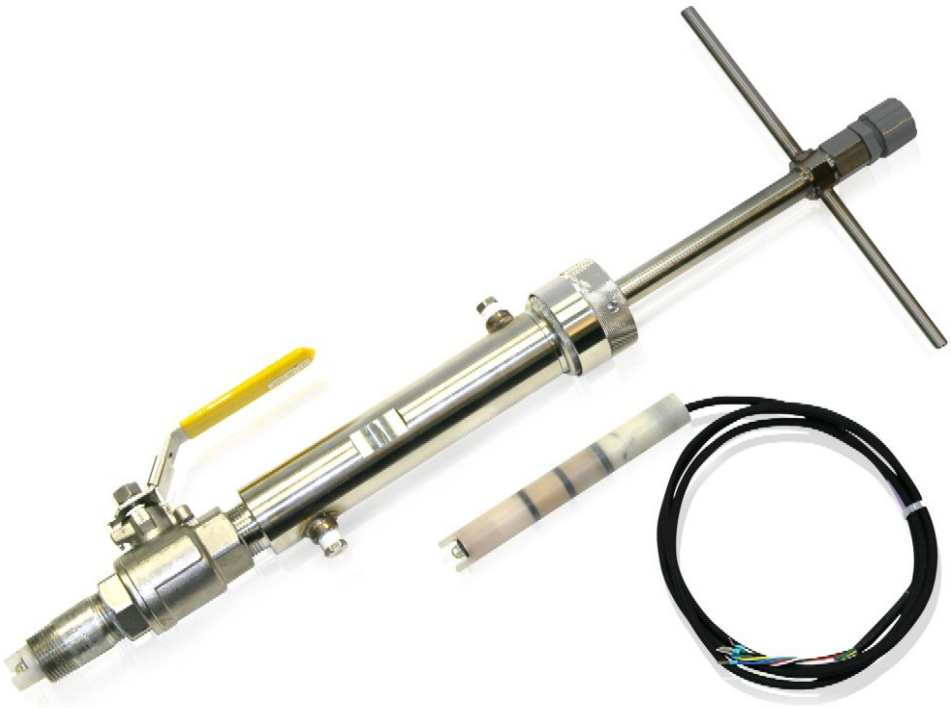
Operating Instructions TBX587

Analytical Sensors
Model TBX587

Endura pH/Redox (ORP) Sensor



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WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices which could result in property damage.

NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

WARNING

POSSIBLE PROCESS UPSETS. Maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

NOTICE

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Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

Table of Contents

List of Figures

List of Tables

1.0 Introduction

1.1 Purpose

This document describes the installation and maintenance of the TBX587 Industrial pH and Redox (ORP) Electrode systems.

1.2 Sensor Description

These sensors are hot tap, ball valve insertion designs. They enable sensor maintenance or replacement without interrupting the process. The "T" style handle is used to push the sensor into the process while under pressure.

The insertion rod of the sensor is smaller diameter then the sensor body. A larger diameter mechanical stop is incorporated into the insertion rod. This prevents accidental sensor removal while under pressure. Unlike chain or cable restraints this safety-by-design is a mechanical part of the construction.

The TBX587 sensor is inserted through a standard 1 in. full port ball valve. The valve is used to isolate the sensor from the process.

The extraction housing provides spacing to accommodate the sensor when it is withdrawn from the process. The extraction housing has ¼ in. connections which can be used to bleed off residual process pressure when the sensor is extracted. If the application involves strong chemicals then the ¼ in. connections can be used to flush and drain the housing prior to sensor removal.

The compression fitting mounted at the end of the extraction housing. It is used to hold the sensor in place when inserted into the process. It must be loosened to remove the sensor from the process. Once the sensor is removed from the process the ball valve must be closed to isolate the sensor.

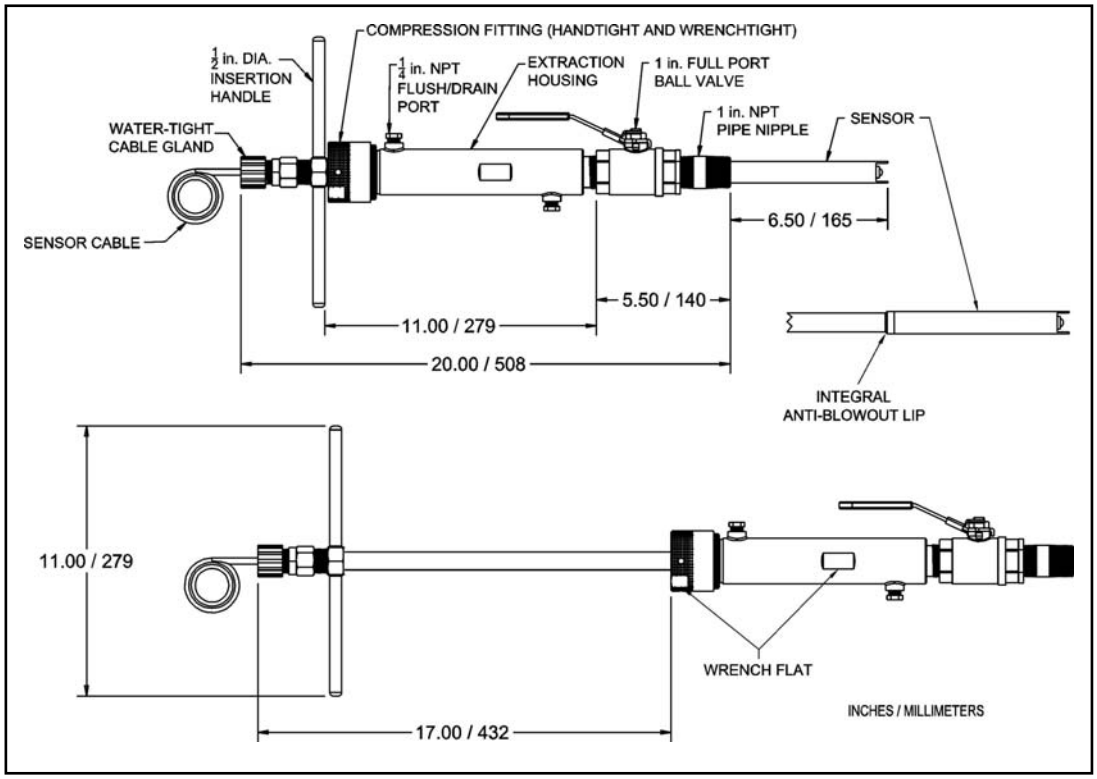


Figure 1-1 Sensor Dimensions

2.0 Installation

2.1 Recommended Installation

The TBX587 is supplied with a notched tip. This notched design protects the glass electrode from breakage during handling and insertion. If the process liquid tends to build up on the electrode tip then these notches can be clipped off to better expose the glass electrode to the process. If the process is abrasive then the flat glass electrode can be used for additional protection. The sensor tip should be at a 90° angle to the process flow for optimal self cleaning.

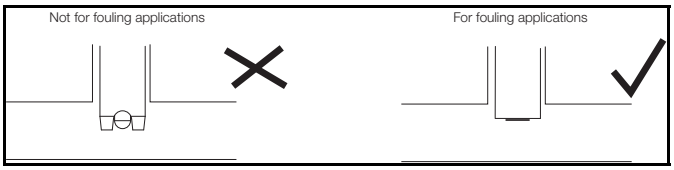


Figure 2-1. Recommendations for Fouling Applications

The flow of sample passing the sensor helps to keep the sensor clean.

Sensors should be positioned such that they are always immersed in the sample.

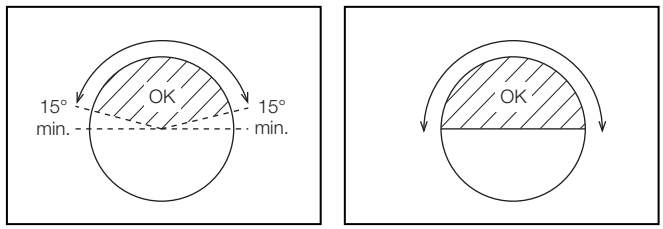
2.2 Installation Instructions

1. Process pressure must not exceed 10.4 bar (150 PSIG) continuous service. Sensors should be retracted during process start-up to prevent damage due to pressure surges or water hammer.

2. Sensor tip should be kept wet at all times. If the process will be shut down then retract the sensor and keep isolated in the extraction housing with the ball valve closed to keep the electrode wet.

3. The maximum insertion depth of the TBX587 is 165mm (6.5 in.). This additional insertion depth is used to overcome additional spacing due to flanges and nozzles on the process piping. The tip of the sensor should only be inserted to a maximum of 25mm (1 in.) beyond the inner diameter of the process. This is sufficient to get flow past the electrode tip. Over-insertion may result in damage to the sensor.

4. Fully retract the sensor before closing the isolation ball valve. Fully open the valve before insertion of the sensor.



Mounting Range for Flat Glass Electrodes in Horizontal Piping

Mounting Range for Hemispherical Glass Electrodes in Horizontal Piping

Figure 2-2. Preferred Mounting

2.3 Electrical Connections

All TBX587 sensors are supplied with either integral cable or with a detachable Variopin connection. Integral cable lengths are as follows:

1.5 M (5 ft)
3 M(10 ft)
6 M(20 ft)
9 M(30 ft)

The detachable Variopin cables are supplied separately and include the lengths listed above in addition to 15 M (50 ft), 23 M (75 ft), and 30 M (100 ft). Electrical connections to various ABB electronics are listed below.

TB82 / TB84 Terminal Block		TB(X)5 Series Sensors	
Number	Label	Color	Function
1	SENSE	Blue	Glass/Metal Electrode
2	GUARD	Yellow	Shield/Screen
3	REF	Black	Reference Electrode
4	SOL GND	Green	Solution Ground
5	RTD	Red	Temperature Compensator
6	RTD	White	Temperature Compensator
7	SHIELD	Dark Green	Shield/Screen

Table 2-1. TB82PH / TB84PH Terminal Block Connections

AX4xx Analyzer Terminal Block		TB(X)5 Series Sensors	
Sensor A	Sensor B	Color	Function
B9	B1	White	Temperature Compensator
B10	B2	–	Link B1 to B2 & B9 to B10
B11	B3	Red	Temperature Compensator
B12	B4	Black	Reference Electrode
B13	B5	–	–
B14	B6	Green	Solution Ground
B15	B7	Yellow	Shield/Screen
B16	B8	Blue	Glass/Metal Electrode

Table 2-2. AX4xx Terminal Block Connections

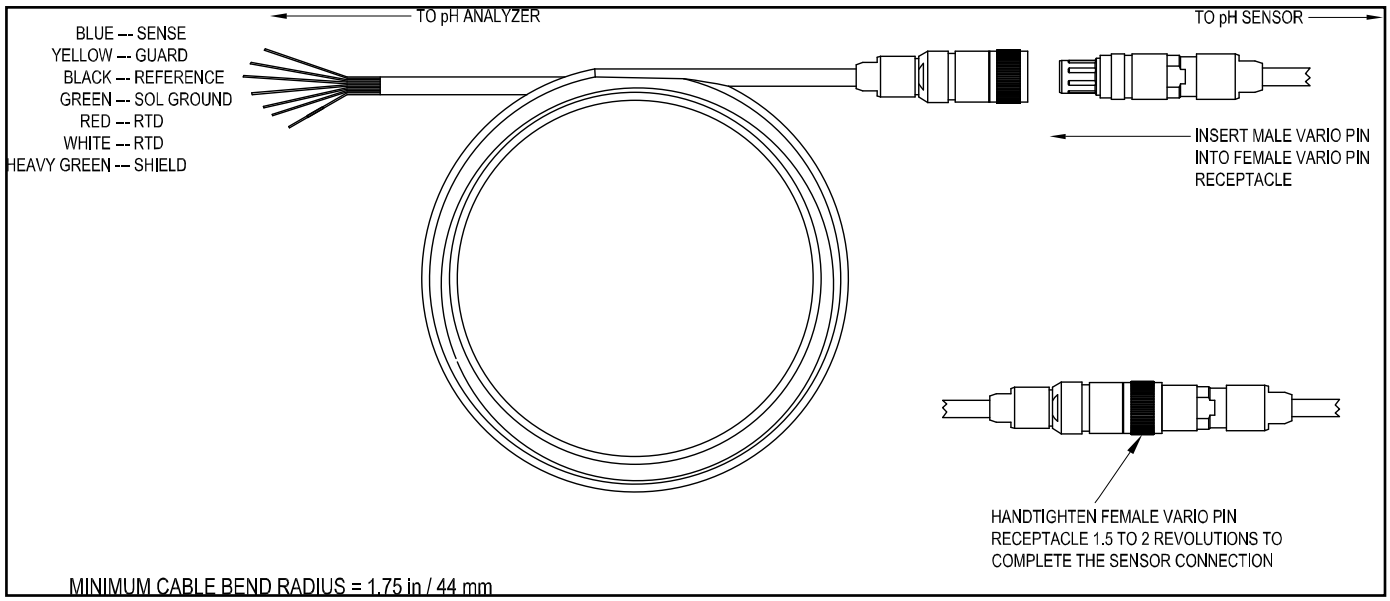


Figure 2-3. Variopin connection

3.0 Calibration

When the sensor has been correctly connected and all electrical connections have been made to the associated electronics the sensor is ready for calibration.

pH and Redox (ORP) sensors are consumable products that will require periodic recalibration. ABB recommends that initial calibration be performed with liquid buffer solutions as a two point calibration. In harsh chemical processes, follow-up calibrations should be single point grab sample calibrations.

3.1 pH Sensor

Tips for new pH sensors

- Allow sensor to cool to room temperature.
- For new sensors perform buffer calibration in two separate solutions of known pH values for a two point calibration.
- Rinse sensor in tap water between immersion in each solution.
- For best accuracy with TBX587 sensors use the MANUAL two point calibration option in the pH electronics.
- calibration solutions should be at least 3pH units in difference. (e.g. – 4pH buffer and 7pH buffer).

For sensors already in use a buffer calibration may be performed but optimum calibration requires a single point grab sample calibration.

- Take a sample of the process liquid being measured and verifying pH / mV on a laboratory or portable pH meter.
- The sample should not be allowed to cool off.
- The reading from the portable pH meter can then be used to adjust the reading in the electronics.

Refer to the instruction manual for the pH electronics for full details of the calibration procedure.

3.2 Redox (ORP) Sensor

Calibration procedures for ORP sensors follow the same recommendations as for pH sensors shown in Section 3.1. Note the following for ORP solutions:

- Pre-prepared ORP calibration solutions should have at least 200 mV difference for optimum calibration.
- If quinhydrone is used then ABB recommends using 100mL of 4pH and 7pH buffer solutions. Add 1 gram of analar quinhydrone to each buffer and let stand for 30 minutes.

The quinhydrone values should be within +/-15mV of the values listed below.

4 pH	+259 mV
7 pH	+82 mV

Warning: Before removing a sensor from a flow line, ensure that all isolating valves have been closed.

Caution: It is important when buffering to ensure that the visible surfaces of the electrodes have been cleaned using demineralized water. Also ensure when moving from one buffer solution to the next to wash the electrodes and dry them carefully using a soft tissue.

4.0 Cleaning

4.1 General Electrode Cleaning

To ensure accurate monitoring, keep the sensor free of contaminants by periodic cleaning, the frequency of which depends on the particular application.

Methods of removing various types of deposits are detailed below. A soft cotton cloth or toothbrush can be used to directly clean the glass electrode. Replace the sensor if its performance does not improve after cleaning.

To clean	Use
General foulants	3 to 5 % hydrochloric acid solution High pressure water jet (from a pressurized canister)
Oils and greases	Isopropyl alcohol (rubbing alcohol) Methanol Other solvent known to cut the specific grease High pressure water jet (from a pressurized canister)
Scales (and similar) from medium to high pH solutions	5 to 10 % hydrochloric acid solution 3 to 7 % sulfuric acid solution Industrial toilet bowl cleaner (mix of strong hydrochloric acid and phosphoric acid)
Scales (and similar) from low (<5) pH solutions	5 to 10 % warm (>54 °C [130 °F]) caustic solution Rust stain remover
Sulfates and carbonates	5 to 10 % hydrochloric acid solution Industrial toilet bowl cleaner (mixture of strong hydrochloric acid and phosphoric acid) Combination of sodium metabisulfite and sodium hydrosulfite
Silica or tenacious scales	2 to 3 % hydrofluoric acid solution

Note: If the TB5/TB(X)5 sensor has been cleaned, refit it to the process or place it in distilled water before use or calibration.

4.2 Troubleshooting

Listed below are some common symptoms of sensor malfunction together with possible cures.

Short scaling (low slope) or sluggish response

- Glass sensor membrane is dirty or coated – Refer to section 4.1 for cleaning information
- Sensor has been in service for a long time and lost its speed of response. Check age of sensor and replace.

No Response to pH buffer or sample

- Check sensor wiring in section 2 or refer to the electronics instructions.
- Look for cracks in the glass membrane. They create a short circuit thus the sensor will not respond.
- Inspect sensor cable for damage. Abraded cable can cause short circuits and lack of sensor response.

Unstable reading or drift

- Check sensor wiring in section 2 or refer to the electronics instructions.
- Dry or dirty reference junction – clean as instructed in section 4.1 of the manual.
- Allow sensor to soak for several hours in deionized water

Stable but incorrect readings

- Recalibrate using grab sample calibration method suggested in section 3.1 of the manual
- Check temperature compensation to verify that the process temperature matches the reading from the sensor

Note: All of the above symptoms could be caused by a faulty extension cable. Check and replace it, if necessary.

4.3 Electrode Storage

Caution: Failure to ensure that the glass membrane and reference junction do not dry out may irreversibly affect the response of the electrode.

If it is necessary to remove the electrode from the sample line, fill the retained protective cap with buffer solution and cotton wool, or equivalent, and fit it to the sensor.

5.0 Spares & Accessories

5.1 Model Number Breakdown (Nomenclature)

Variant digit No.	1-6	7	8	9	10	11	12	13	14	15
Endura 1 inch Retractable pH / Redox (ORP) sensor assembly	**TBX587**	X	X	X	X	X	X	X	X	X
Measurement Electrode										
Flat Glass (10 … 100 deg °C, 0 … 14 pH) For high particulates with flow at 90 deg		1								
General Purpose Glass (0 ...100 °C, 0 … 12 pH) For low temperature applications		2								
High Temp Glass (10 … 140 °C, 0 … 14 pH) Sensor cable rated to 140 °C		3								
Platinum, (Flat ORP) (0 … 140 °C, +/- 2000mV)		8								
Antimony (-20 … 80 °C, 3 … 11 pH)		6								
Glass, pH, Fluoride - Resistant (10 … 80 °C, 0 … 14 pH)		F								
Coat - Resistance Glass (10 … 140 °C, 0 … 14 pH) Sensor cable rated to 90 °C		J								
Integral Thermocompensator										
None, Replacement Sensor			0							
3 kOhm		1)	1							
Pt 100		1)	3							
Reference Junction										
Wood, Notched, Next Step			2)	D						
Teflon, Notched, Next Step			2)	E						
Solution Ground Wetted Material										
316 Stainless Steel with Viton O-Rings					1					
316 Stainless Steel with EPDM O-Rings					2					
316 Stainless Steel with Kalrez O-Rings					3					
Titanium with Viton O-Rings					4					
Titanium with EPDM O-Rings					5					
Titanium with Kalrez O-Rings					6					
Hastelloy B-2 with Viton O-Rings					7					
Hastelloy B-2 with EPDM O-Rings					8					
Hastelloy B-2 with Kalrez O-Rings					9					
Accessory Hardware										
None, Replacement Sensor						0				
Complete Hardware Assembly, Stainless with Viton O-Rings						A				
Complete Hardware Assembly, Stainless with EPDM O-Rings						B				
Complete Hardware Assembly, Stainless with Kalrez O-Rings						C				
Complete Hardware Assembly, Titanium with Viton O-Rings						D				
Complete Hardware Assembly, Titanium with EPDM O-Rings						E				
Complete Hardware Assembly, Titanium with Kalrez O-Rings						F				
Complete Hardware Assembly, Hastelloy C with Viton O-Rings						G				
Complete Hardware Assembly, Hastelloy C with EPDM O-Rings						H				
Complete Hardware Assembly, Hastelloy C with Kalrez O-Rings						J				
Sensor Cable Connection Options										
Tinned / Pin Leads							T			
Quick Disconnect Vario Pin Connector							V			
Sensor Cable Length										
5 ft (1.5 m)							3)	0	5	
10 ft (3 m)							3)	1	0	
20 ft (6 m)							3)	2	0	
30 ft (9 m)							3)	3	0	
Quick Disconnect Vario Pin Connector (Select Extension Cable Separately)								0	0	
Tagging										
None										0
Mylar										1
Stainless Steel										2

1) No Integral Thermocompensator when Redox (ORP) or Antimony Electrode Selected for Digit 7.

2) Flush Reference Junction Supplied when Antimony Electrode Selected for Digit 7 (all other electrodes have notched tip).

3) Cable Length only for Tinned/Pinned Leads for Digit 12. Quick Disconnect option requires extension cable.

5.2 Common Spares

Accessories

1 in. Stainless Steel Ball Valve Kit (4TB4951-0118 + 4TB4955-0118)	4TB5205-0302
1 in. Titanium Ball Valve Kit (4TB4951-0119 + 4TB4955-0013)	4TB5205-0303
1 in. Hastelloy C Ball Valve Kit (4TB4951-0120 + 4TB4955-0014)	4TB5205-0304

Extension Cable

Vario Pin Interconnection Cable 5 ft. (2 m) Length	4TB3011-9005
Vario Pin Interconnection Cable 10 ft. (3 m) Length	4TB3011-9010
Vario Pin Interconnection Cable 20 ft. (6 m) Length	4TB3011-9020
Vario Pin Interconnection Cable 30 ft. (10 m) Length	4TB3011-9030
Vario Pin Interconnection Cable 50 ft. (15 m) Length	4TB3011-9050
Vario Pin Interconnection Cable 75 ft. (23 m) Length	4TB3011-9075
Vario Pin Interconnection Cable 100 ft. (30 m) Length	4TB3011-9100

5.3 Exploded View Spares

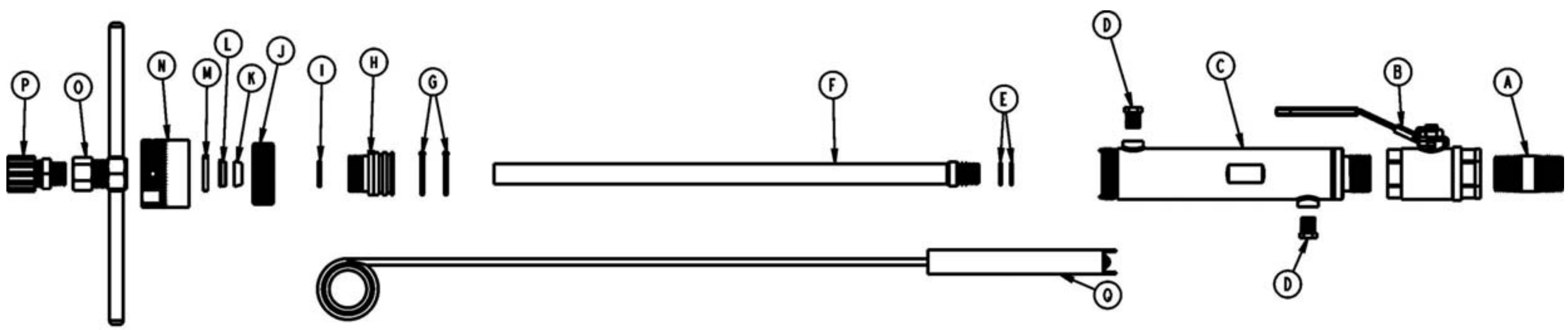


TABLE A: HARDWARE MATERIAL									
NOMENCLATURE TBX587_ _ _ _ ! _ _ _	ITEM A PART NUMBER	ITEM B PART NUMBER	ITEM C PART NUMBER	ITEM D PART NUMBER	ITEM E PART NUMBER	ITEM F PART NUMBER	ITEM G PART NUMBER	ITEM H PART NUMBER	ITEM I PART NUMBER
0 - NONE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
A - STAINLESS STEEL, VITON	4TB4951-0118	4TB4955-0012	4TB4955-0115	4TB4951-0014	4TB4904-0006	4TB5205-0298	4TB4904-0117	4TB4953-0124	4TB4904-0171
D - TITANIUM, VITON	4TB4951-0119	4TB4955-0013	4TB4955-0116	4TB4951-0089	4TB4904-0006	4TB5205-0299	4TB4904-0117	4TB4953-0125	4TB4904-0171
G - HASTELLOY, VITON	4TB4951-0120	4TB4955-0014	4TB4955-0117	4TB4951-0122	4TB4904-0006	4TB5205-0300	4TB4904-0117	4TB4953-0126	4TB4904-0171
B - STAINLESS STEEL, EPDM	4TB4951-0118	4TB4955-0012	4TB4955-0115	4TB4951-0014	4TB4904-0028	4TB5205-0298	4TB4904-0118	4TB4953-0124	4TB4904-0172
E - TITANIUM, EPDM	4TB4951-0119	4TB4955-0013	4TB4955-0116	4TB4951-0089	4TB4904-0028	4TB5205-0299	4TB4904-0118	4TB4953-0125	4TB4904-0172
H - HASTELLOY, EPDM	4TB4951-0120	4TB4955-0014	4TB4955-0117	4TB4951-0122	4TB4904-0028	4TB5205-0300	4TB4904-0118	4TB4953-0126	4TB4904-0172
C - STAINLESS STEEL, KALREZ	4TB4951-0118	4TB4955-0012	4TB4955-0115	4TB4951-0014	4TB4904-0165	4TB5205-0298	4TB4904-0119	4TB4953-0124	4TB4904-0173
F - TITANIUM, KALREZ	4TB4951-0119	4TB4955-0013	4TB4955-0116	4TB4951-0089	4TB4904-0165	4TB5205-0299	4TB4904-0119	4TB4953-0125	4TB4904-0173
J - HASTELLOY, KALREZ	4TB4951-0120	4TB4955-0014	4TB4955-0117	4TB4951-0122	4TB4904-0165	4TB5205-0300	4TB4904-0119	4TB4953-0126	4TB4904-0173

Figure 5-1. Exploded View

6.0 Specifications

6.1 Maximum Pressure

10.3 bar (150 PSI)

6.2 Temperature Compensator (pH sensors only)

Quick Response Integral Pt100 or 3 kΩ Balco

6.3 Wetted Material Options

Glass	pH Electrode
Platinum	Redox (ORP)
PTFE	Reference Junction
Wood	Reference Junction
PVDF	Sensor Body
Stainless Steel	Solution Ground + Hardware
Titanium	Solution Ground + Hardware
Hastelloy	Solution Ground + Hardware
EPDM	O-Rings
Viton	O-Rings
Kalrez	O-Rings

Code	Type	Description	Ratings			
			Range	Operating		Quick TC Standard?
				°C	°F	
1	Flat Glass	Flush glass for slurries and high particulate applications.	0 … 14 pH	10 ... 100 (Note 1)	60 ... 212 (Note 1)	Yes
2	General Purpose Glass	Low temperature and light duty applications. Not for high pH.	0 ... 12 pH	0 ... 100	32 ... 212	Yes
3	High Temp Glass	High Temperature glass electrode and special high temperature cable	0 ... 14 pH	10 ... 140	50 ... 284	Yes
8	Flat Redox (ORP)	Flush Platinum element. Well suited for slurry applications.	0 ... ±2000 mV	0 ... 140	32 ... 284	No
6	Antimony (Sb)	Metal pH electrode for HF Acid or high abrasion applications.	3 ... 11 pH	-20 … 80	-4 … 176	No
F	Fluoride Resistant Glass	Etch resistant pH glass up to several % HF Acid concentration as well as other strong acids.	0 ... 12 pH	10 ... 80 (Note 2)	50 ... 176 (Note 2)	Yes
J	Coat Resistant Glass	Most common industrial glass electrode for applications with coating and build-up.	0 ... 14 pH	10 … 140 (Note 3)	50 ... 284 (Note 3)	Yes

Notes
1) 0 to 121 °C (32 to 250 °F) for sterilization cycles
2) 50 °C (122 °F) maximum temperature recommended for high HF concentration
3) 90 °C (194 °F) maximum cable temperature

Table 6-1. Measurement Electrode Type & Rating

Contact us

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