

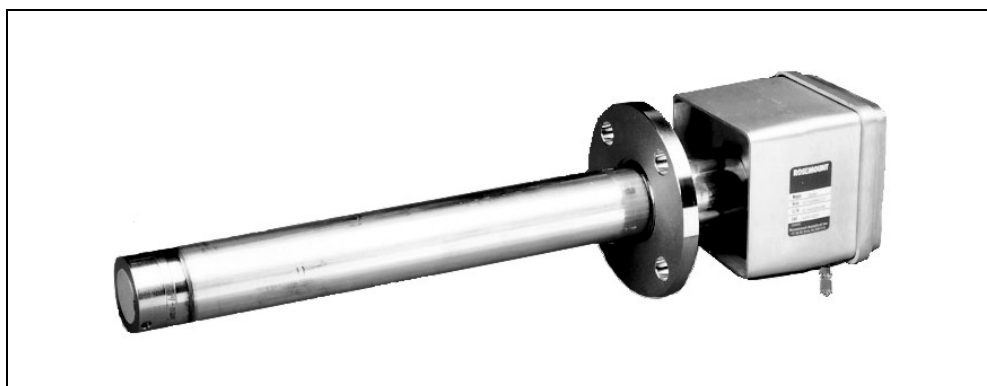
Instruction Manual

IB-106-300DR Rev. 3.3

February 2000

World Class 3000

Oxygen Analyzer Direct
Replacement Probe for
use with Existing Signal
Conditioning Electronics



ROSEMOUNT[®]
Analytical

<http://www.processanalytic.com>


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Process Management

ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Rosemount Analytical representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product.**
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes.** Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY.** Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.**

The information contained in this document is subject to change without notice.

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HIGHLIGHTS OF CHANGES

Effective June, 1996 Rev. 3

Page	Summary
---	General. Updated text and illustrations to reflect probe design changes.
Page 1-15	Added "Extended temperature by-pass arrangements" to Figure 1-15, sheet 3 of 3.

Effective December, 1996 Rev. 3.1

Page	Summary
Page P-2	Added "Safety instructions for the wiring and installation of this apparatus".
Page 1-4	Corrected Figure 1-3 item listing.
Page 2-1	Added one WARNING to read new safety instructions and another WARNING regarding protective covers and grounds.
Page 3-1	Added WARNING regarding protective covers and grounds.
Page 4-1	Added WARNING regarding protective covers and grounds.
Page 4-6	Added title block to Figure 4-6.
Page 5-1	Added WARNING regarding protective covers and grounds.
Page 7-1	Corrected cell replacement kit part numbers in Table 7-1.
Page 7-2	Corrected cell replacement kit part number in Table 7-1.

Effective May, 1997 Rev. 3.2

Page	Summary
Page P-2	Added safety sheet.

Effective February, 1998 Rev. 3.3

Page	Summary
Page 2-2	Figure 2-1. Changed calibration gas tube dimensions.

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CAUTION

The World Class 3000 Direct Replacement Probe can be used with any of the following model electronics: 218, 225, 218A, ZA8C, and TC200. Read the appropriate setpoint adjustment in this manual to prevent damage to the probe.

PREFACE

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of this particular probe.

Some sections may describe equipment not used in your configuration. The user should become thoroughly familiar with the operation of this module before operating it. Read this instruction manual completely.

DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this publication.

WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE

Highlights an essential operating procedure, condition, or statement.

⊕ : EARTH (GROUND) TERMINAL

⊕ : PROTECTIVE CONDUCTOR TERMINAL

⚠ : RISK OF ELECTRICAL SHOCK

⚠ : WARNING: REFER TO INSTRUCTION BULLETIN

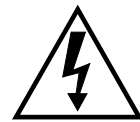
NOTE TO USERS

The number in the lower right corner of each illustration in this publication is a manual illustration number. It is not a part number, and is not related to the illustration in any technical manner.

IMPORTANT
SAFETY INSTRUCTIONS
FOR THE WIRING AND INSTALLATION
OF THIS APPARATUS

The following safety instructions apply specifically to all EU member states. They should be strictly adhered to in order to assure compliance with the Low Voltage Directive. Non-EU states should also comply with the following unless superseded by local or National Standards.

1. Adequate earth connections should be made to all earthing points, internal and external, where provided.
2. After installation or troubleshooting, all safety covers and safety grounds must be replaced. The integrity of all earth terminals must be maintained at all times.
3. Mains supply cords should comply with the requirements of IEC227 or IEC245.
4. All wiring shall be suitable for use in an ambient temperature of greater than 75°C.
5. All cable glands used should be of such internal dimensions as to provide adequate cable anchorage.
6. To ensure safe operation of this equipment, connection to the mains supply should only be made through a circuit breaker which will disconnect all circuits carrying conductors during a fault situation. The circuit breaker may also include a mechanically operated isolating switch. If not, then another means of disconnecting the equipment from the supply must be provided and clearly marked as such. Circuit breakers or switches must comply with a recognized standard such as IEC947. All wiring must conform with any local standards.
7. Where equipment or covers are marked with the symbol to the right, hazardous voltages are likely to be present beneath. These covers should only be removed when power is removed from the equipment — and then only by trained service personnel.
8. Where equipment or covers are marked with the symbol to the right, there is a danger from hot surfaces beneath. These covers should only be removed by trained service personnel when power is removed from the equipment. Certain surfaces may remain hot to the touch.
9. Where equipment or covers are marked with the symbol to the right, refer to the Operator Manual for instructions.
10. All graphical symbols used in this product are from one or more of the following standards: EN61010-1, IEC417, and ISO3864.



SECTION 1 DESCRIPTION AND SPECIFICATIONS

1-1 COMPONENT CHECKLIST

The Direct Replacement (DR) Probe package of the World Class 3000 Oxygen Analyzer typically includes the probe, the instruction bulletin, and the mounting hardware. These three items are shown in Figure 1-1. Record the Part Number, Serial Number, and Order Number of your system on the first page of this manual.

Replacement Probe can be interfaced to a number of different and earlier model electronics packages. These electronic packages are not covered in this manual. For specific information concerning calibration and operation of the system, refer to the Instruction Bulletin applicable to your electronics package.

1-2 SYSTEM OVERVIEW

a. Scope

This Instruction Bulletin has been designed to supply details needed to install, start up, and troubleshoot the Rosemount World Class 3000 Oxygen Analyzer. The Direct

b. System Function

The Rosemount Oxygen Analyzer (Probe) is designed to measure the net concentration of oxygen in an industrial process; i.e., the oxygen remaining after all fuels have been oxidized. The probe is permanently positioned within an exhaust duct or stack. The sampling system is in situ rather than extractive.

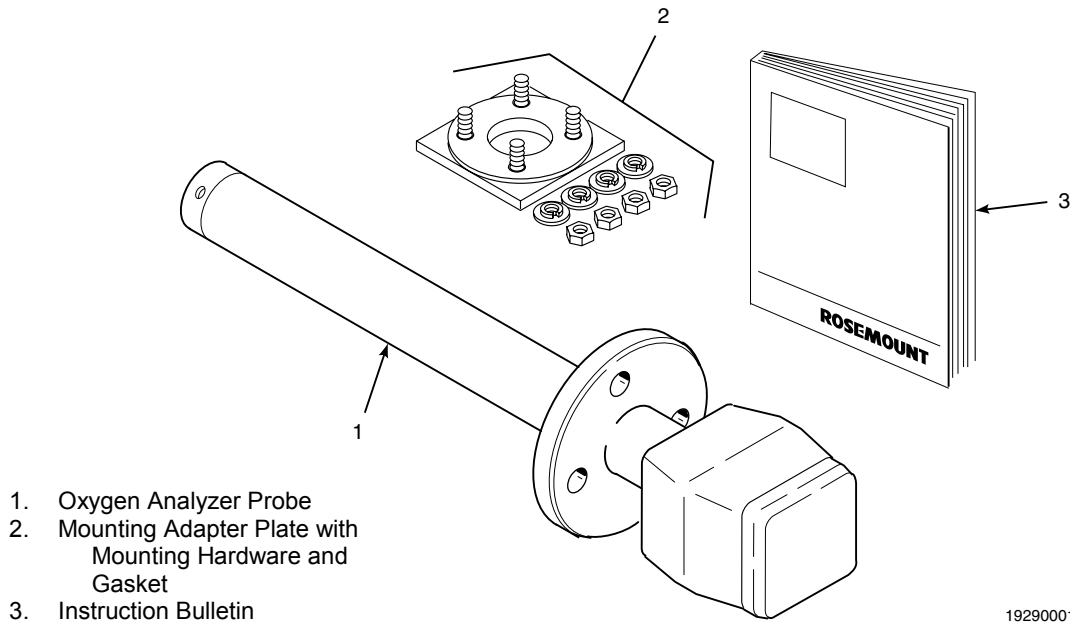


Figure 1-1. Typical System Package

The equipment measures oxygen percentage by reading the voltage developed across a heated electrochemical cell, which consists of a small yttria-stabilized, zirconia disc. Both sides of the disc are coated with porous metal electrodes. When operated at the proper temperature, the millivolt output voltage of the sensor cell is given by the following Nernst equation:

$$EMF = KT \log_{10}(P_1/P_2) + C$$

Where:

1. P_2 is the partial pressure of the oxygen in the measured gas on one side of the cell,
2. P_1 is the partial pressure of the oxygen in the reference gas on the other side,
3. T is the absolute temperature,
4. C is the cell constant,
5. K is an arithmetic constant.

NOTE

For best results, use clean, dry, instrument air (20.95% oxygen) as a reference gas.

When the cell is at operating temperature, oxygen ions will travel through the cell from high to low oxygen partial pressures. The resulting output voltage is about 50 mV per decade. The voltage varies with the ratio of oxygen partial pressures of the reference gas over the sample gas. Thus, the output signal increases as the sample oxygen level decreases. This property gives the analyzer high sensitivity at low oxygen levels.

Oxygen analyzer equipment measures net oxygen concentration in the presence of all the products of combustion, including water

vapor. Therefore, it may be considered an analysis on a "wet" basis. In comparison with older methods, such as the Orsat apparatus, which provides an analysis on a "dry" gas basis, the "wet" analysis will, in general, indicate a lower percentage of oxygen. The difference will be proportional to the water content of the sampled gas stream.

c. System Configuration

The DR probe is similar to the Exchange Probe (NE model) except that the DR uses a 115 V heater like most older systems. The DR does not require a separate power supply as does the NE. The DR probe (like the NE) is available in five lengths. The length of stack penetration depends on the size of the stack or duct. The length options are 18 in., 3 ft, 6 ft, 9 ft, and 12 ft (457 mm, 0.9 m, 1.8 m, 2.7 m, and 3.7 m).

d. Features

1. Output voltage and sensitivity increase as the oxygen concentration decreases.
2. In situ, non-sampling analyzer.
3. Field replaceable cell.
4. Analyzer constructed of rugged 316 LSS for all wetted parts.
5. Suitable for use in temperatures up to 1300°F (700°C).
6. The DR probe uses a 115 V heater and does not require a separate heater power supply.

e. Handling the Oxygen Analyzer

CAUTION

It is important that printed circuit boards and integrated circuits are handled only when adequate antistatic precautions have been taken to prevent possible equipment damage.

The oxygen analyzer is designed for industrial application. Treat each component of the system with care to avoid physical damage. The probe contains components made from ceramics, which are susceptible to shock when mishandled.

NOTE

Retain packaging in which the oxygen analyzer arrived from the factory in case any components are to be shipped to another site. This packaging has been designed to protect the product.

f. System Considerations

Prior to installation of your Rosemount World Class 3000 Oxygen Analyzer, make sure you have all of the components necessary to make the system installation. Ensure all components are properly integrated to make the system functional.

Once you have verified you have all the components, select mounting locations and determine how each component will be placed in terms of available power supply, ambient temperatures, environmental considerations, convenience, and serviceability. A typical installation is illustrated in Figure 1-2.

After selecting the probe mounting location, provision should be made for a platform where the probe can be easily serviced.

A source of instrument air is required at the probe for reference gas use. Since the probe is equipped with an in place calibration feature, provision should be made for

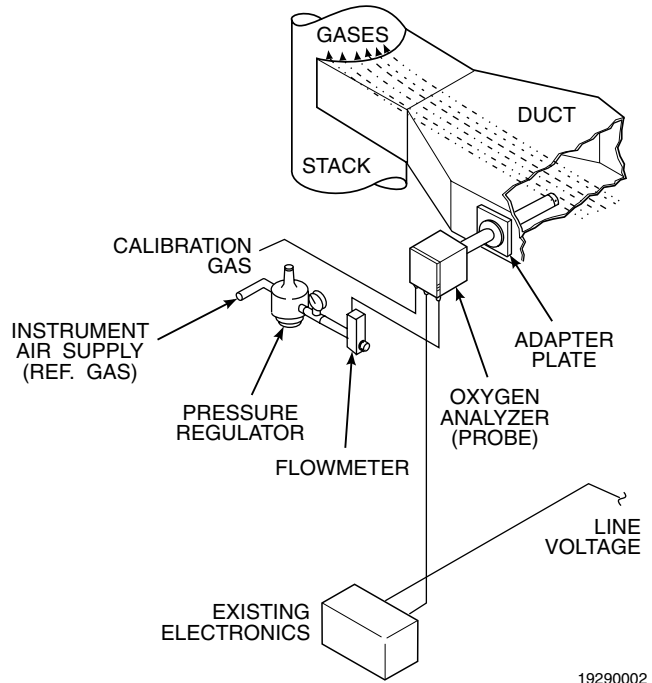


Figure 1-2. Typical System Installation

connecting test gas tanks to the oxygen analyzer when the probe is to be calibrated.

NOTE

Ambient air is not recommended for use as high test gas. An 8% O₂ balance in nitrogen is recommended for high test gas.

If test gas bottles will be hooked up permanently, an optional check valve is recommended next to the calibration fittings on the probe head. This is to prevent breathing of calibration gas line and subsequent flue gas condensation and corrosion. The check valve is in addition to the stop valve in the test gas kit or the solenoid valve in the multiprobe test gas sequencer units.

1-3 PHYSICAL DESCRIPTION

The Oxygen Analyzer Probe, Figure 1-3 consists of three component groups: probe exterior, inner probe, and junction box, Figure 1-4.

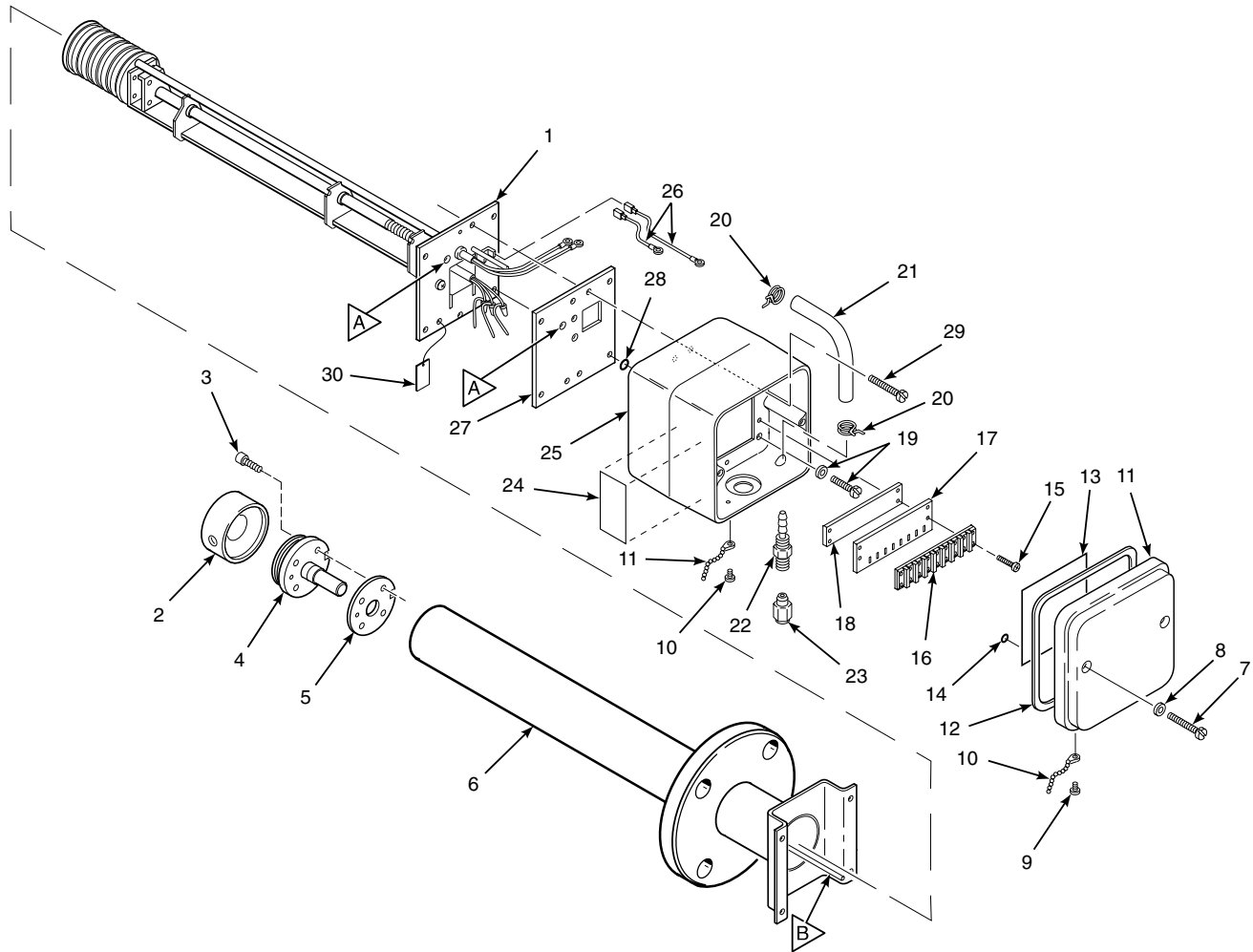
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NOTE: NOT ALL PARTS SHOWN ARE AVAILABLE FOR PURCHASE SEPARATELY. FOR LIST OF AVAILABLE PARTS, SEE TABLE 7-1.



NOTE: ITEM **B**, CALIBRATION GAS TUBE, FITS INTO HOLES **A** WHEN PROBE IS ASSEMBLED.

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- | | | |
|--|-----------------------------------|------------------------|
| 1. Heater, Strut, and Backplate Assembly | 11. Probe Junction Box Cover | 22. Gas Connection |
| 2. Diffusion Assembly | 12. Cover Gasket | 23. Seal Cap |
| 3. Retainer Screw | 13. Insulating Sheet | 24. Label |
| 4. Cell and Flange | 14. O-Ring | 25. Probe Junction Box |
| 5. Corrugated Seal | 15. Terminal Block Screw | 26. Ground Wires |
| 6. Probe Tube Assembly | 16. Terminal Block | 27. Insulating Gasket |
| 7. Cover Screw | 17. Terminal Block Marker | 28. Washer |
| 8. Washer | 18. Terminal Block Mounting Plate | 29. Screw |
| 9. Cover Chain Screw | 19. Probe Junction Box Screws | 30. Tag |
| 10. Cover Chain | 20. Hose Clamp | |
| | 21. Hose | |

Figure 1-3. Oxygen Analyzer Probe - Exploded View

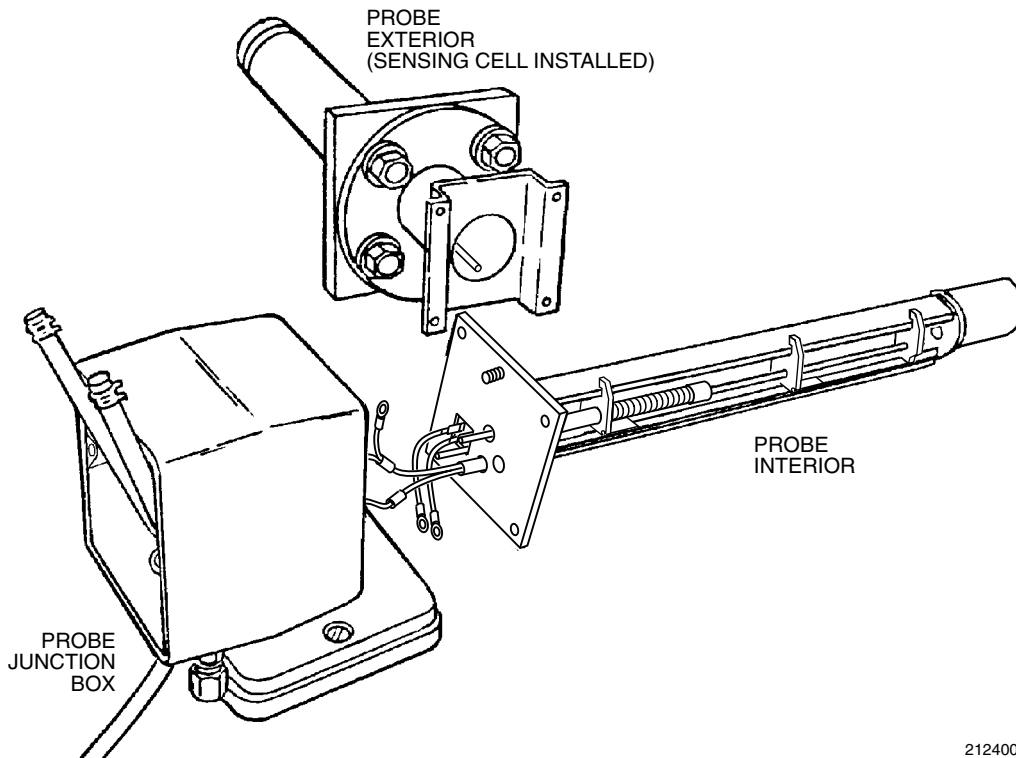


Figure 1-4. Main Probe Components

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1-4 PROBE EXTERIOR

Primary probe exterior components include a flange-mounted zirconium oxide cell, mounted on a tube assembly and protected by a snubber diffusion assembly.

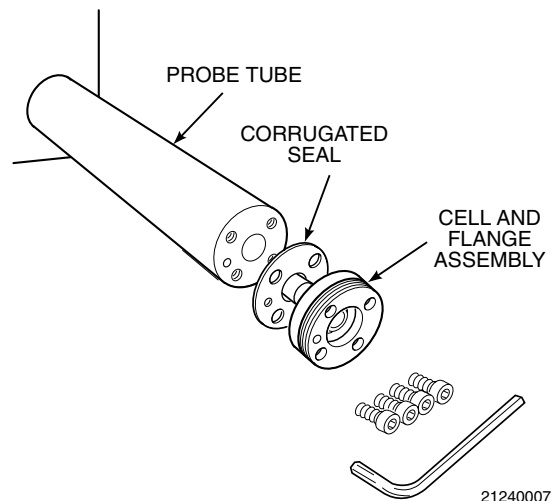
a. Cell and Flange Assembly

The primary component in the cell and flange assembly, Figure 1-5, is a yttria-stabilized zirconium oxide cell. The cell creates an electrical signal when the oxygen level on one side is out of balance with the oxygen level on the other side. This signal is proportional to the difference in oxygen levels.

b. Probe Tube Assembly

Four screws secure the cell and flange assembly, Figure 1-5, to the probe tube assembly. When in place, the cell is inside the tube.

The tube assembly includes a flange which mates with a stack-mounted flange (shown attached to the probe flange in Figure 1-4). Studs on the stack flange make installation easy. There is also a tube to carry calibration gas from the junction box to the process side of the cell during calibration.



21240007

Figure 1-5. Cell and Tube Assemblies

Table 1-1. Specifications for Oxygen Analyzing Equipment^{1 2}

Probe lengths, nominal.....	18 in. (457 mm), 3 ft (0.91 m), 6 ft (1.83 m), 9 ft (2.74 m), or 12 ft (3.66 m), depending on duct dimensions
Temperature limits in process measurement area	50° to 1300°F (10° to 704°C)
Standard/current output.....	4-20 mA dc signal (factory set)
O ₂ indication (Digital display and analog output).....	0.1% O ₂ or ±3% of reading, whichever is greater using Rosemount test gases
System speed of response	less than 3 seconds (amplifier output)
Resolution sensitivity	0.01% O ₂ transmitted signal
Probe reference air flow	2 scfh (56.6 L/hr) clean, dry, instrument quality air (20.95% O ₂), regulated to 5 psi (34 kPa)
Calibration gas mixtures	Rosemount Hagan Test Gas Kit Part No. 6296A27G01 contains 0.4% O ₂ N ₂ Nominal and 8% O ₂ N ₂ Nominal
Calibration gas flow	5 scfh (141.6 L/hr)
Power supply	115 ±10% Vac at 50/60 Hz
Power requirement	200 VA
Ambient operating temperature (Junction Box).....	300°F (149°C) [160°F (71°C) max for YEW replacement]
Approximate shipping weights:	
18 in. (457 mm) package	55 lbs (24.97 kg)
3 ft (0.91 m) package	60 lbs (27.24 kg)
6 ft (1.83 m) package	65 lbs (29.51 kg)
9 ft (2.74 m) package	72 lbs (32.66 kg)
12 ft (3.66 m) package	78 lbs (35.38 kg)

¹ All static performance characteristics are with operating variables constant.

² Equipment ordered utilizing this document as reference will be supplied to the USA standard design. Customers requiring the EEC standard design should request the EEC documentation and utilize its ordering data. Temperatures over 1000°F (537°C) may affect the ease of field cell replaceability.

c. Snubber Diffusion Assembly

The snubber diffusion assembly protects the cell from heavy particles and isolates the cell from changes in temperature. The snubber assembly threads onto the cell and flange assembly. Pin spanner wrenches (probe disassembly kit 3535B42G01) are applied to holes in the diffusion element hub to remove or install the snubber assembly.

An optional ceramic diffusor element and vee deflector shown in Figure 1-6, is available. The ceramic diffusor assembly is also available in a flame arresting version to keep heat from the cell from igniting flue gases.

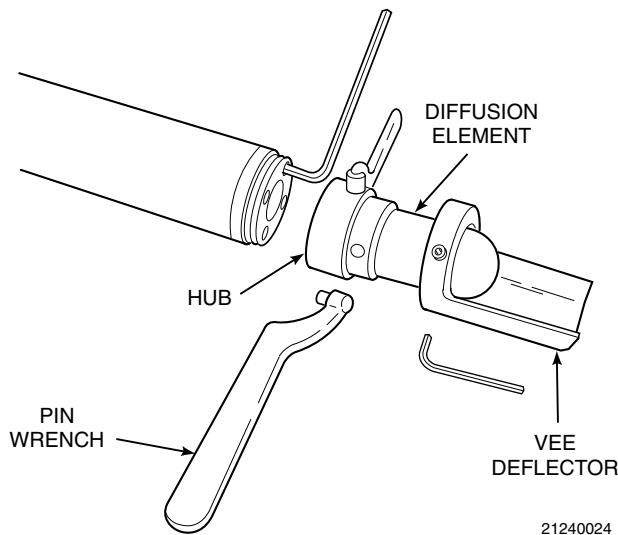


Figure 1-6. Optional Ceramic Diffusor and Vee Deflector Assembly

Systems that use an abrasive shield require a special diffusor assembly with a hub that is grooved to accept two dust seal gaskets. This special diffusor is available in both snubber and ceramic versions. See Probe Options, paragraph 1-8.

d. Cell – General

The components which make up the cell are machined to close tolerances and assembled with care to provide accurate oxygen measurements. Any replacement requires attention to detail and care in assembly to provide good results.

WARNING
Failure to follow the instructions in this manual could cause danger to personnel and equipment. Read and follow instructions in this manual carefully.

The oxygen probe includes an inner electrode for the cell assembly. It consists of a platinum pad and a platinum/inconel composite wire which produces the cell constant offset voltage described in the Nernst equation.

With this pad and wire, the constant will be between -10 and +15 mV. The cell constant

is noted in the calibration data sheet supplied with each probe.

Every probe should be calibrated and checked after repair or replacement of cell, pad and wire, heater, and thermocouple, or after disassembly of the probe.

WARNING
There are two styles of the heater/strut inner probe assembly. P/Ns 3D39441G06 through G10 identify the 44 V heater design. P/Ns 3D39441G01 through G05 and G11 through G15 identify the 115 V heater design. Both styles look the same. When replacing a strut, be sure the replacement has the same part number as the original. A stainless steel tag is attached to the inner probe assembly to identify the 115V design. Operating a probe on the wrong heater voltage can cause injury or severe damage to equipment.

1-5 PROBE INTERIOR

The inner probe assembly, Figure 1-7, consists of six main parts:

- a. Ceramic support rod with four holes running through the length. The holes serve as insulated paths for the cell signal wire and thermocouple wires.
- b. A heater that is helically wrapped on a quartz support cylinder and insulated.
- c. A chromel-alumel thermocouple which acts as the sensing element for the temperature controller. (Not visible in Figure 1-7; located within ceramic support rod.)
- d. A platinum screen pad which forms electrical contact with the inner electrode of the electrochemical cell. (Not visible in Figure 1-7; located at end of ceramic support rod.) The pad is attached to an inconel/stainless steel wire which carries the signal to the terminal strip.
- e. A V-strut assembly to give support to the inner probe assembly.

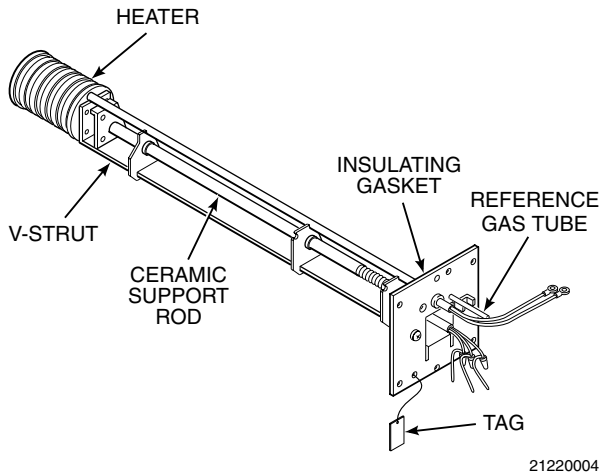


Figure 1-7. Inner Probe Assembly

- f. A tube to carry reference gas to the cell.

Refer to Section 4, Maintenance and Service, for repair procedures for probe components.

1-6 JUNCTION BOX

The junction box, Figure 1-8, is positioned at the external end of the probe and contains a terminal strip for electrical connections and fittings for reference and calibration gases. Fittings are for 0.250 inch stainless steel tubing on American units, and 6 mm tubing on European units. The calibration fitting has a seal cap which must remain in place except during calibration. A tubing fitting is also supplied to be used with the calibration gas supply during calibration.

If the calibration gas bottles will be permanently hooked up to the probe, a manual block valve is required at the probe (between the calibration fitting and the gas line) to prevent condensation of flue gas down the calibration gas line.

During operation and calibration, reference gas is supplied through the reference gas fitting to the reference side of the cell. This gives the

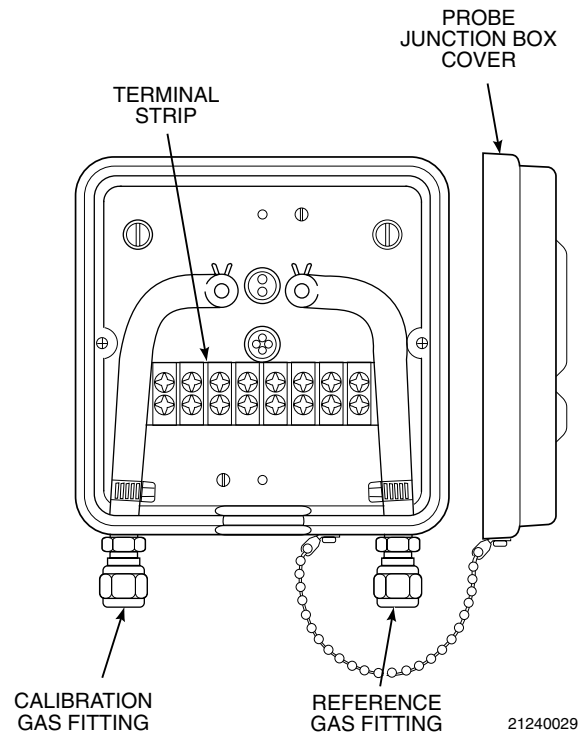


Figure 1-8. Junction Box

system a known quantity of oxygen with which to compare the oxygen level in the process gas. Though ambient air can be used for this purpose, accuracy can only be assured if a reference gas air set is used.

During calibration, two gases of different known oxygen concentrations are injected one at a time through the calibration gas fitting. Stainless steel tubing delivers this gas to the process side of the cell. In a healthy cell, the difference in oxygen pressure from the process side to the reference side of the cell will cause a millivolt output proportional to the difference in oxygen levels. The electronics unit can use the two millivolt outputs caused by the two calibration gases for either automatic or semi-automatic calibration.

CAUTION

Do not attempt to remove a process gas sample through either gas fitting. Hot gases from the process would damage gas hoses in the junction box.

1-7 CABLE ASSEMBLY

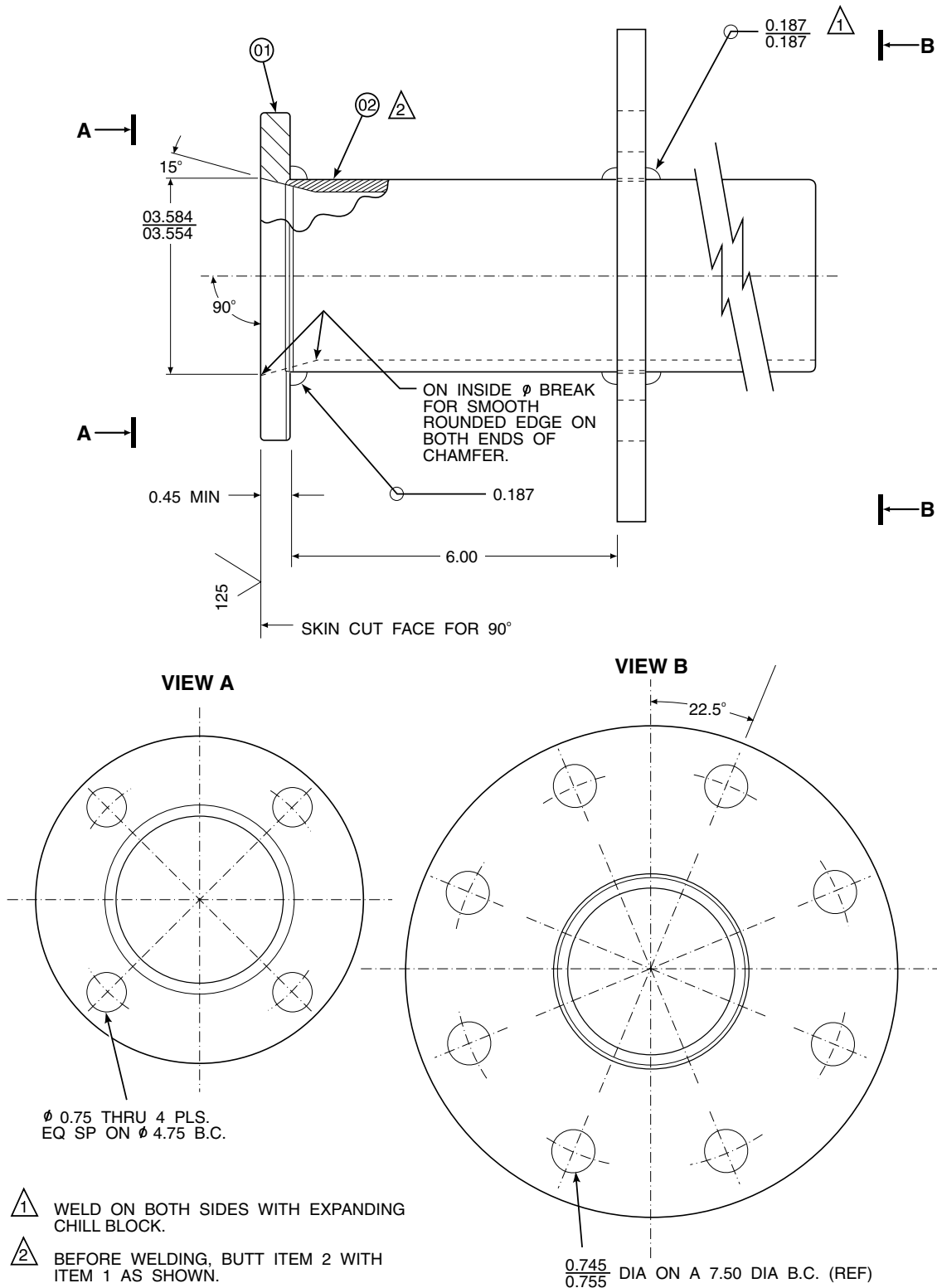
The Westinghouse and Rosemount systems use a 7-conductor cable to connect the probe to the electronics package. Standard length for this cable is 20 ft (6 m), but lengths up to 150 ft (45 m) are available. The seven conductors include one shielded pair of wires for the cell millivolt signal, one shielded pair of type K wires for the thermocouple, and three individual 16-gauge wires for the heater and for ground. The assembled conductors are wrapped by a Teflon™ jacket and braided stainless steel

shield. The Teflon™ and stainless steel jacketing is suitable for high temperature use. All metal shields are isolated at the probe end and connect by drain wires to ground at the electronics.

1-8 PROBE OPTIONS

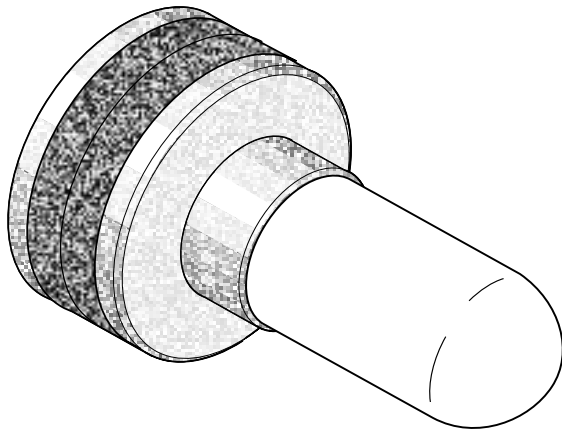
a. Abrasive Shield Assembly

The abrasive shield assembly, Figure 1-9, is a stainless-steel tube that surrounds the probe assembly. The shield protects the probe against particle abrasion and corrosive condensations, provides a guide for ease of insertion, and acts as a probe position support, especially for longer length probes. The abrasive shield assembly uses a modified diffusion and vee deflector assembly fitted with dual dust seal packing.



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Figure 1-9. Abrasive Shield Assembly



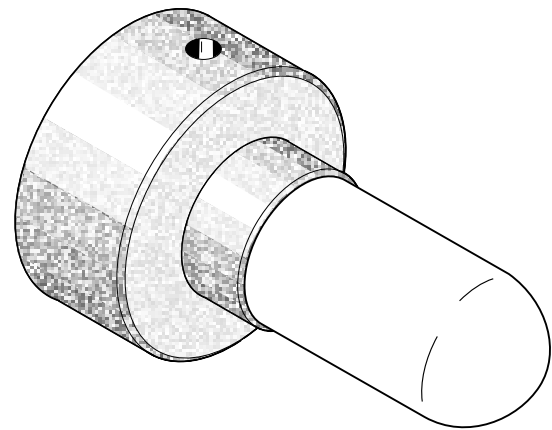
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Figure 1-10. Ceramic Diffusion/Dust Seal Assembly

These modified diffusion and vee deflector assemblies are available in standard, Figure 1-10, and flame arrester version, Figure 1-11.

b. Ceramic Diffusion Assembly

The ceramic diffusion assembly, Figure 1-12, is the traditional design for the probe. Used for over 25 years, the ceramic diffusion assembly provides a greater filter surface area for the probe.



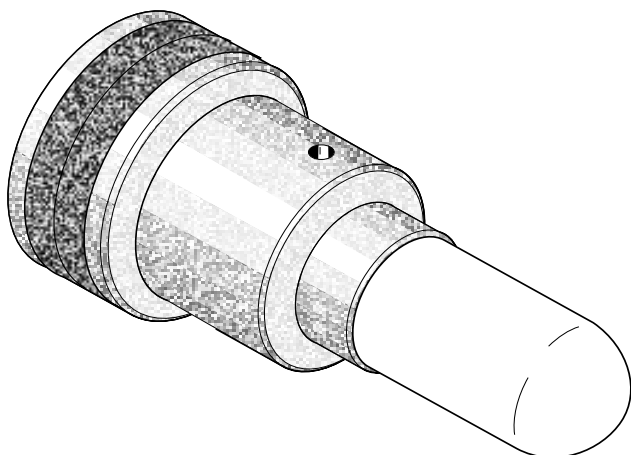
19280010

Figure 1-12. Ceramic Diffusion Assembly

c. Flame Arrester Diffusion Assembly

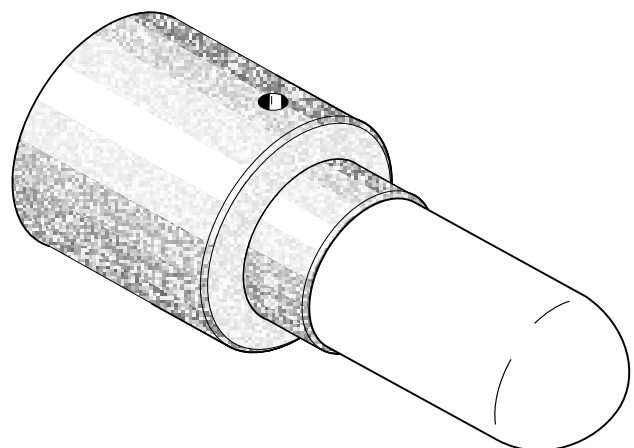
Where a high concentration of unburned fuel is present in the exhaust gases, a flame arrester diffusion assembly, Figure 1-11 and Figure 1-13 is recommended.

The flame diffusion assembly includes a set of baffles between the cell and the stack gases. This keeps 1500°F (816°C) cell temperatures from igniting unburned fuel in the stack.



P0011

Figure 1-11. Flame Arrester Diffusion/Dust Seal Assembly



P0012

Figure 1-13. Flame Arrester Diffusion Assembly

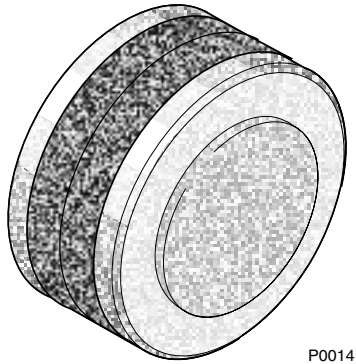


Figure 1-14. Snubber Diffusion/Dust Seal Assembly

d. Snubber Diffusion/Dust Seal Assembly

The snubber diffusion/dust seal assembly, Figure 1-14, is used in applications where an abrasive shield is to be used with a snubber type diffusion element. The dust seal consists of two rings of packing to prevent abrasive dust from collecting inside the abrasive shield.

e. Bypass Probe Options

For processes where the flue gas exceeds the maximum allowable temperature of 1300°F (704°C) a bypass sensor package

can be employed. The bypass system uses an 18 inch (457 mm) or 3 foot (0.92 m) probe mounted externally on the stack or duct. The process or exhaust gases are directed out to the probe through a passive sampling system using inconel tubes. Flue gas flow induces the movement of gases into, through, and out of the bypass unit. The bypass arrangement does not require the use of aspiration air and the gas which flows past the probe is returned to the stack or duct.

The bypass probe package is normally used for process temperatures of 1300°F (704°C) to 2000°F (1094°C). A higher temperature version of the bypass provides for operation at temperatures up to 2500°F (1372°C). In this version the pick up tubes are made of a special high-temperature alloy.

Overall dimensions and mounting details of the American and European bypass systems are shown in Figure 1-15.

f. Probe Mounting Jacket Options

A probe mounting jacket option is available to allow the probe to operate at temperatures of up to 2000°F (1095°C). A separate instruction bulletin is available for this option.

- NOTES:
1. REFERENCE AIR SUPPLY CONNECTION BITE TYPE FITTING (PARKER CPI) FOR 0.250 O.D. TUBING. 2 SCFH AT 3 PSIG MAX. CLEAN DRY AIR REQUIRED. FITTING IS LOCATED ON FAR SIDE.
 2. CALIBRATION AND PURGE GAS CONNECTION. BITE TYPE FITTING (PARKER CPI) 10 SCFH AT 32 PSIG MAX. CALIBRATION GAS REQUIRED.
 3. LAG TO ENSURE GAS TEMPERATURE DOES NOT GO BELOW DEW POINT OR EXCEED 500°C.
 4. INSTALL WITH ANALYZER IN A VERTICALLY DOWNWARDS DIRECTION ONLY.
 5. FLUE GAS OPERATING TEMPERATURE RANGE 1200° TO 1800°F (650° TO 980°C).
 6. RECOMMENDED TWO INCH THK INSULATION. THERMAL CONDUCTIVITY K EQUALS 0.5 FOR INSULATION.
 7. DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN PARENTHESES.

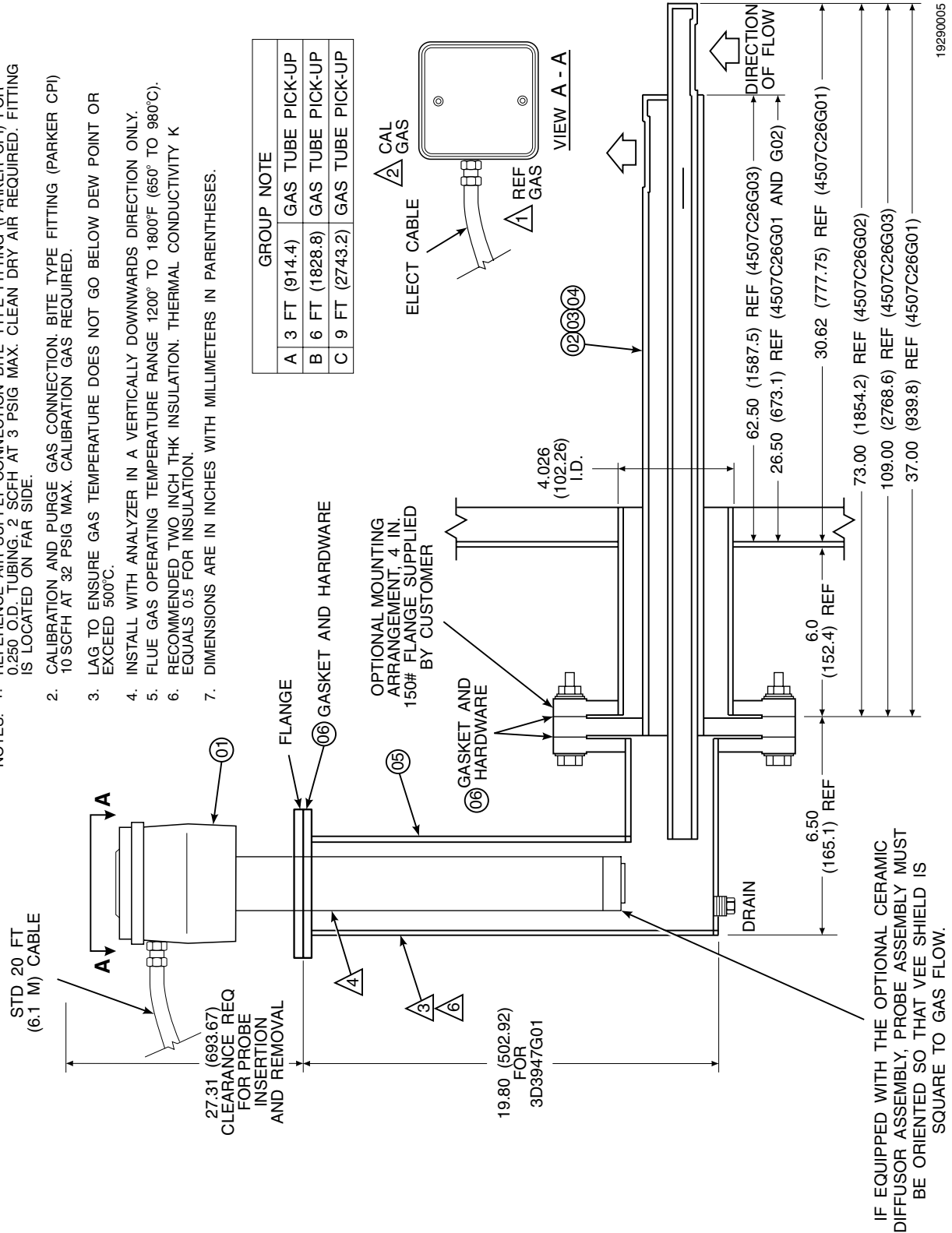


Figure 1-15. Bypass Probe Option (Sheet 1 of 3)

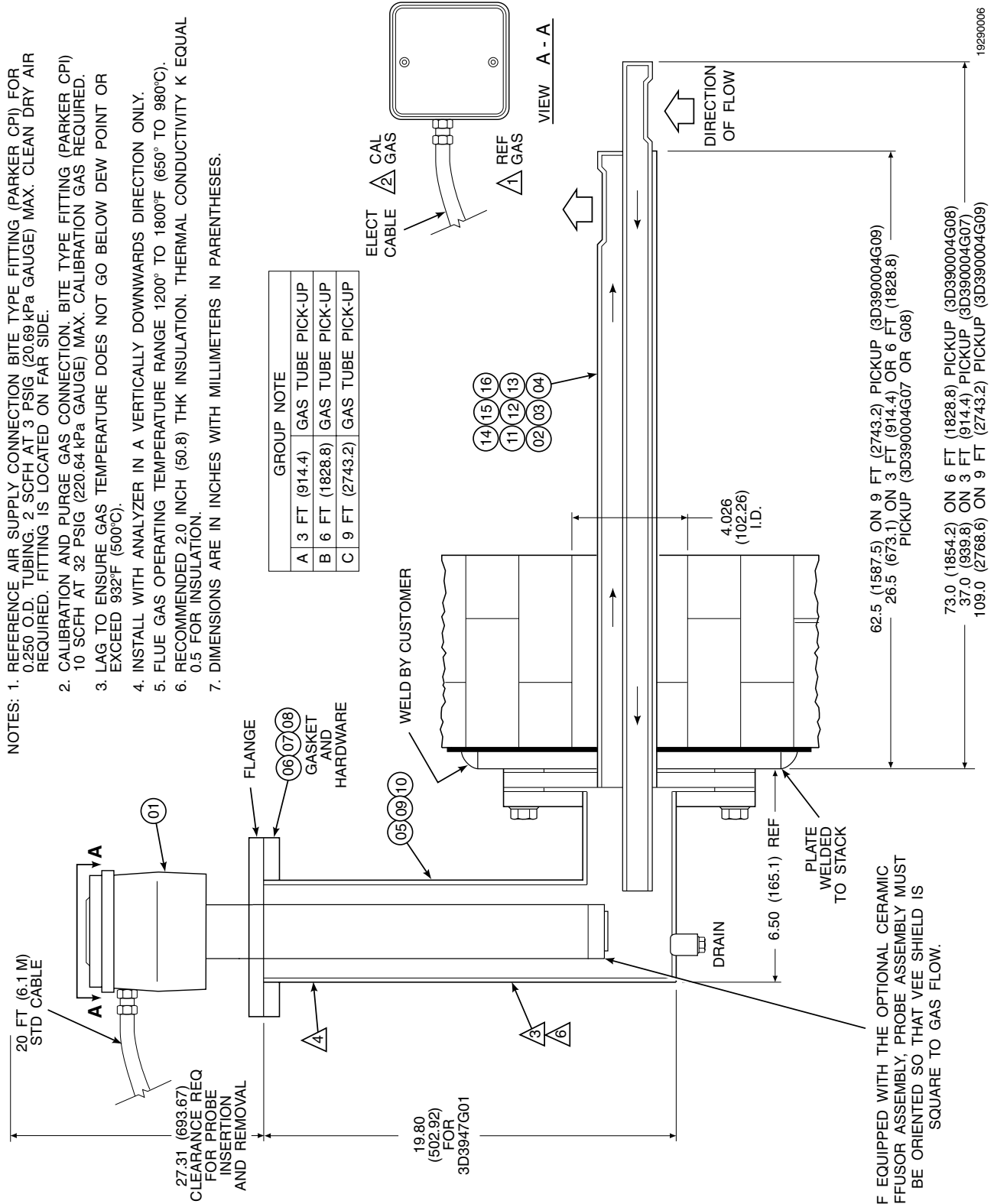


Figure 1-15. Bypass Probe Option (Sheet 2 of 3)

PARTS LIST		PARTS LIST UNITS: INCHES		FLANGE STYLE	ANSI			JIS			DIN			
				GROUP NOTE	A	B	C	A	B	C	A	B	C	
NOTE	PART NAME	DEFINER	SIZE-REFERENCE INFORMATION	MAIL CODE PART NUMBER OR REF DWG	3D39004 GROUP									
ITEM					G01	G02	G03	G04	G05	G06	G07	G08	G09	
01	WORLD CLASS 3000	DWG	PROBE 18 IN.	ORDER FROM MATRIX										
02	GAS PICK-UP	DWG	3 FT	4507C26G01	1									
03	GAS PICK-UP	DWG	6 FT	4507C26G02		1								
04	GAS PICK-UP	DWG	9 FT	4507C26G03			1							
05	ANALYZER HOUSING	DWG	FOR WORLD CLASS 3000 ANSI	3D39005G01	1	1	1							
06	MTG HARDWARE	DWG	FOR ANSI FLANGE	3535B58G01	1	1	1							
07	MTG HARDWARE	DWG	FOR JIS	3535B58G03				1	1	1				
08	MTG HARDWARE	DWG	FOR DIN	3535B58G05							1	1	1	
09	ANALYZER HOUSING	DWG	FOR JIS	3D39005G02				1	1	1				
10	ANALYZER HOUSING	DWG	FOR DIN	3D39005G03							1	1	1	
11	GAS PICK-UP	DWG	FOR JIS 3 FT	4507C26G04				1						
12	GAS PICK-UP	DWG	FOR JIS 6 FT	4507C26G05					1					
13	GAS PICK-UP	DWG	FOR JIS 9 FT	4507C26G06						1				
14	GAS PICK-UP	DWG	FOR DIN 3 FT	4507C26G07							1			
15	GAS PICK-UP	DWG	FOR DIN 6 FT	4507C26G08								1		
16	GAS PICK-UP	DWG	FOR DIN 9 FT	4507C26G09										1

Extended Temperature By-Pass Arrangements (2400°F; 1300°C)

PART NO.	GROUP CODE	DESCRIPTION
1U0571	G01	3' By-pass Package with ANSI bolt pattern.
1U0571	G02	6' By-pass Package with ANSI bolt pattern.
1U0571	G03	9' By-pass Package with ANSI bolt pattern.
1U0571	G04	3' By-pass Package with JIS bolt pattern.
1U0571	G05	6' By-pass Package with JIS bolt pattern.
1U0571	G06	9' By-pass Package with JIS bolt pattern.
1U0571	G07	3' By-pass Package with DIN bolt pattern.
1U0571	G08	6' By-pass Package with DIN bolt pattern.
1U0571	G09	9' By-pass Package with DIN bolt pattern.

Figure 1-15. Bypass Probe Option (Sheet 3 of 3)

SECTION 2 INSTALLATION

WARNING

Before starting to install this equipment, read the "Safety instructions for the wiring and installation of this apparatus" at the front of this Instruction Bulletin. Failure to follow the safety instructions could result in serious injury or death.

WARNING

Install all protective equipment covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

- b. Ensure that the area is clear of obstructions, internal and external, that will interfere with installation. Allow adequate clearance for removal of probe (Figure 2-1).

CAUTION

The junction box temperature must not exceed 300°F (149°C). If used with the Yokogawa ZA8C electronics, junction box temperature is limited to 160°F (71°C). To meet these limits, the user may need to make a heat shield or provide cooling air to the junction box. The temperature limit is due to the thermocouple "cold reference" device.

2-1 LOCATING THE OXYGEN ANALYZER PROBE

The location of the probe in the stack or flue is most important for maximum accuracy in the oxygen analyzing process. The probe must be positioned so that the gas it measures is representative of the process. Best results are normally obtained if the probe is positioned near the center of the duct (40 to 60% insertion). A point too near the edge or wall of the duct may not provide a representative sample because of the possibility of gas stratification. In addition, the sensing point should be selected so that the process gas temperature falls within a range of 50° to 1300°F (10° to 704°C). Figure 2-1 provides mechanical installation references.

- a. Check the flue or stack for holes and air leakage. The presence of this condition will substantially affect the accuracy of the oxygen reading. Therefore, either make necessary repairs or install the probe upstream of any leakage.

2-2 SERVICE REQUIRED

- a. Power input: 115 ±10% Vac single phase, 50 to 60 Hz, 3 amp minimum. (See label.)
- b. Compressed air: 10 psig (69 kPa gauge) minimum, 225 psig (1551 kPa gauge) maximum at 2 scfh (56.6 L/hr) maximum; supplied by one of the following (less than 40 parts-per-million total hydrocarbons). Regulator outlet pressure should be set at 5 psi (35 kPa).
 1. Instrument air - clean, dry.
 2. Bottled standard air with step-down regulator.
 3. Bottled compressed gas mixture (20.95% oxygen in nitrogen).
 4. Other equivalent clean, dry, oil-free air supply.

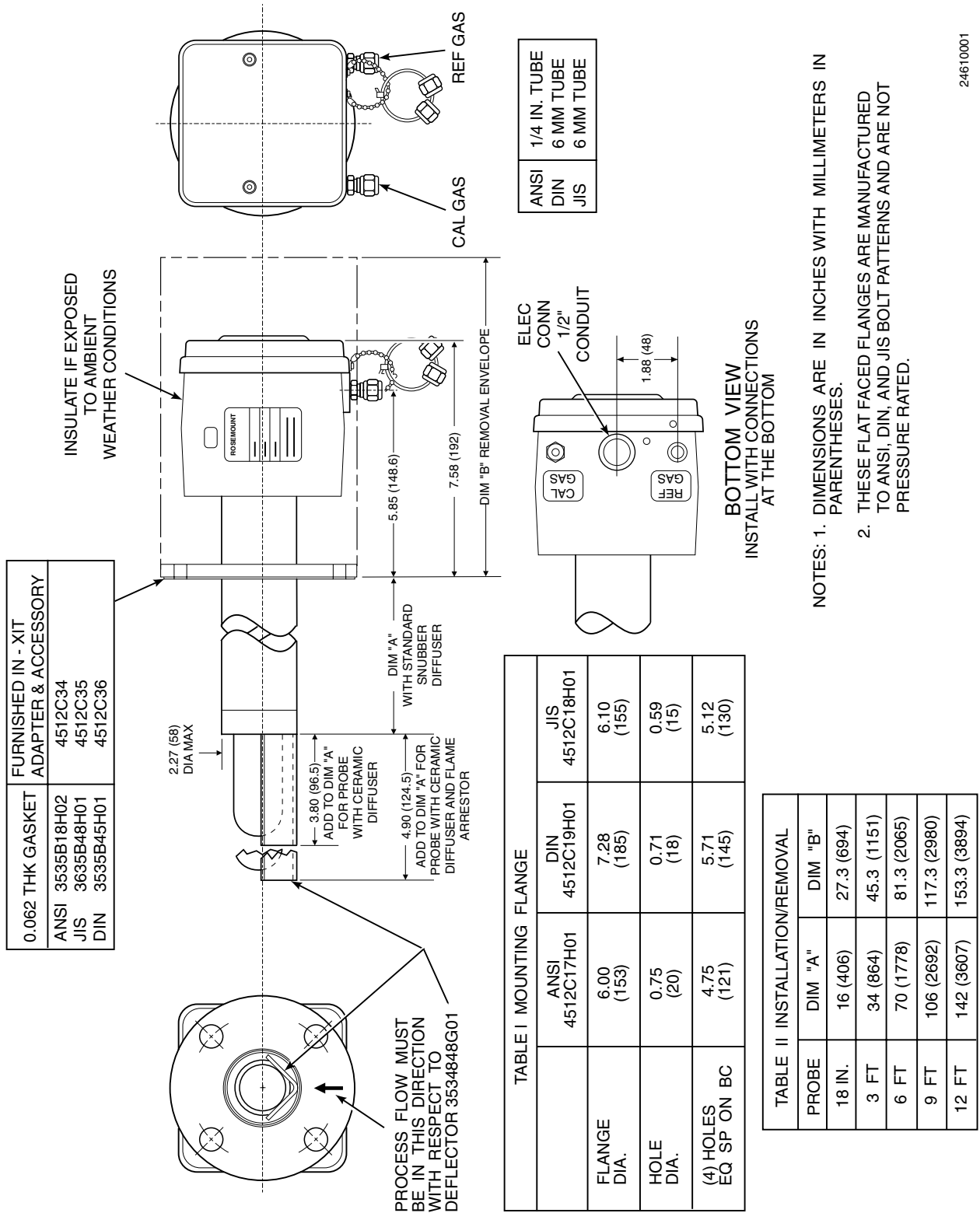


Figure 2-1. Probe Installation (Sheet 1 of 5)

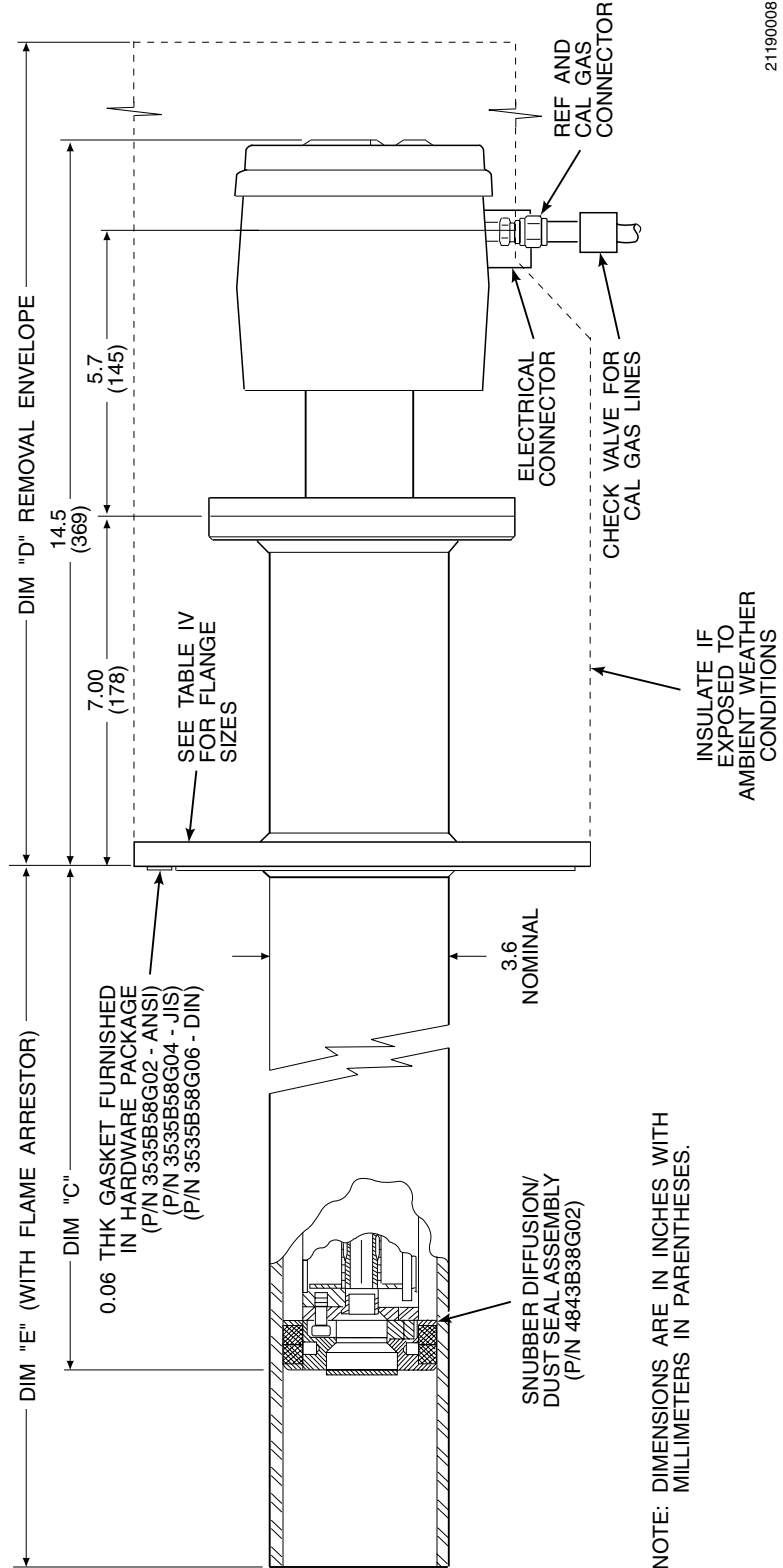
TABLE IV. FLANGE SIZE

	FLANGE DIAMETER	(8) HOLES DIAMETER	BOLT CIRCLE
ANSI*	9.00 (153)	0.75	7.50
JIS*	9.25 (235)	0.75	7.48
DIN*	9.25 (235)	0.945	7.48

* FLANGES ARE MANUFACTURED TO ANSI, DIN, AND JIS BOLT PATTERNS AND ARE FLAT FACED. THESE FLANGES ARE NOT PRESSURE RATED.

TABLE III. REMOVAL/INSTALLATION NOMINAL MEASUREMENTS

	DIM "C"	DIM "D"	DIM "E"
3 FT	27 (686)	45.3 (1151)	31.1 (790)
6 FT	63 (1600)	81.3 (2065)	67.1 (1704)
9 FT	99 (2515)	117.3 (2980)	103.1 (2619)
12 FT	135 (3429)	153.3 (3894)	139.1 (3533)



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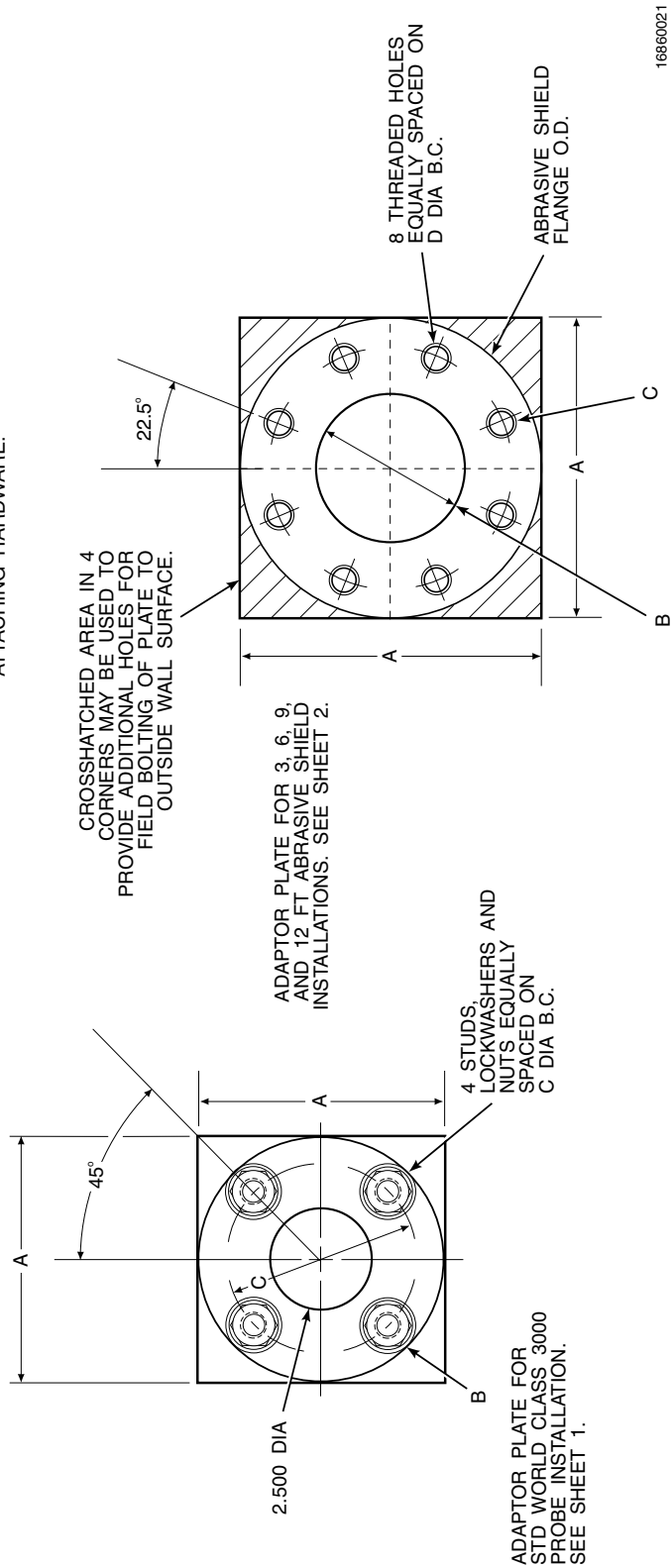
Figure 2-1. Probe Installation (Sheet 2 of 5)

ADAPTOR PLATE OUTLINE

TABLE V. ADAPTOR PLATE DIMENSIONS FOR PROBE			TABLE VI. ADAPTOR PLATE DIMENSIONS FOR ABRASIVE SHIELD			
DIMENSIONS IN. (mm)	ANSI (P/N 4512C34G01)	DIN (P/N 4512C36G01)	JIS (P/N 4512C35G01)	ANSI (P/N 3535B58G02)	DIN (P/N 3535B58G06)	JIS (P/N 3535B58G04)
"A"	6.00 (153)	7.5 (191)	6.50 (165)	9.00 (229)	9.25 (235)	9.25 (235)
"B" THREAD	0.625-11	(M-16 x 2)	(M-12 x 1.75)	4.75 (121)	3.94 (100)	4.92 (125)
"C" DIA	4.75 (121)	5.708 (145)	5.118 (130)	0.625-11	(M-16 x 2)	(M-20 x 2.5)
"D" DIA				7.50 (191)	7.48 (190)	7.894 (200)

NOTE: PART NUMBERS FOR ADAPTOR PLATES INCLUDE ATTACHING HARDWARE.

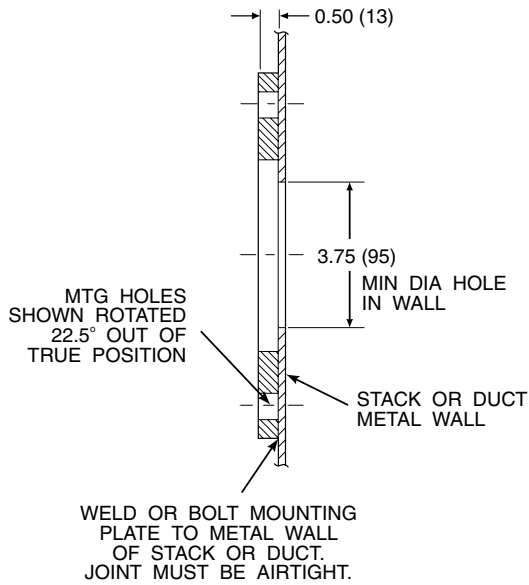
NOTE: PART NUMBERS FOR ADAPTOR PLATES INCLUDE ATTACHING HARDWARE.



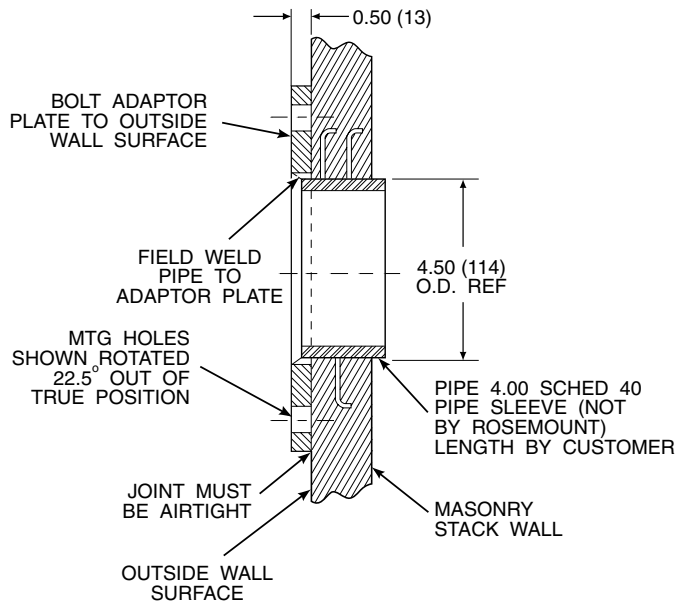
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Figure 2-1. Probe Installation (Sheet 3 of 5)

INSTALLATION FOR METAL WALL STACK OR DUCT CONSTRUCTION

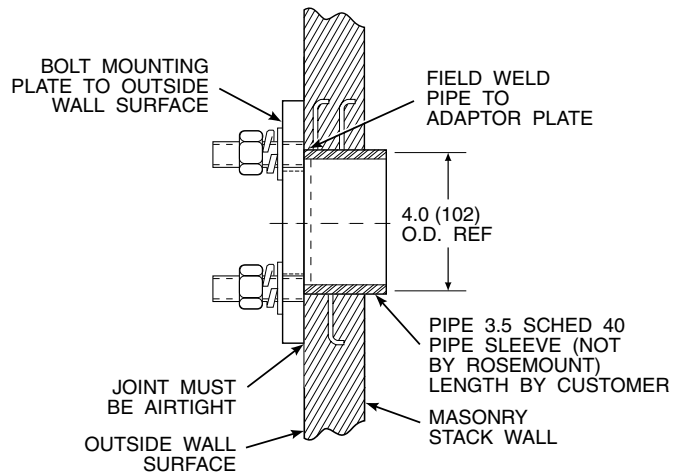
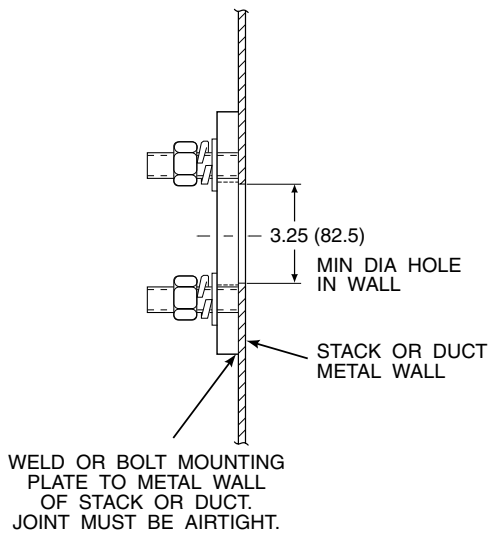


INSTALLATION FOR MASONRY WALL STACK CONSTRUCTION



NOTE: ALL MASONRY STACK WORK AND JOINTS EXCEPT ADAPTOR PLATE NOT FURNISHED BY ROSEMOUNT.

ABRASIVE SHIELD MOUNTING



NOTE: DIMENSIONS IN INCHES WITH MILLIMETERS IN PARENTHESES.

PROBE MOUNTING

P0038

Figure 2-1. Probe Installation (Sheet 4 of 5)

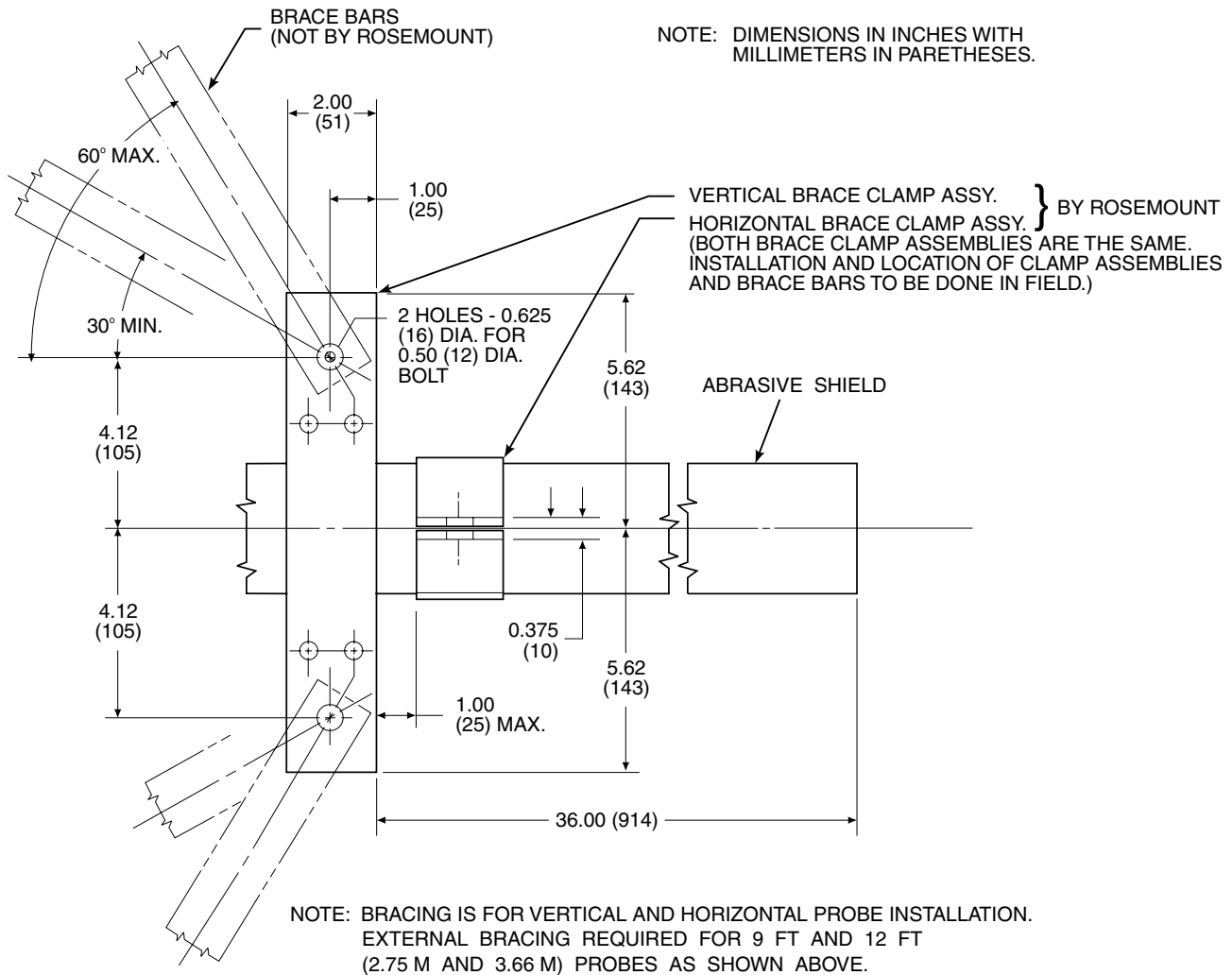


Figure 2-1. Probe Installation (Sheet 5 of 5)

P0039

2-3 MECHANICAL INSTALLATION

NOTE

- a. Ensure that all components are available for installation of the probe. If equipped with the optional ceramic diffusor, check to ensure that it is not damaged. Ensure that the system cable is the required length.
- b. The probe may be installed intact as it is received. It is recommended that you disassemble the adapter plate for each installation.

An abrasive shield is recommended for high velocity particulate in the flue stream (such as those in coal fired boilers, kilns, and recovery boilers). Vertical and horizontal brace clamps are provided for 9 ft and 12 ft (2.75 m and 3.66 m) probes to provide mechanical support of the probe. Refer to Figure 2-1, sheet 5.

- c. Weld or bolt adapter plate (Figure 2-1) onto the duct. Existing stack penetration and mounting hardware may be revised, or new mounting flanges may be installed (see Figure 2-1, sheets 3 and 4).

- d. If using the optional ceramic diffuser element, the vee deflector must be correctly oriented. Before inserting the probe, check the direction of gas flow in the duct. Orient the vee deflector on the probe so that the apex points upstream toward the flow (Figure 2-2). This may be done by loosening the setscrews, and rotating the vee deflector to the desired position. Retighten the setscrews.

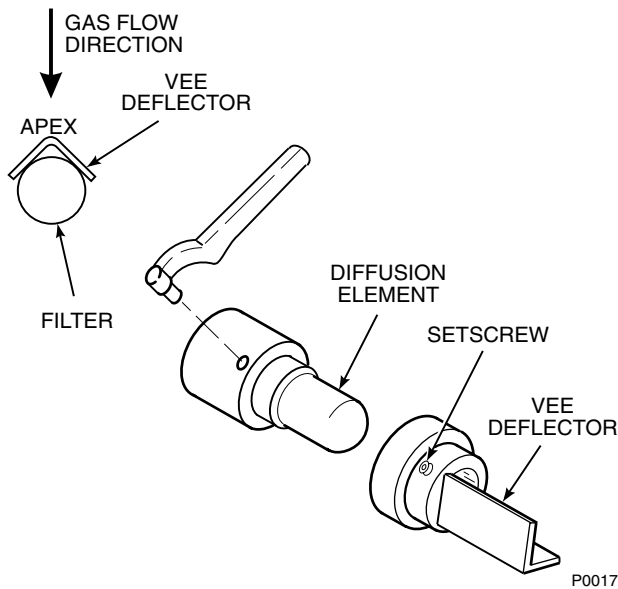


Figure 2-2. Orienting the Optional Vee Deflector

- e. In horizontal installations, the probe cover should be oriented so the system cable drops vertically from the probe cover. In a vertical installation, the system cable can be oriented in any direction.
- f. If the system has an abrasive shield, check the diffusion element dust seal packings. The joints in the two packings must be staggered 180°. Also, make sure that the packings are in the hub grooves as the probe slides into the 15° forcing cone in the abrasive shield.
- g. Insert the probe through the opening in the mounting flange and bolt the unit to the flange. When probe lengths selected are 9 or 12 ft (2.74 or 3.66 m), special brackets are supplied to provide additional support for the probe inside the flue or stack. See Figure 2-1, sheet 5.

2-4 ELECTRICAL INSTALLATION

Figure 2-3 shows the junction box wiring for the direct replacement probe including the 115 V hookup. Consult the electronics manual for the connections to power and the existing signal conditioning electronics.

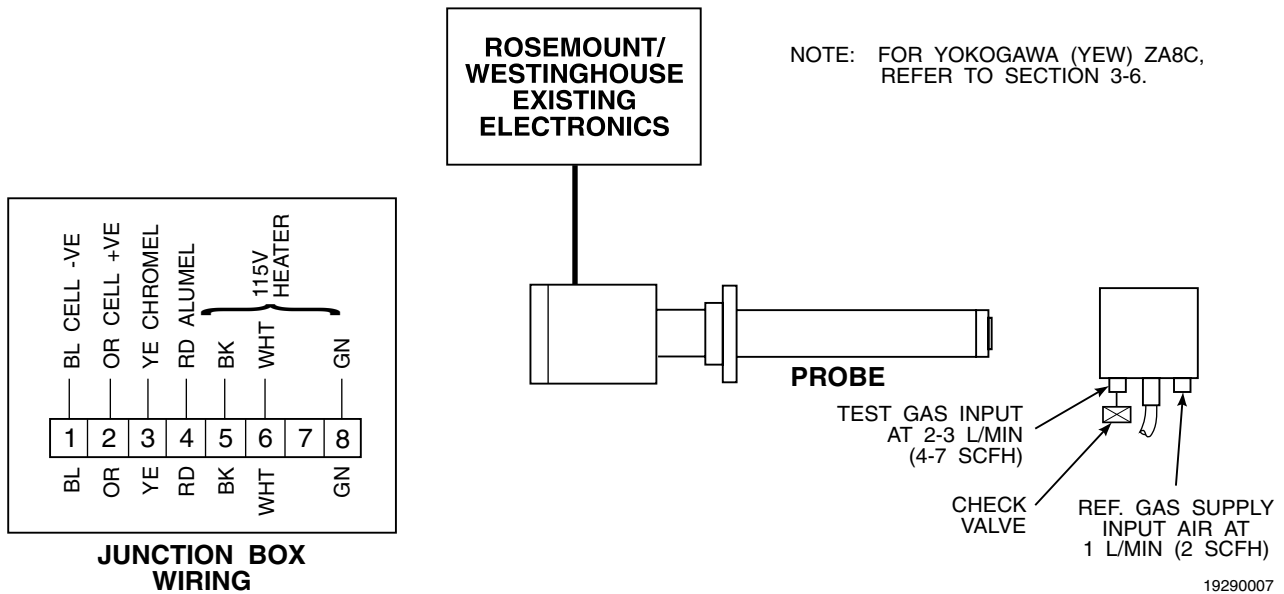


Figure 2-3. Wiring the Direct Replacement Probe

NOTE

Upon completing installation, make sure that the probe is turned on and operating prior to firing up the combustion process. Damage can result from having a cold probe exposed to the process gases.

During outages, and if possible, leave all probes running to prevent condensation and premature aging from thermal cycling.

CAUTION

If the ducts will be washed down during outage, **MAKE SURE** to power down the probes and remove them from the wash area.

SECTION 3 STARTUP

3-1 OVERVIEW

This section covers the setup procedures for the World Class 3000 Oxygen Analyzer. The DR probe can be used with several electronics packages including: Models 218, 218A, 225, 132 (analog and digital), TC200, and ZA8C.

WARNING

Install all protective equipment covers and safety ground leads after setup. Failure to replace covers and ground leads could result in serious injury or death.

For Models 218, 225, and 132 (analog), refer to paragraph 3-2. Additional information can be found in IB-106-101.

For Model 218A, refer to paragraph 3-3. Additional information can be found in IB-106-101A.

For Model TC200, refer to paragraph 3-4. Additional information can be found in IB-107-020.

For Model 132 (digital), refer to paragraph 3-5. Additional information can be found in IB-106-106A.

For Yokogawa Model ZA8C, refer to paragraph 3-6.

3-2 MODELS 218, 225, AND 132 (ANALOG) ELECTRONICS SETUP

Before beginning operation, it is important that the probe heater setpoint of the existing electronics be changed to support the World Class 3000 probe. The setpoint adjustment procedure required for Models 218, 225, and 132 analog electronics is as follows:

- a. Open electronics enclosure.
- b. On temperature controller card, Figure 3-1, connect jumper wire from TP3 to either Pin 2 or Pin 7.
- c. Set voltmeter to read DC millivolts (MV).

- d. Attach voltmeter with positive (+) lead on TP1 and negative (-) on either Pin 2 or 7.

NOTE

The voltage given above is for an ambient (machinery space) temperature of 77°F (25°C). For each degree of ambient temperature above or below 77°F (25°C), add or subtract 0.242 mV from the nominal. Example: at 87°F (31°C), the nominal voltage of -322.3 Mv should be increased (made less negative) by 10×0.242 or 2.42 mV, making the adjusted nominal -319.9 Mv.

- e. Adjust potentiometer M110-1 to read -322.3 millivolts nominal.
- f. Remove voltmeter leads.
- g. Remove jumper wire.

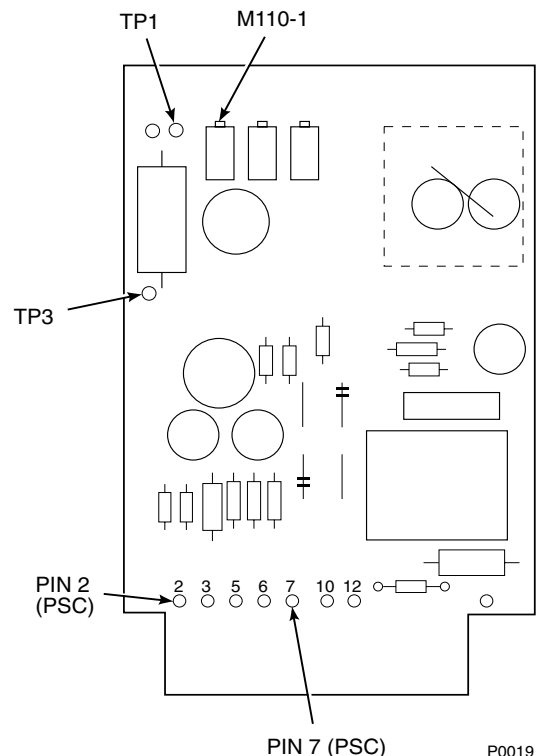


Figure 3-1. Temperature Controller Card Calibration Points

3-3 MODEL 218A ELECTRONICS SETUP

Before beginning operation, it is important that the probe heater setpoint of the existing electronics be changed to support the World Class 3000 probe. To convert the Model 218A Digital Electronics Package for use with the DR probe, an EPROM change is necessary. Remove Main PCB and check back of board to identify unit as G02 or G04. The replacement EPROM needed is as identified below:

	G02	G04
United States	1M03192G01	1M02982G01
United Kingdom	1M03192G02	1M02982G02
Germany	1M03192G03	1M02982G03
France	1M03192G04	1M02982G04
Italy	1M03192G05	1M02982G05

NOTE

The replacement EPROM when using a multiprobe averager unit is 1M02982G10.

To replace the EPROM, proceed as follows:

- a. Shut off and lock out power to the electronics package.
- b. Open electronics enclosure.
- c. On the Main PCB, Figure 3-2, locate and remove old EPROM.
- d. Replace with new EPROM.
- e. Close electronics enclosure and power up system.

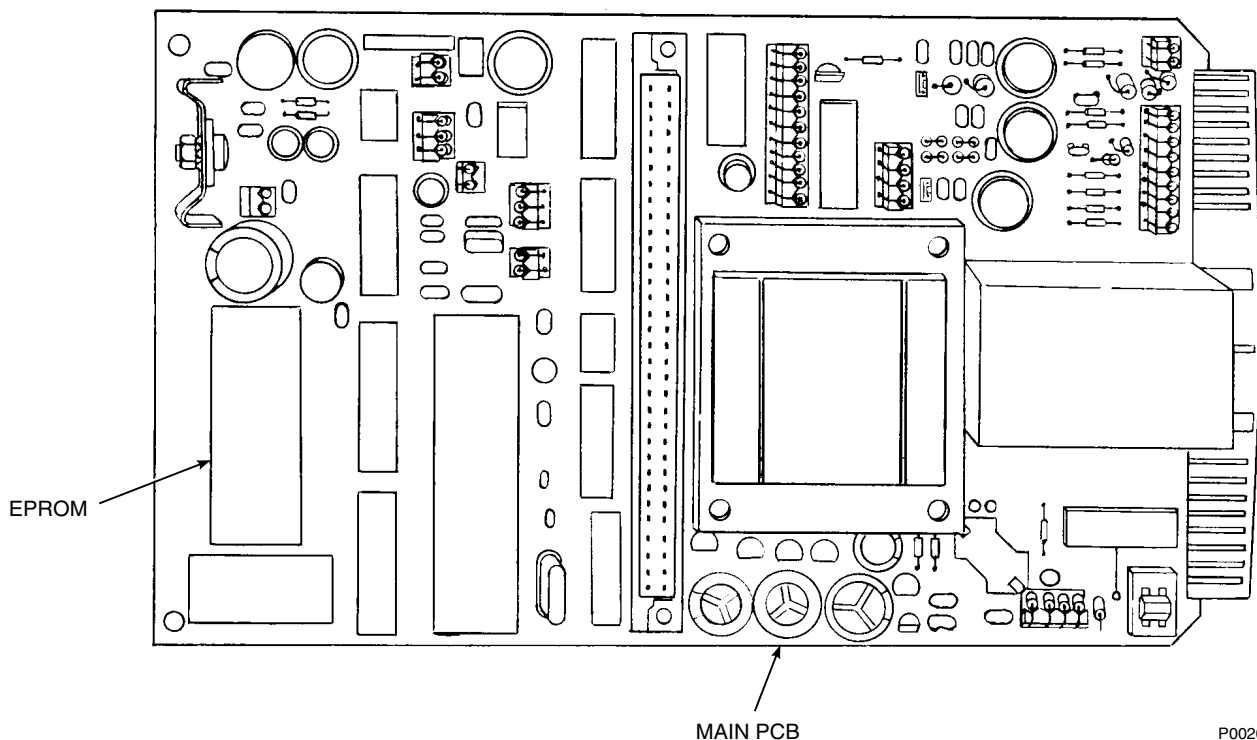


Figure 3-2. Main PCB (Model 218A) EPROM Replacement

P0020

3-4 MODEL TC200 VERITRIM ELECTRONICS SETUP

Before beginning operation, it is important that the probe heater setpoint of the existing electronics be changed to support the World Class 3000 Probe. To convert the Model TC200 Electronics Package for use with the DR probe, an EPROM change is necessary. The replacement EPROM needed is part number 1M03154G02.

a. EPROM Replacement

To replace the EPROM, proceed as follows:

1. Shut off and lock out power to the electronics package.
2. Open electronics enclosure.
3. On the main PCB, Figure 3-3, locate and remove old EPROMs U11 and U12.

4. Replace with new EPROMs (part number 1M03154G02) being careful to install U11 and U12 in their proper locations.
5. Close electronics enclosure and power up system.

b. Heater SetPoint Adjustment

The adjustment procedure required for the Model TC200 Electronics Package is as follows:

1. Open keylocked enclosure to access membrane keyboard.
2. Put controller in PAR (parameter) mode by depressing "LOCK" "▲" "%O₂" "INC" "ACK" in sequence.
3. Depress "ACK" pushbutton to clear display.

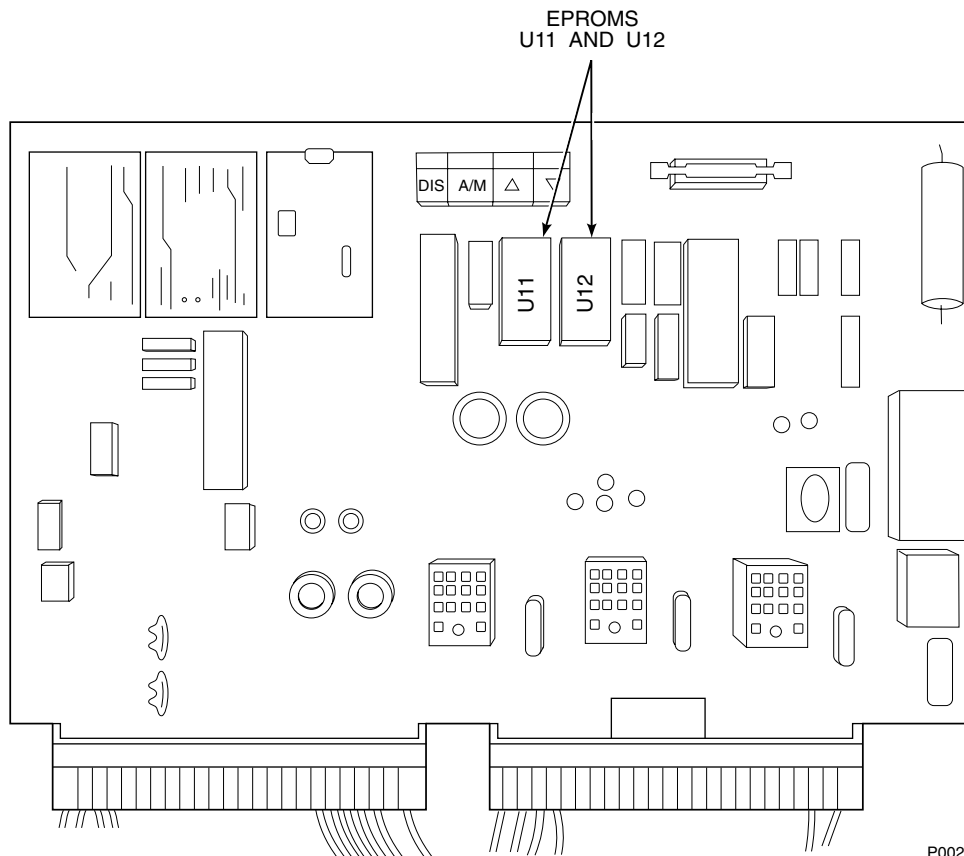


Figure 3-3. Main PCB (Model TC200) EPROM Replacement

4. Press "NUM" pushbutton.
5. Using "INC", "DEC" buttons, display parameter 125.
6. Press "VAL" button.
7. Using "INC", "DEC" buttons, change parameter 125 value to 15.4.
8. Press "ENT" to save new value.

3-5 MODEL 132 DIGITAL ELECTRONICS SETUP

Before beginning operation, it is important that the probe heater setpoint of the existing electronics be changed to support the World Class 3000 Probe. To convert the Model 132 Digital Electronics Package for use with the DR probe, an EPROM change is necessary. The replacement EPROM needed is as identified below:

United States IM03222G01
 United Kingdom
 Germany
 France
 Italy

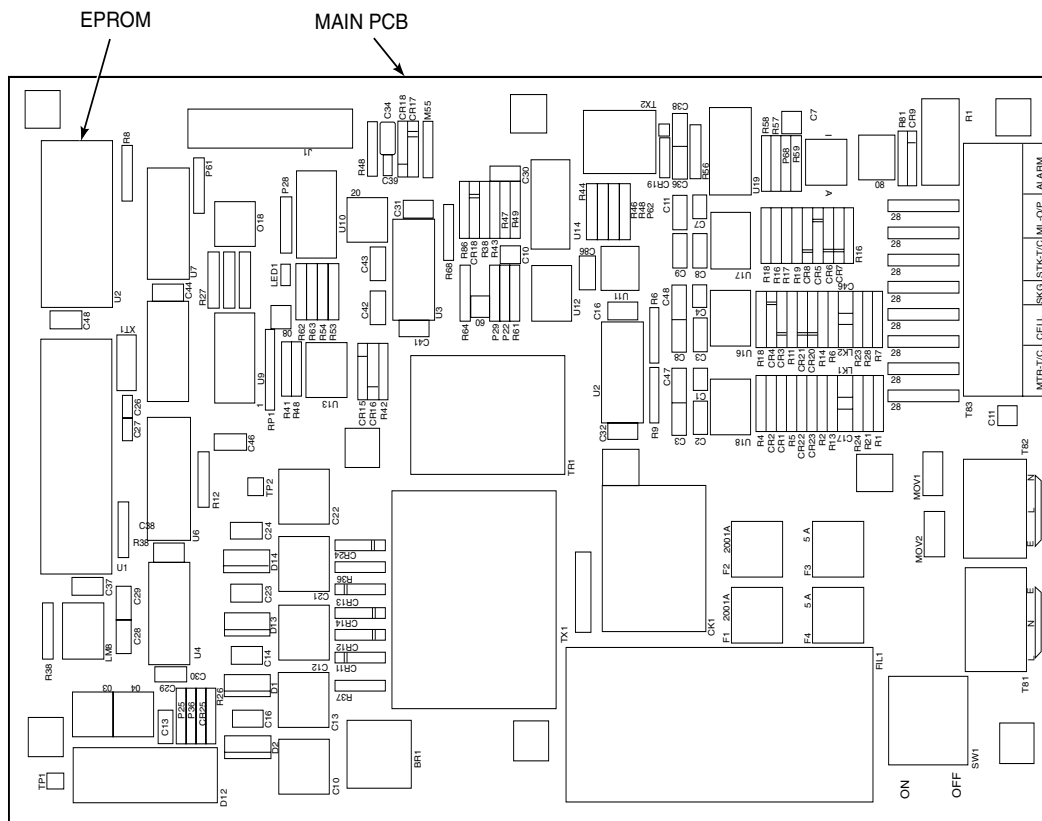
To replace the EPROM, proceed as follows:

- a. Shut off and lock out power to the electronics package.
- b. Open electronics enclosure.
- c. On the Main PCB, Figure 3-4, locate and remove old EPROM.
- d. Replace with new EPROM.
- e. Close electronics enclosure and power up system.

3-6 THE YOKOGAWA ZA8C AND AV8C CONVERTER ELECTRONICS SETUP

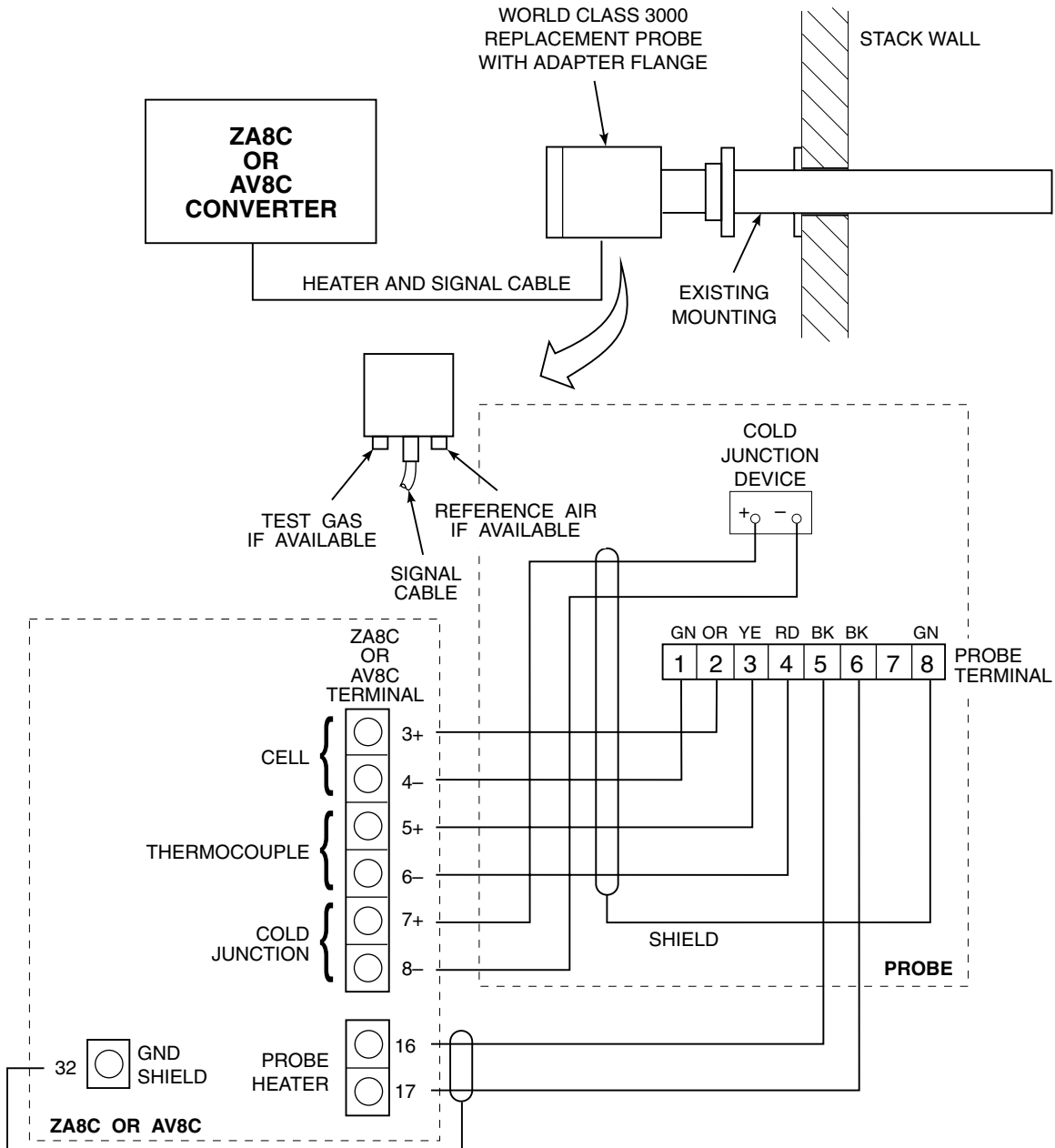
The DR probe can be wired to work with the Yokogawa® ZA8C and AV8C Converters.

Connect the cabling from the ZA8C or AV8C terminal to the probe terminal in the junction box as shown in Figure 3-5.



P0022

Figure 3-4. Main PCB (Model 132) EPROM Replacement



NOTES: 1. HEATER TEMPERATURE SET TO 1380°F (750°C)

2. THE GREATER MASS OF THE WORLD CLASS DIRECT REPLACEMENT PROBE REQUIRES LONGER TIME TO HEAT UP. UPON STARTUP, THE YOKOGAWA ELECTRONICS MAY INDICATE AN ERROR BECAUSE THE PROBE HAS NOT REACHED TEMPERATURE SETPOINT IN THE NORMAL TIME. REMOVE POWER FROM THE YOKOGAWA ELECTRONICS OR PROBE MODULE TO CLEAR THE ERROR, AND RESTORE POWER. THIS PROCEDURE MAY HAVE TO BE REPEATED A COUPLE OF TIMES BEFORE PROBE OPERATING TEMPERATURE IS REACHED.

624023

Figure 3-5. DR Probe Wired to the ZA8C or A V8C Converter

SECTION 4 MAINTENANCE AND SERVICE



NOTE

Upon completing installation, make sure that the probe is turned on and operating prior to firing up the combustion process. Damage can result from having a cold probe exposed to the process gases.

During outages, and if possible, leave all probes running to prevent condensation and premature aging from thermal cycling.

CAUTION

If the ducts will be washed down during outage, MAKE SURE to power down the probes and remove them from the wash area.

4-1 OVERVIEW

This section describes routine maintenance of the oxygen analyzer probe. Spare parts referred to are available from Rosemount. Probe disassembly kit 3535B42G01 contains the required spanner and hex wrenches. Refer to Section 7 for part numbers and ordering information.

The cell replacement kit contains a cell and flange assembly, corrugated seal, setscrews, socket head cap screws, and anti-seize compound. Items are carefully packaged to preserve precise surface finishes. Do not remove items from packaging until they are ready to be used. Spanner wrenches and hex wrenches needed for this procedure are part of an available special tools kit, Table 7-1.

WARNING

Install all protective equipment covers and safety ground leads after equipment repair or service. Failure to install covers and ground leads could result in serious injury or death.

WARNING

Wear heat resistant gloves and clothing to remove probe from stack. Normal operating temperatures of diffusor and vee deflector are approximately 600° to 800°F (316° to 427°C). They could cause severe burns.

4-2 PROBE CALIBRATION

The oxygen analyzer system should be calibrated when commissioned. Under normal circumstances the probe will not require frequent calibration. When calibration is required, follow the procedure described in the Instruction Bulletin applicable to your electronics package.

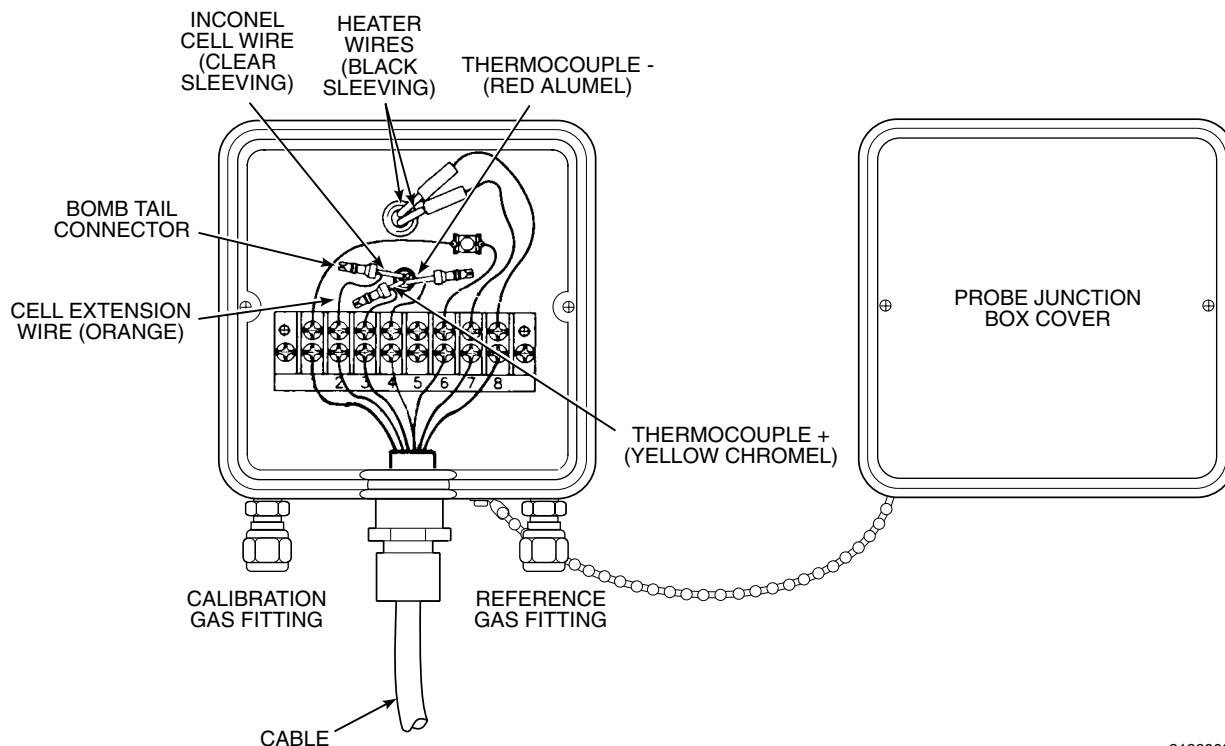
Disconnect and lock out power before working on any electrical components. There is voltage up to 115 Vac.

4-3 CELL REPLACEMENT

This paragraph covers oxygen sensing cell replacement. Do not attempt to replace the cell until all other possibilities for poor performance have been considered. If cell replacement is needed, order cell replacement kit, Table 7-1.

CAUTION

Do not remove cell unless it is certain that replacement is needed. Removal may damage cell and platinum pad. Go through complete troubleshooting procedure to make sure cell needs replacement before removing it.



21220001

Figure 4-1. Cell Wiring Connection

- a. Disconnect and lock out power to electronics. Shut off and disconnect reference gas and calibration gas supplies from junction box, Figure 4-1. Wearing heat resistant gloves and clothing, remove probe assembly from stack carefully and allow to cool to room temperature. Do not attempt to work on unit until it has cooled to a comfortable working temperature.
- b. If the probe uses the standard diffusion element, use a spanner wrench to remove the diffusion element.
- c. If equipped with the optional ceramic diffuser assembly, remove and discard setscrews, Figure 4-2, and remove vee deflector. Use spanner wrenches from probe disassembly kit, Table 7-1, to turn hub free from retainer. Inspect diffusion element. If damaged, replace element.
- d. Loosen four socket head cap screws from the cell and flange assembly and remove the assembly and the corrugated seal. The cell flange has a notch which may be used to gently pry the flange away from the probe. Note that the contact pad inside the probe will sometimes fuse to the oxygen sensing cell. If the cell is fused to the contact pad, push the cell assembly back into the probe (against spring pressure), and quickly twist the cell assembly. The cell and contact pad should separate. **If the contact pad stays fused** to the cell, a new contact/thermocouple assembly must be installed. Disconnect the cell and the thermocouple wires at the probe junction box, and withdraw the cell with the wires still attached (see paragraph 4-5).

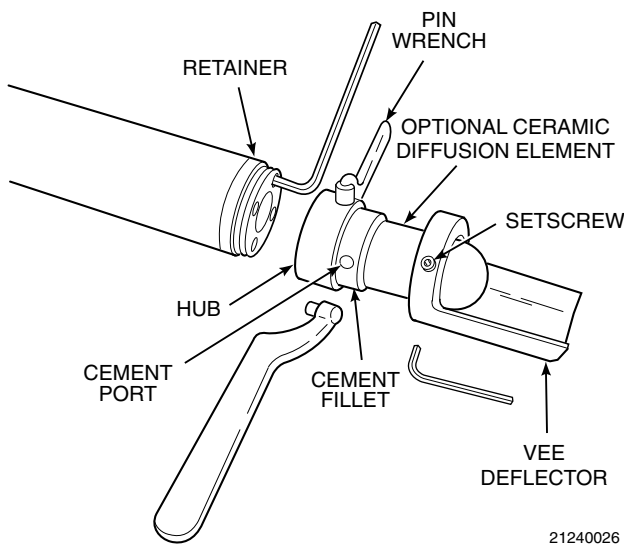


Figure 4-2. Removal of Optional Ceramic Diffusor and Vee Deflector

- e. If contact assembly is damaged, replace contact and thermocouple according to paragraph 4-5, Replacement of Contact and Thermocouple Assembly.
- f. Remove and discard corrugated seal. Clean mating faces of probe tube and retainer. Remove burrs and raised surfaces with block of wood and crocus cloth. Clean threads on retainer and hub.
- g. Rub a small amount of anti-seize on both sides of corrugated seal.
- h. Assemble cell and flange assembly, corrugated seal, and probe tube. Make sure the calibration tube lines up with the calibration gas passage in each component. Apply a small amount of anti-seize compound to screw threads and use screws to secure assembly. Torque to 35 in-lbs (4 N·m).
- i. Apply anti-seize compound to threads of cell assembly, hub, and setscrews. Reinstall hub on cell assembly. Using pin spanner wrenches, torque to 10 ft-lbs (14 N·m). If applicable, reinstall vee deflector, orienting apex toward gas flow. Secure with setscrews and anti-seize compound. Torque to 25 in-lbs (2.8 N·m).

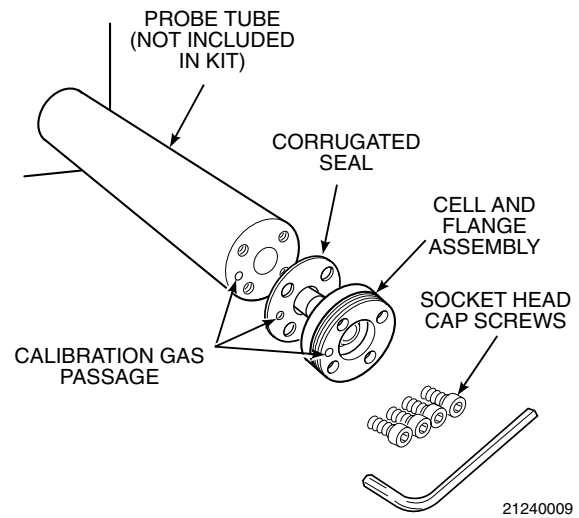


Figure 4-3. Cell Replacement Kit

- j. On systems equipped with an abrasive shield, install dust seal gaskets, with joints 180° apart.
- k. Reinstall probe and gasket on stack flange. If there is an abrasive shield in the stack, make sure dust seal gaskets are in place as they enter 15° reducing cone.
- l. Turn power on to electronics and monitor thermocouple output. It should stabilize at 29.3 ±0.2 mV. Set reference air flow at 2 scfh (56.6 L/hr). After probe stabilizes, calibrate probe per Instruction Bulletin applicable to your electronics package. If new components have been installed, repeat calibration after 24 hours of operation.

4-4 OPTIONAL CERAMIC DIFFUSION ELEMENT REPLACEMENT

a. General

The optional ceramic diffusion element protects the cell from particles in process gases. It does not normally need to be replaced because the vee deflector protects it from particulate erosion. In severe environments the filter may be broken or subject to excessive erosion. Examine the diffusion element whenever removing the probe for any purpose. Replace if damaged.

Damage to the diffusion element may become apparent during calibration. Compare probe response with previous response. A broken diffusion element will cause a slower response to calibration gas.

Hex wrenches needed to remove setscrews and socket head screws in the following procedure are available as part of a special tool kit, Table 7-1.

WARNING

Wear heat resistant gloves and clothing to remove probe from stack. Normal operating temperatures of diffusor and vee deflector are approximately 600° to 800°F (300° to 425°C). These high temperatures can cause severe burns.

Disconnect and lock out power before working on any electrical component. There is voltage up to 115 Vac.

CAUTION

Do not remove the cell unless it is certain that replacement is necessary. Cell cannot be removed for inspection without damaging it. Refer to paragraph 4-3, Cell Replacement.

b. Replacement Procedure.

1. Shut off power to electronics. Disconnect cable conductors and remove cable, Figure 4-1. Shut off and disconnect reference gas and calibration gas supplies from probe head. Wearing heat resistant gloves and clothing, carefully remove probe assembly from stack and allow to cool to room temperature. Do not attempt to work on unit until it has cooled to a comfortable working temperature.
2. Loosen setscrews, Figure 4-2, using hex wrench from special tools kit, Table 7-1, and remove vee deflector. Inspect setscrews. If damaged, replace

with M-6 x 6 stainless setscrews coated with anti-seize compound.

3. On systems equipped with abrasive shield, remove dual dust seal gaskets.
4. Use spanner wrenches from special tool kit, Table 7-1, to turn hub free from retainer.
5. Put hub in vise. Break out old diffusion element with chisel along cement line and 3/8 inch (9.5 mm) pin punch through cement port.
6. Break out remaining diffusion element by tapping lightly around hub with hammer. Clean grooves with pointed tool if necessary.
7. Replace diffusion element, using replacement kit listed in Table 7-1. This consists of a diffusion element, cement, setscrews, anti-seize compound and instructions.
8. Test fit replacement element to be sure seat is clean.

CAUTION

Do not get cement on diffusion element except where it touches the hub. Any cement on ceramic element blocks airflow through element. Wiping wet cement off of ceramic only forces cement into pores.

9. Thoroughly mix cement and insert tip of squeeze bottle into cement port. Tilt bottle and squeeze while simultaneously turning diffusion element into seat. Do not get any cement on upper part of diffusion element. Ensure complete penetration of cement around three grooves in hub. Cement should extrude from opposite hole. Wipe excess material back into holes and wipe top fillet of cement to form a uniform fillet. (A Q-Tip is useful for this.) Clean any excess cement from hub with water.

10. Allow filter to dry at room temperature overnight or 1 to 2 hours at 200°F (93°C).
 11. Wipe a heavy layer of anti-seize compound onto the threads and mating surfaces of the diffusion hub and retainer.
 12. Assemble retainer and diffusion hub with two pin spanner wrenches. Torque to 10 ft-lbs (14 N·m).
 13. On systems equipped with abrasive shield, install dust seal gaskets with joints 180° apart.
 14. Reinstall vee deflector, orienting apex toward gas flow. Apply anti-seize compound to setscrews, and tighten with hex wrench.
 15. Reinstall probe on stack flange.
 16. Turn power on to electronics and monitor thermocouple output. It should stabilize at 29.3 ± 0.2 mV. Calibrate probe per Instruction Bulletin applicable to your electronics package.
- a. Disconnect and lock out power to electronics. Using heat resistant gloves and clothing, remove junction box cover. Squeezing tabs on hose clamps, remove hoses from junction box, Figure 4-4. Remove four screws in corners of the junction box. Pull junction box and inner probe assembly free from probe tube. Set on bench and allow to cool to room temperature.
 - b. Disconnect cell extension wire (orange), thermocouple wire (red alumel), and thermocouple wire (yellow chromel) by cutting bomb tail connections from the terminal strip, Figure 4-1.
 - c. Remove two screws, Figure 4-4, lockwashers, and flat washers that connect junction box to inner probe assembly. Pull heater, V-strut and backplate assembly away from junction box. Inspect all O-rings and insulating gasket; replace if worn or damaged.

4-5 REPLACEMENT OF CONTACT AND THERMOCOUPLE ASSEMBLY

WARNING

Use heat resistant gloves and clothing when removing junction box and inner probe assembly. Do not attempt to work on these components until they have cooled to room temperature. Probe components can be as hot as 800°F (427°C), and can cause severe burns.

Disconnect and lock out power before working on any electrical components. There is voltage up to 115 Vac.

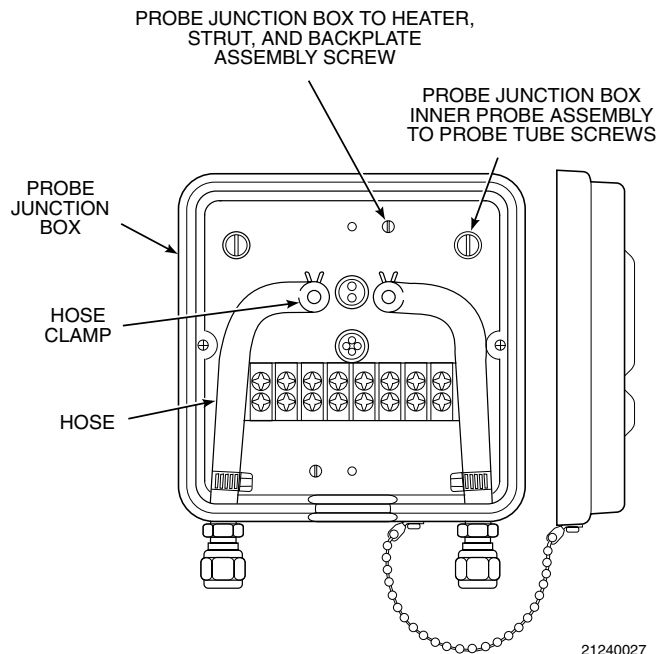


Figure 4-4. Junction Box Mechanical Connections

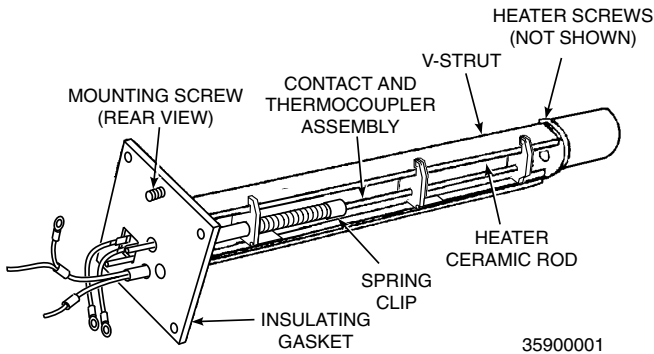


Figure 4-5. Inner Probe Replacement (Heater, V-Strut, and Backplate Assembly)

- d. Use a pencil to mark locations of spring clip on ceramic rod, Figure 4-5.
- e. Pry or squeeze tabs on spring clips, and pull contact and thermocouple assembly out of probe assembly. Retain spring clips and spring; replace if damaged.

CAUTION

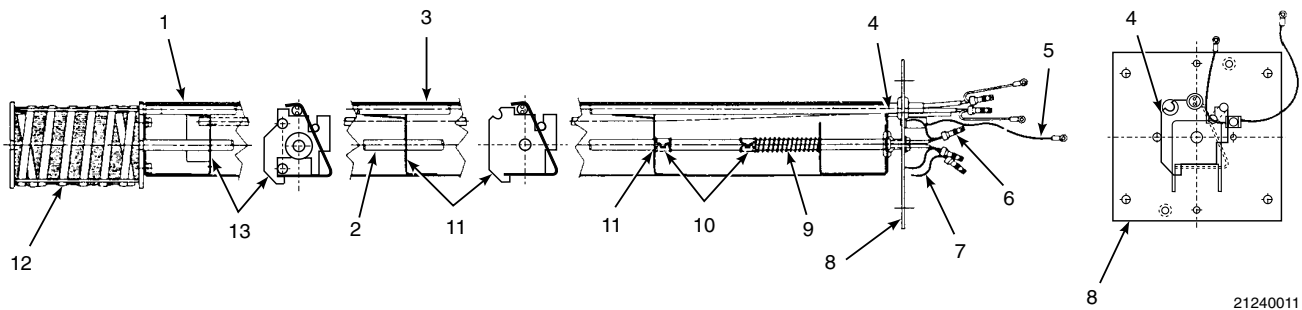
Be very careful when handling contact and thermocouple assembly. The ceramic rod in this assembly is fragile.

- f. While very carefully handling new contact and thermocouple assembly, lay old assembly next to new one. Transfer pencil marks to new rod.
- g. Note wire lengths of old assembly as an aid for trimming new lengths in step (j). Trimming of wires will not always be necessary. Throw away old contact and thermocouple assembly.
- h. Carefully guide new contact and thermocouple assembly through V-strut assembly leaf spring (4, Figure 4-6), spring (9), spring clip (10) (held open by squeezing tabs), and tube supports (11, 13) until spring clip reaches pencil mark.
- i. Reinstall insulating gasket on backplate, replace two screws, O-rings, lockwashers and flat washers connecting junction box to inner probe assembly.

CAUTION

Do not trim new wiring shorter than existing (old) wiring. Excessive wire trim will prevent connections from being properly made and will require new replacement kit.

- j. Trim wires, if necessary, as noted in step (g).



- | | | |
|--------------------------------------|-------------------|--------------------------|
| 1. Heater Ceramic Rod | 5. Ring Lug | 10. Spring Clip Assembly |
| 2. Contact and Thermocouple Assembly | 6. Butt Connector | 11. Common Tube Support |
| 3. Strut | 7. Extension Wire | 12. Heater |
| 4. Leaf Spring | 8. Backplate | 13. Short Tube Support |
| | 9. Spring | |

Figure 4-6. Heater, Strut, and Backplate Assembly (Inner Probe Assembly)

- k. Connect color coded wires to proper terminals as shown in Figure 4-1. Rosemount recommends connecting the thermocouple wires directly to the terminal strip. This is because the junction of different metals at the wires and lugs and at the lugs and the terminal strip could act as additional thermocouple junctions. This could produce a voltage that would affect the thermocouple output signal.

Do not bend wires closer than 1/4 in. (6.4 mm) from end of ceramic rod. Dress wires so they do not touch sides of junction box.

- l. Slide assembled junction box and inner probe assembly into probe tube. To align calibration gas tube with corresponding hole in backplate (A, B, Figure 1-3), insert scribe through hole in backplate and into calibration gas tube. Secure with screws. Reinstall hoses and probe cover.
- m. Power up system. Monitor thermocouple output. It should stabilize at setpoint mV ± 0.2 mV. Recalibrate probe per Instruction Bulletin applicable to your electronics package.

4-6 REPLACEMENT OF HEATER, V-STRUT AND BACKPLATE ASSEMBLY (Inner Probe Assembly; Includes Contact And Thermocouple Assembly).

WARNING

Wear heat resistant gloves and clothing when remove probe head and inner probe assembly. Do not attempt to work on these components until they have cooled to room temperature. Probe components can be as hot as 800°F (427°C). This can cause severe burns.

Disconnect and lock out power before working on any electrical components. There is voltage up to 115 Vac.

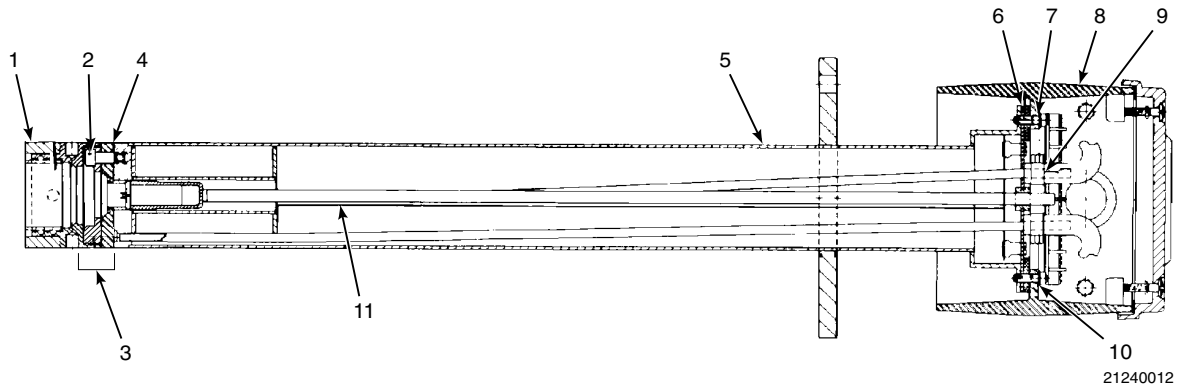
WARNING

There are two styles of the heater/strut inner probe assembly. P/Ns 3D39441G06 through G10 identify the 44 V heater design. P/Ns 3D39441G01 through G05 and G11 through G15 identify the 115 V heater design. Both styles look the same. When replacing a strut, be sure the replacement has the same part number as the original. A stainless steel tag is attached to the inner probe assembly to identify the 115V design. Operating a probe on the wrong heater voltage can cause injury or severe damage to equipment.

NOTE

This replacement may be done without removing the probe from the duct.

- a. Disconnect and lock out power to electronics. Using heat resistant gloves and clothing, remove probe cover. Squeeze tabs on hose clamps and remove hoses from junction box, Figure 4-4. Remove four screws and lockwashers (7 and 10, Figure 4-7) that hold junction box and inner probe assembly to probe tube. Pull junction box and inner probe assembly free from probe tube. Set on bench and allow to cool to room temperature.
- b. Disconnect cell extension wire (orange), thermocouple wire (red alumel), and thermocouple wire (yellow chromel) by cutting bomb tail connections from the terminal strip, Figure 4-1.
- c. Remove two screws, lockwashers, and flat washers that connect junction box to inner probe assembly. Remove and discard inner probe assembly (heater, V-strut, and backplate assembly). Replace with new inner probe assembly. Reinstall screws, lockwashers and flat washers.



- | | | |
|--|--|---------------------------|
| 1. Snubber Diffusion Element | 6. Gasket
4.0 in. (102 mm) x 4.0 in.
x 0.12 in. (3 mm) | 9. Hose Clamp |
| 2. Socket Hd Cap Screw
(0.25 in.-28 x 0.63 (16 mm)) | 7. Fillister Hd Screw
8-32 x 0.5 in. (12.7 mm) | 10. Lockwasher, #8 Split |
| 3. Cell and Flange assembly | 8. Cover Head Assembly | 11. Heater Strut Assembly |
| 4. Corrugated Seal | | |
| 5. Probe Tube Assembly | | |

Figure 4-7. Oxygen Analyzer Probe, Cross-Sectional View

d. Connect color coded wires to proper terminals as shown in Figure 4-1. Rosemount recommends connecting the thermocouple wires directly to the terminal strip. This is because the junction of different metals at the wires and lugs and at the lugs and the terminal strip could act as additional thermocouple junctions. This could produce a voltage that would affect the thermocouple output signal.

Do not bend wires closer than 1/4 in. (6.4 mm) from end of ceramic rod. Dress wires so they do not touch sides of junction box.

e. Slide assembled junction box and inner probe assembly into probe tube. To align calibration gas tube with corresponding hole in backplate (A, B, Figure 1-3), insert aligning tool (included in probe disassembly kit, P/N 3535B42G01) through hole in backplate and into calibration gas tube, while sliding the heater strut into the probe tube. Secure with screws. Reinstall hoses and probe cover.

f. Power up system. Monitor thermocouple output. It should stabilize at set point ± 0.2 mV. Recalibrate probe per Instruction Bulletin applicable to your electronics package.

4-7 CALIBRATION AND REFERENCE GAS LINES FOR HIGH TEMPERATURE - CORROSIVE ENVIRONMENT OPERATION

A high temperature, corrosive environment kit is available when the probe is exposed to these types of operating conditions. The kit includes stainless steel tubing and teflon fittings for inside the junction box. The kit part number is 4843B93G01.

a. Installation Procedure

WARNING

Use heat resistant gloves and clothing when removing junction box and inner probe assembly. Do not attempt to work on these components until they have cooled to room temperature. Probe components can be as hot as 800°F (427°C). This can cause severe burns.

Disconnect and lock out power before working on any electrical components. There is voltage up to 115 Vac.

1. Disconnect and lock out power to digital electronics. Using heat resistant gloves and clothing, remove probe cover. Squeezing tabs on hose clamps, remove hoses from junction box (Figure 4-4).

CAUTION

Do not use sealant when installing the stainless steel tubes. Gas samples may become contaminated.

2. First install the stainless steel tubing on the fitting at the bottom of the junction box. Install the other end of the stainless steel tube onto the tube going to the probe (Figure 4-8).

NOTE

If abrasive conditions of high ash content and high velocity exist, an abrasive shield is recommended. To balance out the wear on the shield, rotate the shield 90° every time the probe is powered down for service.

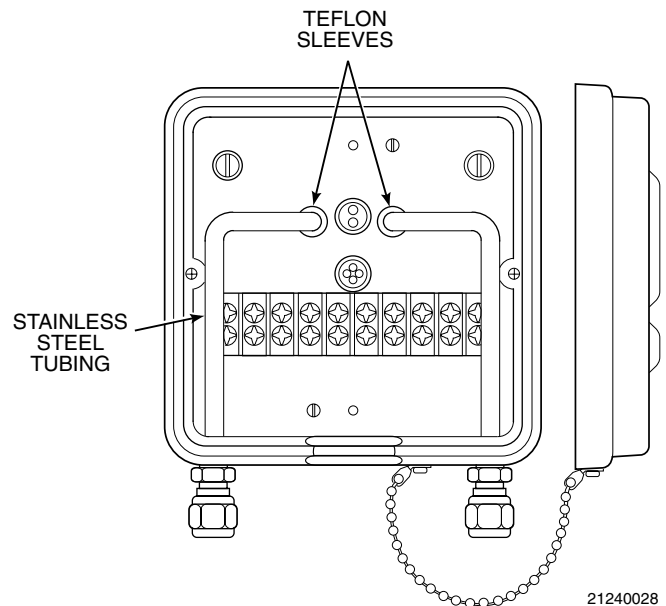


Figure 4-8. High Temperature – Corrosive Environment Kit

SECTION 5 TROUBLESHOOTING

5-1 OVERVIEW

Troubleshooting for the oxygen analyzer system is broken down to the main component level. In addition to the information in this section, instruction bulletins for individual models also discuss troubleshooting.

WARNING

Install all protective equipment covers and safety ground leads after troubleshooting. Failure to replace covers and ground leads could result in serious injury or death.

For Models 218, 225, and 132 (analog), refer to IB-106-101.

For Model 218A, refer to IB-106-101A.

For Model TC200, refer to IB-107-020.

For Model 132 (digital), refer to IB-106-106A.

For Yokogawa (YEW) ZA8C Converter, refer to original converter documentation.

5-2 PROBE TROUBLESHOOTING

a. Probe Faults

Listed below are the five symptoms of probe failure.

1. The system does not respond to changes in the oxygen concentration.
2. The system responds to oxygen changes but does not give the correct indication.
3. The system does not give an acceptable indication of the value of the oxygen test gas being applied during calibration.
4. The probe takes a long time to return to flue gas value after the calibration gas is turned off.
5. The probe heater temperature is unstable.

- b. Table 5-1 provides a guide to fault finding for the above symptoms.

Table 5-1. Fault Finding

SYMPTOM	CHECK	FAULT	REMEDY
<p>1. No response to oxygen concentration change when:</p> <p>Heater is cold and TC mV output is less than setpoint</p> <p>Heater is hot and T/C mV output is at set point ± 0.2 mV</p>	<p>Thermocouple continuity</p> <p>Heater cold resistance should be 67 ohm to 77 ohm</p> <p>Triac O/P to heater</p> <p>Recorder chart</p> <p>Cell mV input to electronics and cell mV at probe head</p>	<p>Thermocouple failure</p> <p>Heater failure</p> <p>Failure of electronics</p> <p>Recorder failure</p> <p>No cell mV at probe when test gas applied</p> <p>Probe cell mV OK but no input to electronics</p> <p>Cell mV satisfactory both at junction box and input to electronics - failure of electronics</p>	<p>Replace thermocouple or return probe to Rosemount.</p> <p>Replace heater or return probe to Rosemount.</p> <p>Check electronics package.</p> <p>See Recorder Instruction Manual.</p> <p>Replace cell or return probe to Rosemount.</p> <p>Check out cable connection.</p> <p>Check electronics package.</p>
<p>2. System responds to oxygen concentration changes <u>but</u> does not give correct indication</p> <p>Good response, with incorrect indication</p>	<p>Recorder or remote indicator</p> <p>System calibration</p> <p>Probe mounting and condition of duct</p> <p>Cell mV input to electronics</p>	<p>Calibration error</p> <p>Calibration error</p> <p>Air ingress into duct</p> <p>Failure of electronics</p>	<p>Recalibrate recorder or indicator. Reference Recorder Instruction Manual.</p> <p>Recalibrate system.</p> <p>Stop air leaks or resite probe.</p> <p>Check electronics package.</p>
<p>3. Probe does not give accurate indication of applied test gas</p>	<p>Test gas input port</p> <p>Ceramic diffusion element</p> <p>Blocked port</p>	<p>Blocked port</p> <p>Diffusion element cracked, broken, or missing</p>	<p>Clean port. If the flue gas is condensing in the test gas line, insulate the back of the probe. Make sure that the test gas line is capped between calibrations, or a check valve is installed.</p> <p>Replace diffusion element.</p>

Table 5-1. Fault Finding (continued)

SYMPTOM	CHECK	FAULT	REMEDY
4. Probe takes a long time to return to flue gas value after calibration gas is turned off	Plugged diffusion element	Plugged diffusion element	Change diffusion element or snubber diffusion element.
5. Probe heater temperature unstable	Proper voltage heater is installed	Wrong heater	Change heater to proper voltage.

SECTION 6 RETURN OF MATERIAL

6-1 If factory repair of defective equipment is required, proceed as follows:

- a. Secure a return authorization number from a Rosemount Analytical Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted.

In no event will Rosemount be responsible for equipment returned without proper authorization and identification.

- b. Carefully pack defective unit in a sturdy box with sufficient shock absorbing material to insure that no additional damage will occur during shipping.
- c. In a cover letter, describe completely:
 - 1. The symptoms from which it was determined that the equipment is faulty.
 - 2. The environment in which the equipment has been operating (housing, weather, vibration, dust, etc.).
 - 3. Site from which equipment was removed.
 - 4. Whether warranty or nonwarranty service is requested.

5. Complete shipping instructions for return of equipment.

6. Reference the return authorization number.

- d. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in Rosemount Return Authorization, prepaid, to:

Rosemount Analytical Inc.
RMR Department
1201 N. Main Street
Orrville, Ohio 44667

If warranty service is requested, the defective unit will be carefully inspected and tested at the factory. If failure was due to conditions listed in the standard Rosemount warranty, the defective unit will be repaired or replaced at Rosemount's option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

SECTION 7 REPLACEMENT PARTS

Table 7-1. Replacement Parts for Probe

FIGURE and INDEX No.	PART NUMBER	DESCRIPTION
4-5	3D39441G01 ¹	Heater, V-Strut, and Backplate Assembly (115 V), 18 in. (45.6 cm)
4-5	3D39441G02 ¹	Heater, V-Strut, and Backplate Assembly (115 V), 3 ft (0.9 m)
4-5	3D39441G03 ¹	Heater, V-Strut, and Backplate Assembly (115 V), 6 ft (1.8 m)
4-5	3D39441G04 ¹	Heater, V-Strut, and Backplate Assembly (115 V), 9 ft (2.7 m)
4-5	3D39441G05 ¹	Heater, V-Strut, and Backplate Assembly (115 V), 12 ft (3.6 m)
4-5	3D39441G11 ¹	Heater, V-Strut, and Backplate Assembly, 18 in. (45.6 cm) (For use with YEW electronics)
4-5	3D39441G12 ¹	Heater, V-Strut, and Backplate Assembly, 3 ft (0.9 m) (For use with YEW electronics)
4-5	3D39441G13 ¹	Heater, V-Strut, and Backplate Assembly, 6 ft (1.8 m) (For use with YEW electronics)
4-5	3D39441G14 ¹	Heater, V-Strut, and Backplate Assembly, 9 ft (2.7 m) (For use with YEW electronics)
4-5	3D39441G15 ¹	Heater, V-Strut, and Backplate Assembly, 12 ft (3.6 m) (For use with YEW electronics)
4-6, 2	3534B56G04 ²	Contact and Thermocouple Assembly, 18 in. (45.6 cm)
4-6, 2	3534B56G05 ²	Contact and Thermocouple Assembly, 3 ft (0.9 m)
4-6, 2	3534B56G06 ²	Contact and Thermocouple Assembly, 6 ft (1.8 m)
4-6, 2	3534B56G07 ²	Contact and Thermocouple Assembly, 9 ft (2.7 m)
4-6, 2	3534B56G08 ²	Contact and Thermocouple Assembly, 12 ft (3.6 m)
4-6, 2	4513C61G01 ²	Contact and Thermocouple Assembly, 18 in. (45.6 cm) (For use with YEW electronics)
4-6, 2	4513C61G02 ²	Contact and Thermocouple Assembly, 3 ft (0.9 m) (For use with YEW electronics)
4-6, 2	4513C61G03 ²	Contact and Thermocouple Assembly, 6 ft (1.8 m) (For use with YEW electronics)
4-6, 2	4513C61G04 ²	Contact and Thermocouple Assembly, 9 ft (2.7 m) (For use with YEW electronics)
4-6, 2	4513C61G05 ²	Contact and Thermocouple Assembly, 12 ft (3.6 m) (For use with YEW electronics)
4-6, 2	3D39003G01 ³	Abrasive Shield Assembly, 3 ft (0.9 m)
4-6, 2	3D39003G02 ³	Abrasive Shield Assembly, 6 ft (1.8 m)
1-9	3D39003G07 ³	Abrasive Shield Assembly, 9 ft (2.7 m)
1-9	3D39003G08 ³	Abrasive Shield Assembly, 12 ft (3.6 m)
1-9	4847B61G01	Cell Replacement Kit, ANSI w/No lead wire
1-9	4847B61G02	Cell Replacement Kit, ANSI 18 in. (45.6 cm)
4-3	4847B61G03	Cell Replacement Kit, ANSI 3 ft (0.9 m)
4-3	4847B61G04	Cell Replacement Kit, ANSI 6 ft (1.8 m)
4-3	4847B61G05	Cell Replacement Kit, ANSI 9 ft (2.7 m)
4-3	4847B61G06	Cell Replacement Kit, ANSI 12 ft (3.6 m)

Table 7-1. Replacement Parts for Probe (continued)

FIGURE and INDEX No.	PART NUMBER	DESCRIPTION
4-3	4847B61G07	Cell Replacement Kit, JIS, w/No lead wire
4-3	4847B61G08	Cell Replacement Kit, JIS 18 in. (45.6 cm)
4-3	4847B61G09	Cell Replacement Kit, JIS 3 ft (0.9 m)
4-3	4847B61G10	Cell Replacement Kit, JIS 6 ft (1.8 m)
4-3	4847B61G11	Cell Replacement Kit, JIS 9 ft (2.7 m)
4-3	4847B61G12	Cell Replacement Kit, JIS 12 ft (3.6 m)
4-3	4847B61G13	Cell Replacement Kit, DIN w/No lead wire
4-3	4847B61G14	Cell Replacement Kit, DIN 18 in. (45.6 cm)
4-3	4847B61G15	Cell Replacement Kit, DIN 3 ft (0.9 m)
4-3	4847B61G16	Cell Replacement Kit, DIN 6 ft (1.8 m)
4-3	4847B61G17	Cell Replacement Kit, DIN 9 ft (2.7 m)
4-3	4847B61G18	Cell Replacement Kit, DIN 12 ft (3.6 m)
4-3	3535B42G01	Probe Disassembly Kit
1-13	3535B18G01	Ceramic Diffusor Assembly
1-11	3535B60G01	Ceramic Diffusor Dust Seal Hub Assembly (For use with Abrasive Shield)
1-13	4841B03G02	Stainless Steel Diffusor Assembly
1-12	3535B63G01	Flame Arrestor Diffusor Dust Seal
1-14	3535B62G01	Flame Arrestor Diffusor
4-2	3535B48G01	Vee Deflector Assembly (For use with standard ceramic or dust seal type diffusors)
4-2	6292A74G02	Diffusion Element Replacement Kit
2-1	1537B70G03	Horizontal and Vertical Brace Clamp Assembly, 9 and 12 foot (2.7 and 3.6 m) probe
4-8	4843B93G01	High Temperature - Corrosive Environment Kit
	4843B37G01	Snubber Diffusion Assembly
1-10	4843B38G01	Dust Seal/Snubber Diffusion Assembly

¹Heater, V-strut, and backplate assembly includes contact and thermocouple assembly.

²Contact and thermocouple assembly includes platinum pad and inconel wire.

³Abrasive shield assembly includes accessories necessary for its use and a mounting plate and gasket.

SECTION 8

INDEX

This index is an alphabetized listing of parts, terms, and procedures having to do with the Hazardous Area Oxygen/Combustibles Transmitter. Every item listed in this index refers to a location in the manual by one or more page numbers.

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Instruction Manual

IB-106-300DR Rev. 3.3

February 2000

World Class 3000

World Class 3000 Probe

Part no. _____

Serial no. _____

Order no. _____

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