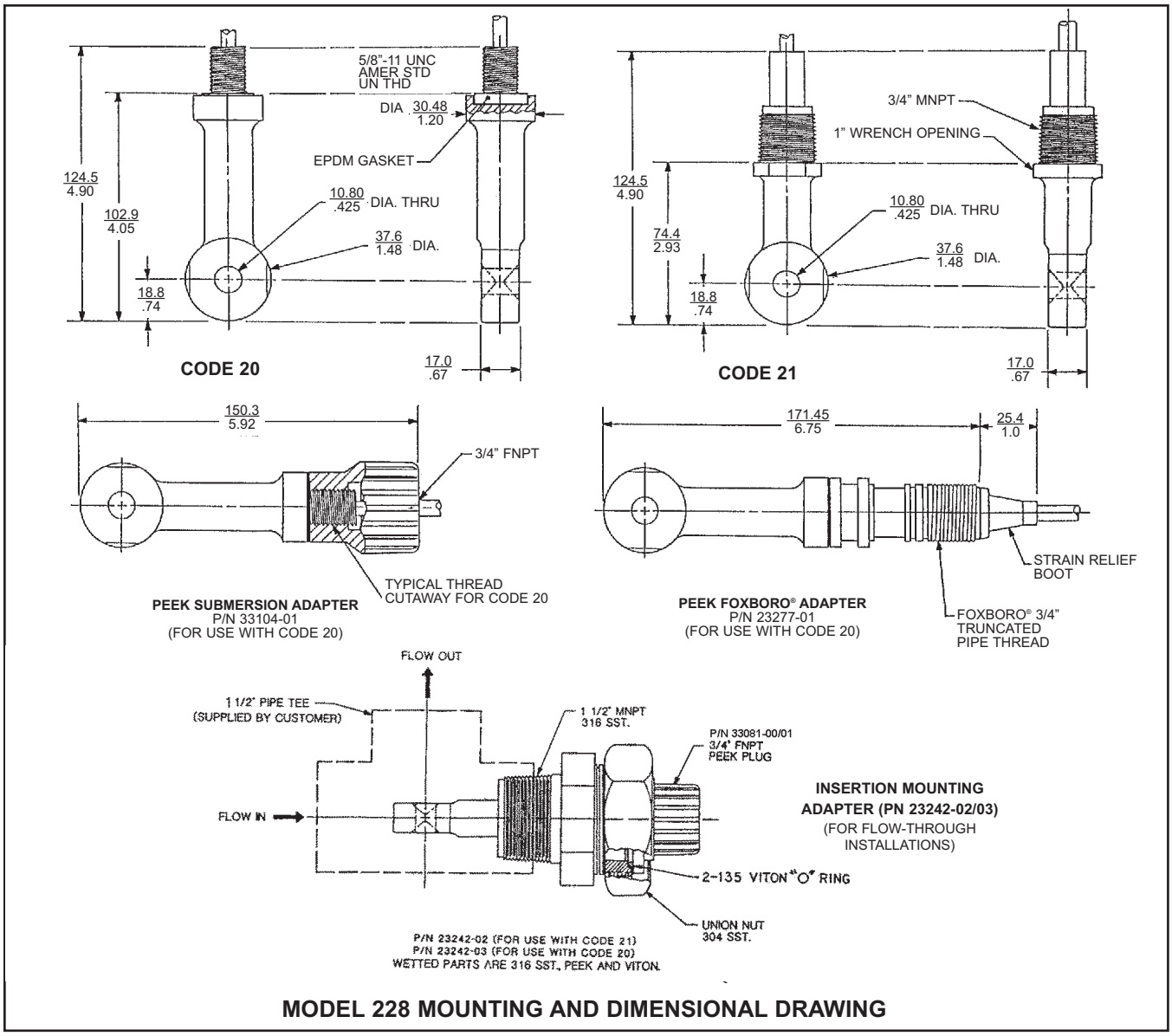
SENSOR SELECTION GUIDE

SPECIFICATIONS	 MODEL 222	 MODEL 225	 MODEL 226	 MODEL 228
Minimum Conductivity	500 µS/cm	200 µS/cm	50 µS/cm	200 µS/cm
Maximum Conductivity	2 S/cm	2 S/cm	1 S/cm	2 S/cm
Type of Installation	Flow Through	Insertion	Submersion/Insertion	Insertion/Submersion
Materials of Construction	Teflon and Carbon Steel	PEEK (Glass-filled, unfilled, or USP Class VI unfilled polyetheretherketone)	PEEK (Glass-filled polyetheretherketone)	PEEK (Polyetheretherketone) Tefzel, both glass-filled Option 20: EPDM
Maximum Temperature	182°C (360°F)	Filled PEEK: 120°C (248°F) Unfilled PEEK: 130°C (266°F)	PEEK: 120°C (248°F)	PEEK: 120°C (248°F) PEEK: 200°C (392°F) Tefzel: 120°C (248°F)
Maximum Pressure	150# Flanges: 125 psig (963 kPa abs) 300# Flanges: 250 psig (1825 kPa abs)	200 psig (1480 kPa [abs])	295 psig (2135 kPa abs)	PEEK: 295 psig (2135 kPa abs) Tefzel: 200 psig (1480 kPa abs)
Integral Cable	20 feet (6.1 meters)	20 feet (6.1 meters)	20 feet (6.1 meters)	20 feet (6.1 meters)
Maximum Cable Length with Model 1181T**	100 feet (30.5 meters)	100 feet (30.5 meters)	100 feet (30.5 meters)	100 feet (30.5 meters)
Maximum Cable Length with Models 54e C/2081C/ 1054A/1054B/2054 Series**	100 feet (30.5 meters)	200 feet (61.0 meters)	200 feet (61.0 meters)	200 feet (61.0 meters)
Process Connections	1 inch 150# or 300# ANSI flange 2 inch 150# or 300# ANSI flange	2 inch Tri-Clamp®	1 inch MNPT 7/8 inch-9 UNC for flange mounting	3/4 inch MNPT 5/8 inch-11 UNC
Weight/ Shipping Weight***	1.0 inch, 150# 11 lb/14 lb (5.0 kg/6.5 kg) 1.0 inch, 300# 17 lb/20 lb (8.0 kg/6.5 kg) 2.0 inch, 150# 33 lb/37 lb (15.0 kg/17.0 kg) 2.0 inch, 300# 34 lb/39 lb (15.5 kg/18 kg)	2 lb/3 lb (1.0 kg/1.5 kg)	2 lb/3 lb (1.0 kg/1.5 kg)	Sensor: 2 lb/3 lb (1.0 kg/1.5 kg) PN 23311-00 12 lb/15 lb (5.5 kg/7.0 kg) PN 23311-01 9 lb/12 lb (4.5 kg/5.5 kg)

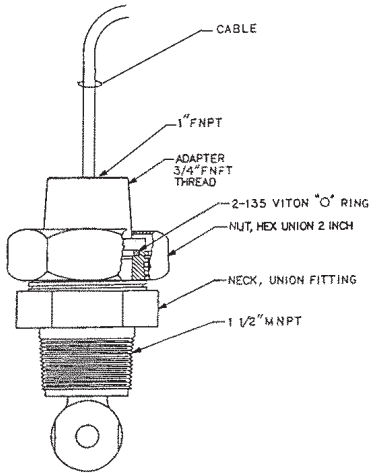
* The minimum range accuracies listed above are based upon spanning or standardizing the loop near the conductivity and temperature of the process being measured with the full length of any interconnecting cable.

** Consult Table 1 for extension cable part number.

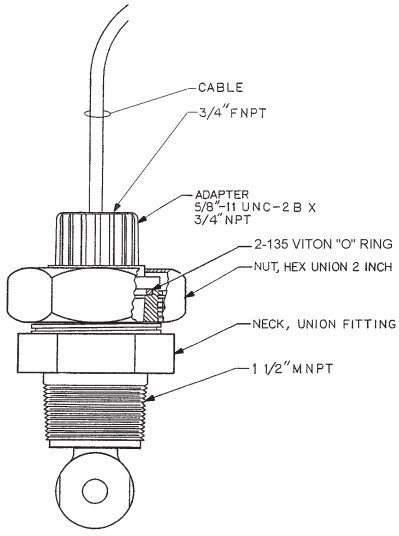
*** Weights and shipping weights are rounded to the nearest 1 lb or 0.5 kg.



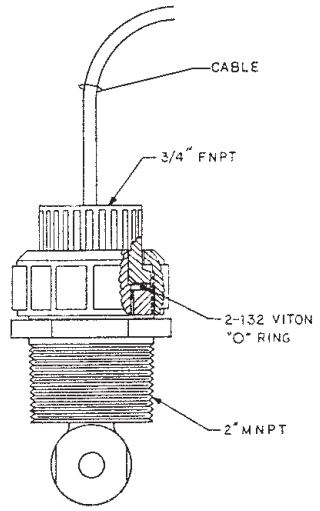
MODEL 228 MOUNTING AND DIMENSIONAL DRAWING



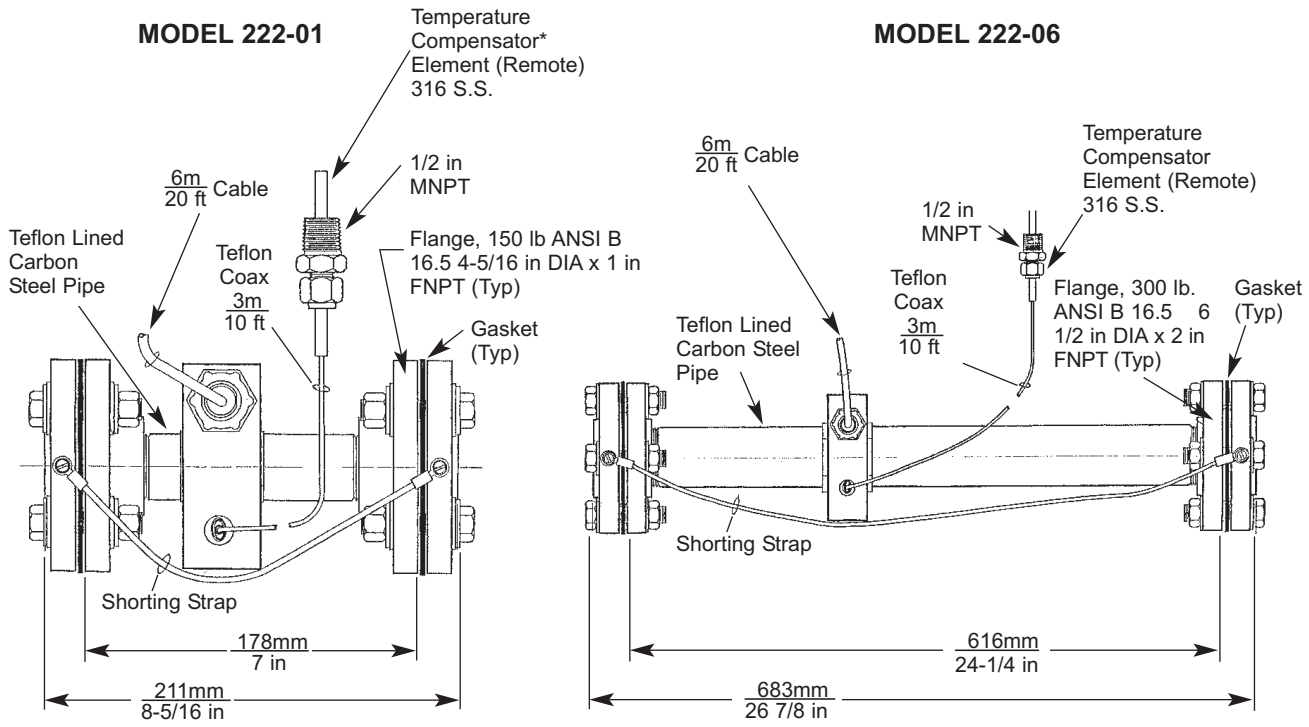
Adapter PN 23242-02
use with 228-21 (3/4 in. MNPT)



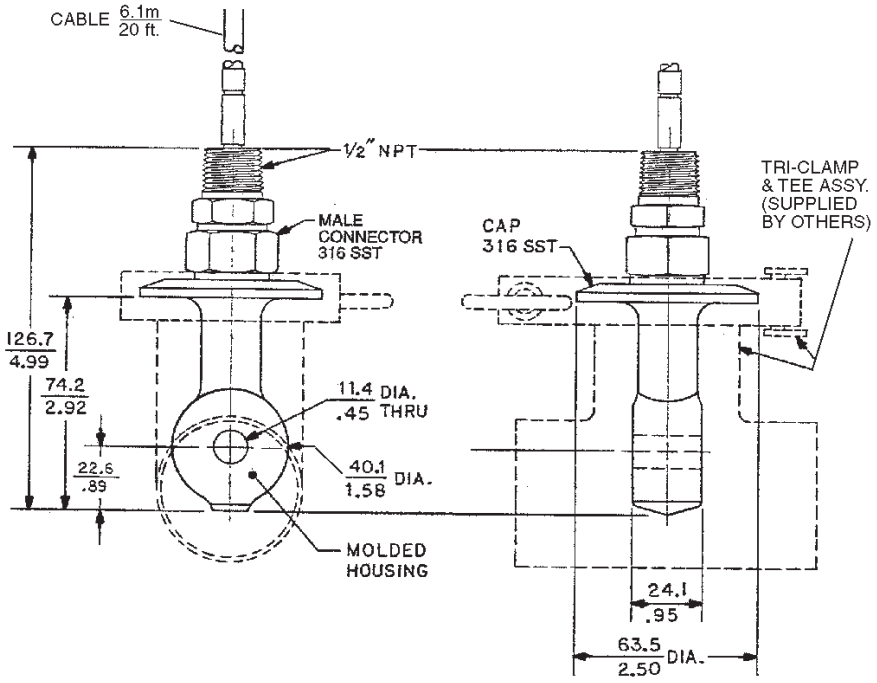
Adapter PN 23242-03
use with 228-20 (5/8-11 UNC threads)



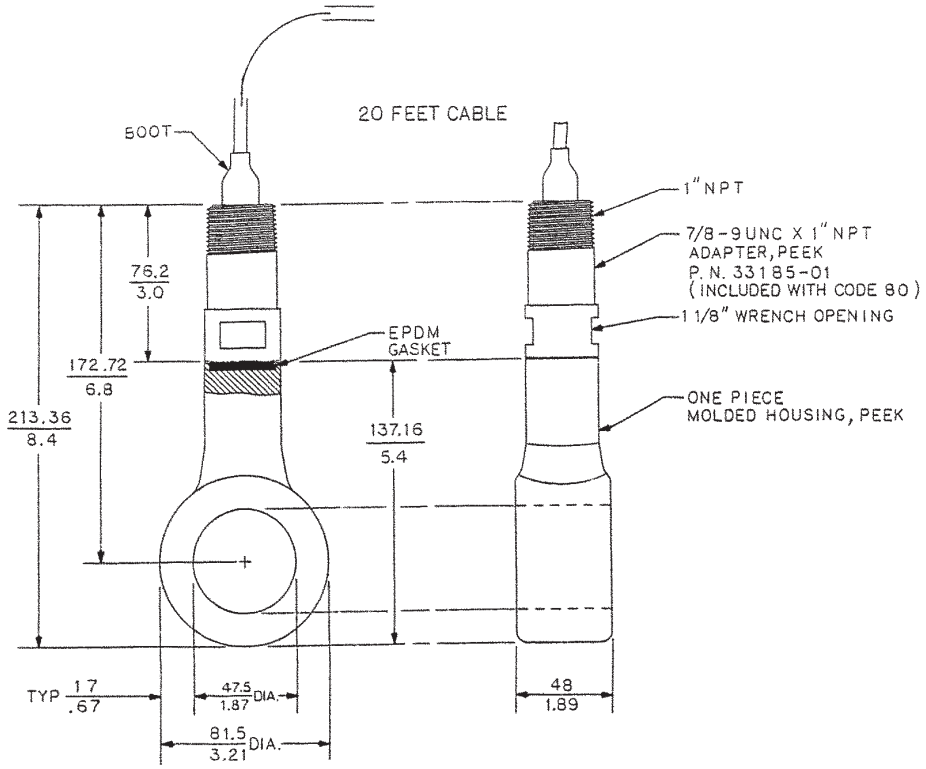
Adapter PN 2001990
use with 228-21 (3/4 in. MNPT)



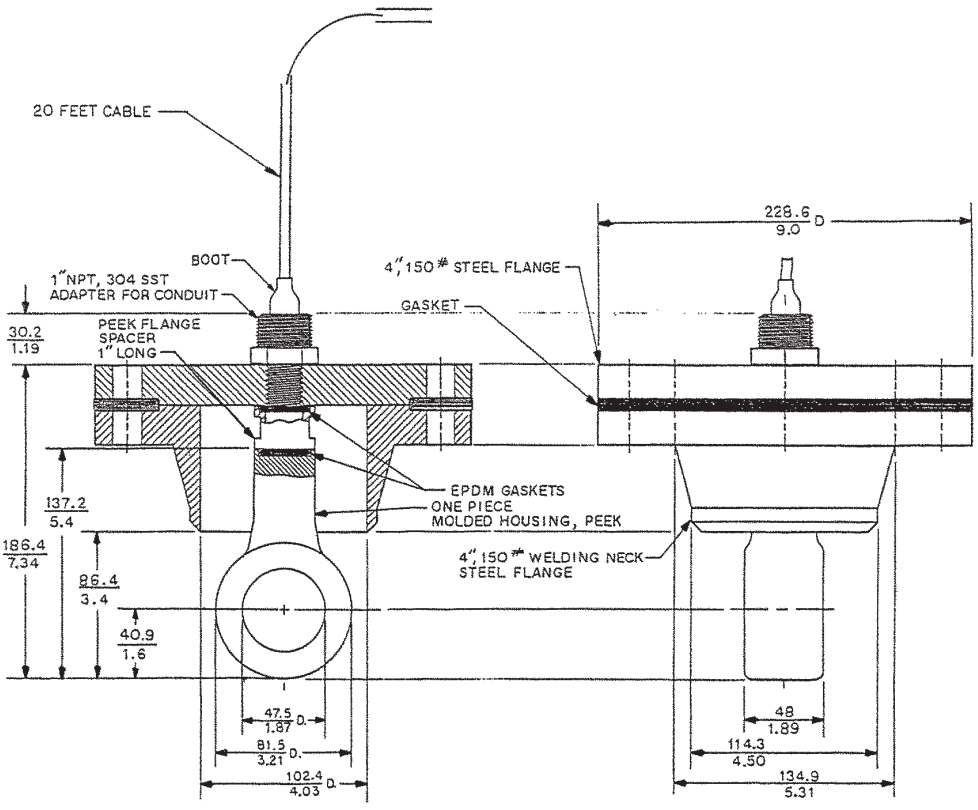
222 MOUNTING & DIMENSIONAL DRAWING



225 MOUNTING & DIMENSIONAL DRAWING (CODE -03)



CODE 80



CODE 81

226 MOUNTING & DIMENSIONAL DRAWING

MODEL 222 TOROIDAL CONDUCTIVITY SENSOR

Model 222 Flow Through Sensor includes Teflon lined pipe, toroid housing, temperature compensation element, mating carbon steel flanges, and 20 ft (6.1 m) of cable. The sensor can be used with the 1054A, 1054B, 2054, 1055, 54C, 54eC, 81T, 2081T, 3081, 4081T, 5081-T, and Xmt-T. See Notes 2 and 3 below. For accessories, see Table 2.

MODEL 222	FLOW-THROUGH TOROIDAL CONDUCTIVITY SENSOR
CODE	**SIZES (Must select one)**
01	1 inch, 150 lb flange
02	2 inch, 150 lb flange (not available with code -21)
05	1 inch, 300 lb flange (not available with code -21)
06	2 inch, 300 lb flange (not available with code -21)
01-21	1 inch, 150 lb flange, 316 SS outer flange

CODE	CABLE (Required selection)
54	For use with all analyzers listed above (Note 1)

222	-01	-54	EXAMPLE

NOTE:

1. *Cables can be extended with the use of remote junction box PN 23550-00 (see Table 1 for interconnect cable).*
2. *A ceramic lined sensor is also available as SQ# 5975 for processes where Teflon is not adequate, such as alumina-caustic ratio control.*
3. *Grounding rings are required for proper operation if the outer flanges of the Model 222 are substituted by customer with Teflon or other non-metallic material. Available as SQ 7430.*

MODEL 225 TOROIDAL CONDUCTIVITY SENSOR

Model 225 Clean-In-Place Toroidal Conductivity Sensor: Molded in glass-filled PEEK or unfilled PEEK. Unfilled PEEK sensors with Tri-Clamp fittings meet 3A sanitary standards. The sensor includes an integral temperature sensor (RTD) and 20 feet (6.1 m) of cable. See Table 2 for accessories. The sensor is compatible with the 1181T, 1054A, 1054B, 2054, 2081T, 1055, 54C, 54eC, 3081T, 4081T, 5081-T, and Xmt-T. For improved EMI/RFI shielding, choose cable option -56 (not for use with the 1181T, 1054A, 1054B, and 2054).

MODEL 225	CLEAN-IN-PLACE TOROIDAL CONDUCTIVITY SENSOR
CODE	**BODY MATERIAL AND MOUNTING STYLE (Required Selection)**
03	Glass-filled PEEK with Tri-Clamp®
07	Unfilled PEEK with Tri-Clamp
08	USP Class VI unfilled PEEK with Tri-Clamp

CODE	CABLE (Required Selection)
50	For use with the Model 1181T (3K RTD) (Note 1)
54	For use with all models listed above except 1181T (Note 1)
56	For use with all analyzers listed above except 1181T, 1054A, 1054B, and 2054 (Notes 1 and 2)

225	-03	-54	EXAMPLE

NOTE:

1. Cables can be extended with the use of remote junction box PN 23550-00 (see Table 1 for interconnect cable).

2. Model option -56 provides additional shielding. This cable is recommended for use with Models 1055, 54eC, 3081T, 4081T, 5081-T, and Xmt-T.

MODEL 226 TOROIDAL CONDUCTIVITY SENSOR

The Model 226 Large Bore Submersion/Insertion Sensor is molded of chemically-resistant glass-filled PEEK (polyetheretherketone). The sensor includes an integral RTD for temperature compensation and 20 feet of integral cable. See Tables 2 and 3 for accessories. The sensor is compatible with the 1181T, 1054A, 1054B, 2054, 2081T, 1055, 54C, 54eC, 3081T, 4081T, 5081-T, and Xmt-T. For improved EMI/RFI shielding, choose cable option -56 (not for use with the 1181T, 1054A, 1054B, and 2054).

MODEL 226	LARGE BORE TOROIDAL CONDUCTIVITY SENSOR
CODE	**SENSOR CONSTRUCTION (REQUIRED SELECTION)**
02	PEEK, standard temperature to 120°C (248°F) (Note 1)

CODE	CABLE (Required Selection)
50	For use with 1181T (Note 2)
54	For use with all analyzers listed above except 1181T (Note 2)
56	For use with all analyzers listed above except 1181T, 1054A, 1054B, and 2054 (Notes 2 and 3)

CODE	MOUNTING KIT OPTIONS (Required Selection)
80	Submersion (includes 1 inch MNPT PEEK adapter)
81	Insertion through user-supplied flange (includes spacer and nut)
82	No kit required (replacement sensor only)

226	-02	-50	-80	EXAMPLE

NOTES:

1. The sensor is supplied with an EPDM gasket. A Viton gasket is available as PN 33151-01.

2. Cables can be extended with the use of remote junction box PN 23550-00 (see Table 1 for interconnect cable).

3. Model option -56 provides additional shielding. This cable is recommended for use with Models 1055, 54eC, 3081T, 4081T, 5081-T, and Xmt-T.

MODEL 228 TOROIDAL CONDUCTIVITY SENSOR

Model 228 Insertion/Submersion Toroidal Sensor is molded of chemically-resistant glass-filled PEEK (polyetheretherketone) or glass-filled Tefzel. Includes an integral RTD for temperature compensation, and 20 ft of integral cable. Sensor is compatible with the 1181T, 1054A, 1054B, 2054, 2081T, 1055, 54C, 54eC, 3081T, 4081T, 5081-T, and Xmt-T. Refer to product data sheet 71-228 for information on the valve insertion assemblies. See Tables 2 and 4 for accessories. For improved EMI/RFI shielding, choose cable option -56-61 (not for use with the 1181T, 1054A, 1054B, and 2054).

MODEL 228	INSERTION/SUBMERSION TOROIDAL SENSOR
CODE	**MATERIALS OF CONSTRUCTION (Required Selection)**
02	PEEK, standard temperature to 120°C (248°F)
03	PEEK, high temperature to 200°C (392°F)
04	Tefzel, standard temperature to 120°C (248°F) (not available with codes 50-62 or 54-62)

CODE	PROCESS CONNECTION TYPE (Required Selection)
20	5/8 in.-11 UNC thread, requires mounting adapter (Note 1)
21	3/4 in. MNPT threads (not available with Code -62)

CODE	CABLE (Required Selection)
50-61	For connection to Model 1181T (Note 2)
54-61	For connection to all models listed above except 1181T (Note 2)
56-61	For connection to all models listed above except 1181T, 1054A, 1054B, and 2054 (Notes 2 and 3)
54-62	10-inch cable for connection to junction box used in valve insertion assembly. Requires extension cable (Note 2). See PDS 71-228 for valve insertion assemblies.

228	-02	-20	-54-61	EXAMPLE

Note:

1. *EPDM gasket is standard (Code 20); however, it is not suitable for use in HF or H2SO4 and HNO3 (at high concentrations). Kalrez (PN 33075-03) is recommended for these processes. A Viton gasket, PN 33075-00, is also available.*
2. *Cables can be extended with the use of remote junction box PN 23550-00 (see Table 1 for interconnect cable).*
3. *Model option -56 provides additional shielding. This cable is recommended for use with Models 1055, 54eC, 3081T, 4081T, 5081-T, and Xmt-T.*

TABLE 1. Extension Cable Chart

Use extension cable to connect the sensor to the analyzer through a remote junction. Extension cable is also required when using the 228 sensor-mounted junction box (Model 228-[ ]-20-54-62).

PN	For use with the following instruments
23294-00	1054A, 1054B, 2054, 1055, 54C, 54eC, 81T, 3081T, 4081T, 5081-T, and Xmt-T
23294-01	1181T only
23294-04	1055, 54C, 54eC, 81T, 3081T, 4081T, 5081-T, and Xmt-T
23294-05	54C, 54eC, 81T, 3081T, 4081T, 5081-T, and Xmt-T

Interconnecting cables 23294-04 and 23204-05 have additional shielding. Cable 23294-05 is recommended for sensor 228-04.

TABLE 2. Accessories for all models

PN	Description
2001492	Stainless steel tag, specify marking
23293-00	Remote junction box for use with 1181T, 1054A, 1054B, and 2054
23550-00	Remote junction box for use with 1055, 54C, 54eC, 81T, 3081T, 4081T, 5081-T, and Xmt-T

TABLE 3. Accessories for Model 226 sensors

PN	Description
33185-01	Mounting adapter, submersion, 3 in length, 1-in MNPT, PEEK (spare only for 226-80)
33185-02	Mounting adapter, insertion, 1 in length, PEEK, includes gasket (spare only for 226-81)
33219-00	Mounting adapter, 304 SS flange nut, 1 in NMPT for conduit (spare only for 226-81)

TABLE 4. Accessories for Model 228 sensors

PN	Description
2001990	Mounting adapter, 2 in MNPT, PVC and Viton for use with 228-21 (see drawing)
23242-02	Mounting adapter, 1-1/2 in MNPT, PEEK, Viton and 316 SS, for use with 228-21 (see drawing)
23242-03	Mounting adapter, 1-1/2 in MNPT, PEEK, Viton and 316 SS, for use with 228-20 (see drawing)
23277-01	Mounting adapter, Foxboro, PEEK, 5/8 11 UNC, for use with 228-20
23277-01 SQ7182	Mounting adapter, Foxboro, Tefzel, 5/8 11 UNC, for use with 228-20 for use with 228-20
23311-00	Valve insertion assembly, mechanical, for 228-20-62 only, see PDS 71-228 for more information
23311-01	Valve insertion assembly, manual, for 228-20-62 only, see PDS 71-228 for more information
33075-00	Gasket, Viton, for 228-20
33075-03	Gasket, Kalrez, for 228-20
33081-00	Adapter insert, PEEK, for 23242-02
33081-00 SQ7091A	Adapter insert, Tefzel, for 23242-02
33081-00 SQ7091B	Adapter insert, Tefzel, for 23242-03
9340065	Ball valve, full port, 1 ½ inch FNPT (to 120°C only) for 23311-00 and 23311-01
9550179	O-ring, EP rubber, 2-135 for 2001990

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