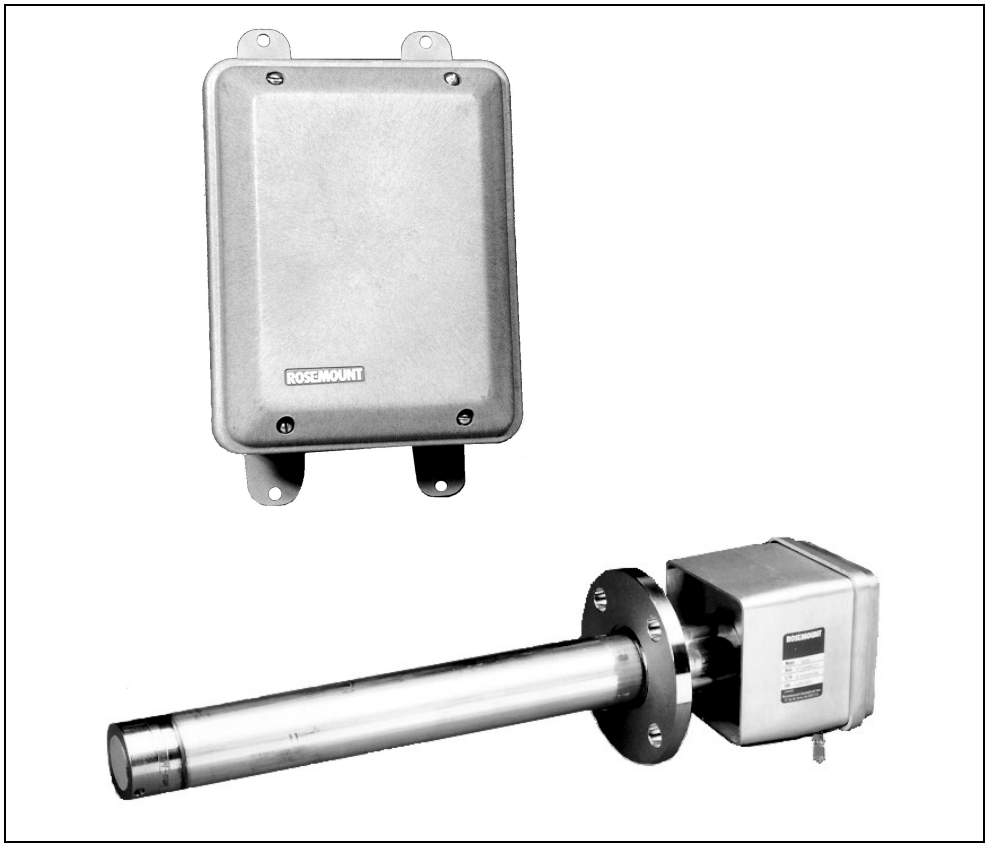
Instruction Bulletin
106-300NE Rev. 3.4
May 2000

World Class 3000

Oxygen Analyzer with HPS Heater Power Supply Field Module (for use with Existing Signal Conditioning Electronics)



ROSEMOUNT® Analytical

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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 October, 1995 Rev. 3

Page	Summary
Page 1-1	Updated art to reflect new probe configuration.
Page 1-3	Updated art to reflect new probe configuration.
Page 1-4	Updated art to reflect new probe configuration.
Page 2-1	Update installation procedure to include optional ceramic diffusor and vee deflector.
Page 2-2	Updated art and dimensions to reflect new probe configurations.
Page 2-3	Updated art and dimensions to reflect new probe configurations.
Page 2-8	Updated art and dimensions to reflect new probe configurations.

Effective June, 1996 Rev. 3.1

Page	Summary
Page 1-3	Added ambient air note.
Page 2-3	Updated Probe Installation, Figure 2-1, sheets 1 and 2 of 5.

Effective January, 1997 Rev. 3.2

Page	Summary
Page iii	Added "Safety instructions for the wiring and installation of this apparatus".
Page 2-1	Added one WARNING to read new safety instructions and another WARNING regarding protective covers and grounds.
Page 2-9	Added WARNING regarding protective covers and grounds and added NOTE regarding HPS fuse locations and specifications.
Page 2-11	Added NOTE regarding HPS fuse specifications to Figure 2-7.
Page 3-1	Added WARNING regarding protective covers and grounds.
Page 4-1	Added WARNING regarding protective covers and grounds.
Page 7-1	Added fuses to index listing.

Effective May, 1997 Rev. 3.3

Page	Summary
Page P-2	Added safety sheets.

Effective February, 1998 Rev. 3.4

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

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

CAUTION

If the HPS 3000 and World Class 3000 probe are used with any of the following model electronics; 218, 225, 218A, and TC200, read appropriate set point adjustment in Instruction Bulletin (IB) 106-300NE to prevent damage to the World Class 3000 probe.

PREFACE

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

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.

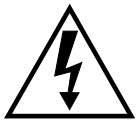
3. Mains supply cords should comply with the requirements of IEC227 or IEC245.

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

1-1 COMPONENT CHECKLIST OF TYPICAL SYSTEM (PACKAGE CONTENTS)

A typical Rosemount World Class 3000 Oxygen Analyzer with HPS 3000 Heater Power Supply package should contain the items shown in Figure 1-1. Record the Part Number, Serial Number, and Order Number for each component of your system in the table located on the first page of this manual.

1-2 OVERVIEW

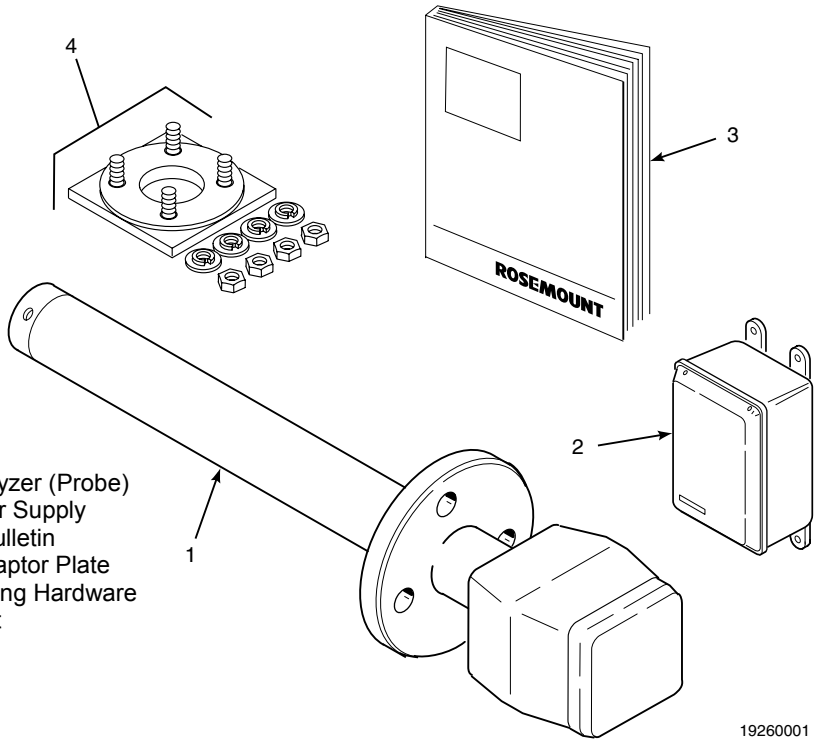
a. Scope

This Instruction Bulletin has been designed to supply details needed to install, start up, and troubleshoot the Rosemount World Class 3000 Oxygen Analyzer with HPS 3000 Heater Power Supply Field Module.

The Heater Power Supply allows the World Class 3000 Oxygen Analyzer (Probe) to be interfaced to a number of different and earlier model electronic 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.

b. System Description

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 and performs its task without the use of a sampling system.



1. Oxygen Analyzer (Probe)
2. Heater Power Supply
3. Instruction Bulletin
4. Mounting Adaptor Plate with Mounting Hardware and Gasket

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 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 and there are unequal oxygen concentrations across the cell, oxygen ions will travel from the high partial pressure of oxygen side to the low partial pressure side of the cell. The resulting logarithmic output voltage is approximately 50 mV per decade. Because the magnitude of the output is proportional to the logarithm of the inverse of the sample of the oxygen partial pressure, the output signal increases as the oxygen concentration of the sample gas decreases. This characteristic enables the oxygen analyzer to provide exceptional sensitivity at low oxygen concentrations.

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 equipment discussed in this manual consists of two major components; the oxygen analyzer (probe), and the heater power supply.

Probes are available in five length options, giving the user the flexibility to use an in situ penetration appropriate to the size of the stack or duct. The options on length are 18 inches (457 mm), 3 feet (0.91 m), 6 feet (1.83 m), 9 feet (2.74 m), or 12 feet (3.66 m).

The heater power supply (HPS) provides an interface to the electronics package and contains a transformer for supplying proper voltage to the 44 Vac and 115 Vac probe heaters. The enclosure has been designed to meet NEMA 4X (IP56) specifications for water tightness; an optional enclosure to meet Class 1, Division 1, Group B (IP56) explosion-proof is also available.

The oxygen analyzer is connected to the HPS and electronics package using seven wires housed within the connecting system cable.

d. Features

1. Unique and patented cell protection action that automatically protects sensor cell when analyzer detects reducing atmospheres.
2. Output voltage and sensitivity increase as the oxygen concentration decreases.
3. In situ, non-sampling analyzer.
4. Field replaceable cell.
5. Analyzer constructed of rugged 316 LSS for all wetted parts.

6. Suitable for use in temperatures up to 1300°F (700°C).

7. Heater power supply allows World Class 3000 probe to be interfaced with existing analog and 218A digital electronic packages.

8. Optional explosion-proof HPS enclosure allows use in hazardous gas areas.

e. Handling the Oxygen Analyzer

WARNING

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 with Heater Power Supply Field Module, 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 and Figure 1-3.

After selecting the probe mounting location, provision should be made for a platform where the probe can be easily serviced. The heater power supply can be located up to 150 feet (45 m) cable distance from the probe.

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 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% O_2 balance in nitrogen is recommended for high test gas.

If test gas bottles will be hooked up permanently, a check valve is required next to the calibration fittings on the probe junction box. 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.

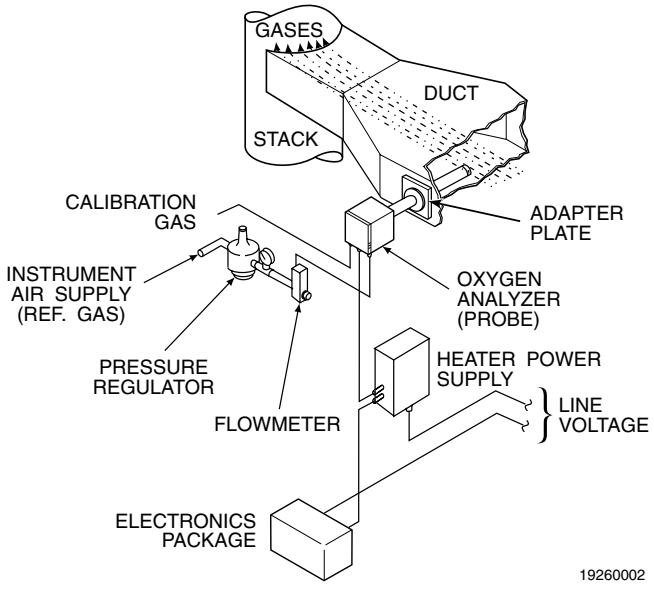


Figure 1-2. Typical System Installation

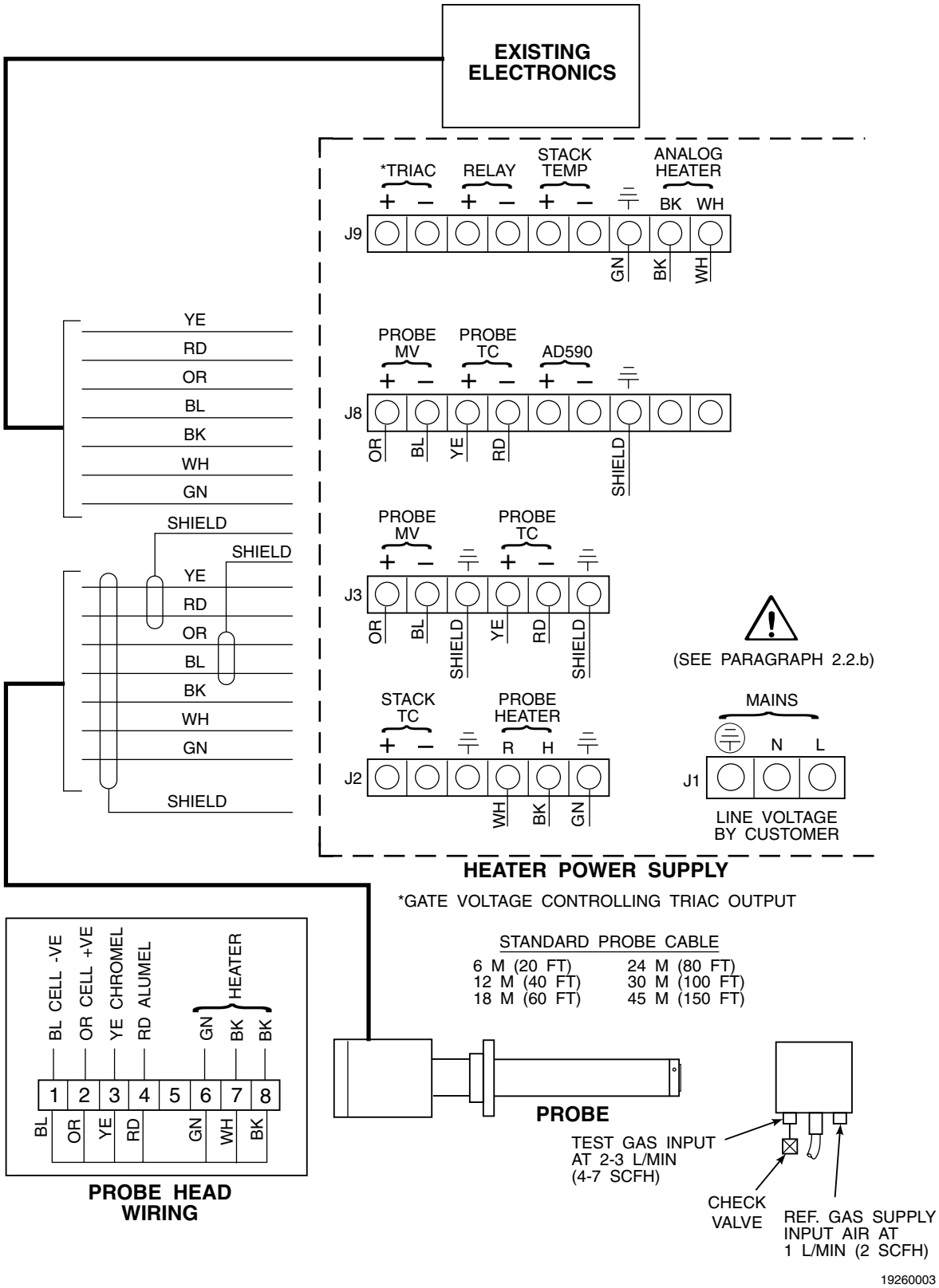


Figure 1-3. Typical System Wiring

SECTION 2
INSTALLATION

2-1 OXYGEN ANALYZER (PROBE) 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.

a. Selecting Location

1. 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.

2. 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.

3. 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

Do not allow the temperature of the probe junction box to exceed 300°F (149°C) or damage to the unit may result. If the probe junction box temperature exceeds 300°F (149°C), the user must fabricate a heat shield or provide adequate cooling air to the probe junction box.

b. Mechanical Installation

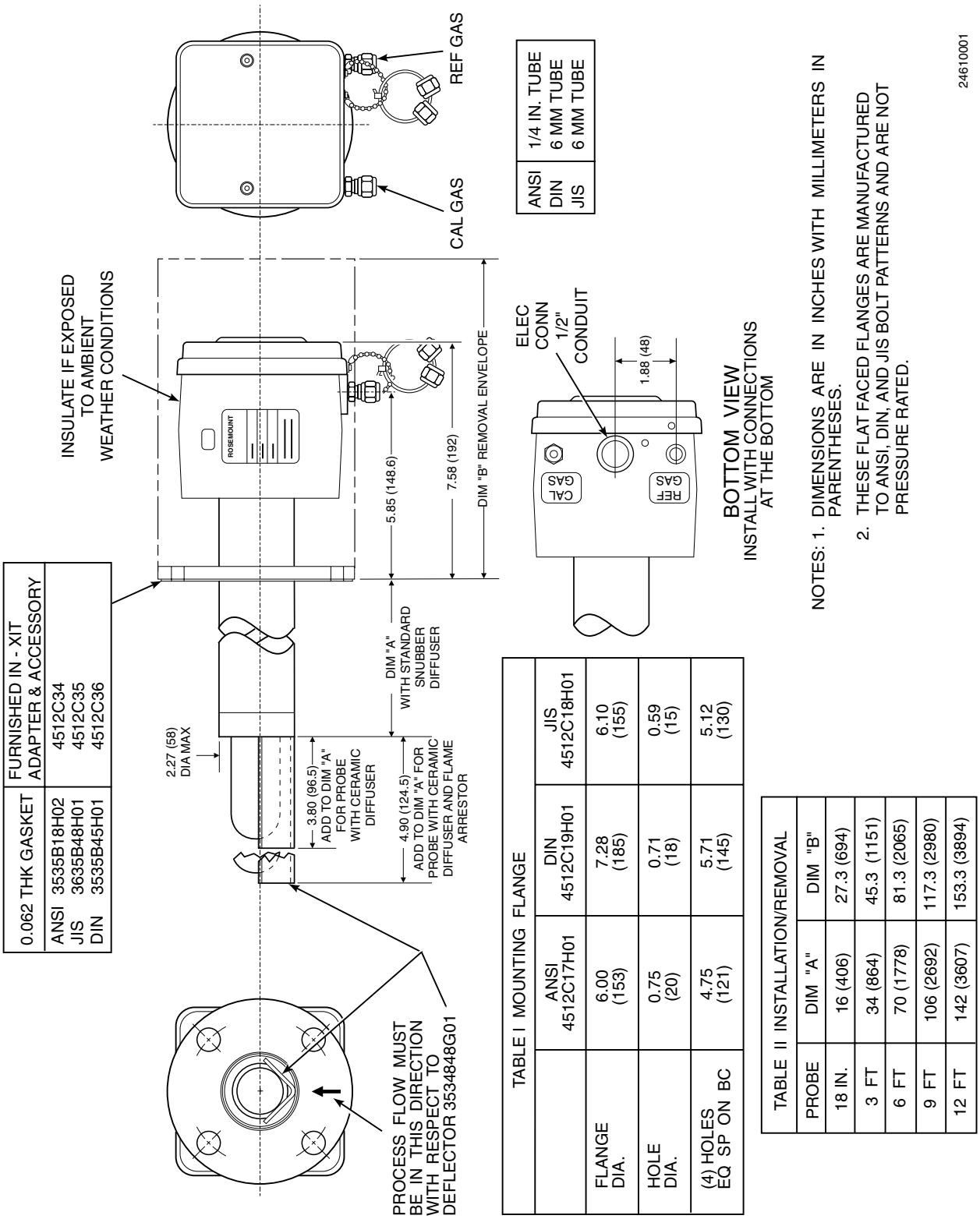
1. Ensure that all components are available for installation of the probe. Ensure that the system cable is the required length. If applicable, check the ceramic filter to ensure that it is not damaged.

2. The probe may be installed intact as it is received. It is recommended that you disassemble the adapter plate for each installation.

NOTE

An abrasive shield is recommended for high velocity particulate in the flue stream (such as those in pulverized coal 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.

3. Weld or bolt adapter plate (Figure 2-1) onto the duct.



0.062 THK GASKET	FURNISHED IN - XIT ADAPTER & ACCESSORY
ANSI 3535B18H02	4512C34
JIS 3635B48H01	4512C35
DIN 3535B45H01	4512C36

NOTES:
1. DIMENSIONS ARE IN INCHES WITH MILLIMETERS IN PARENTHESES.
2. THESE FLAT FACED FLANGES ARE MANUFACTURED TO ANSI, DIN, AND JIS BOLT PATTERNS AND ARE NOT PRESSURE RATED.

TABLE I MOUNTING FLANGE

	ANSI 4512C17H01	DIN 4512C19H01	JIS 4512C18H01
FLANGE DIA.	6.00 (153)	7.28 (185)	6.10 (155)
HOLE DIA.	0.75 (20)	0.71 (18)	0.59 (15)
(4) HOLES EQ SP ON BC	4.75 (121)	5.71 (145)	5.12 (130)

TABLE II INSTALLATION/REMOVAL

PROBE	DIM "A"	DIM "B"
18 IN.	16 (406)	27.3 (694)
3 FT	34 (864)	45.3 (1151)
6 FT	70 (1778)	81.3 (2065)
9 FT	106 (2692)	117.3 (2980)
12 FT	142 (3607)	153.3 (3894)

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

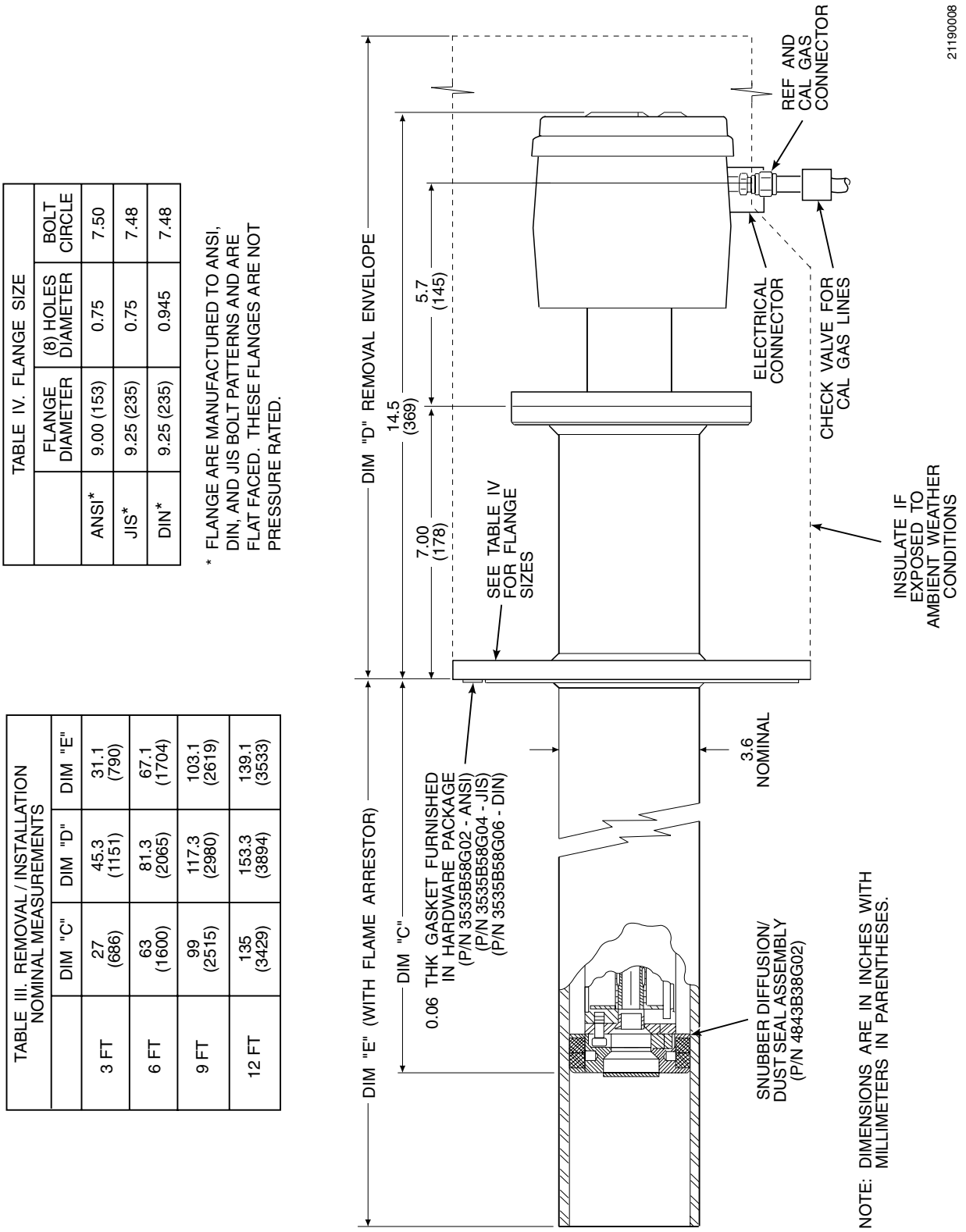


TABLE IV. FLANGE SIZE

	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

* FLANGE 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)

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

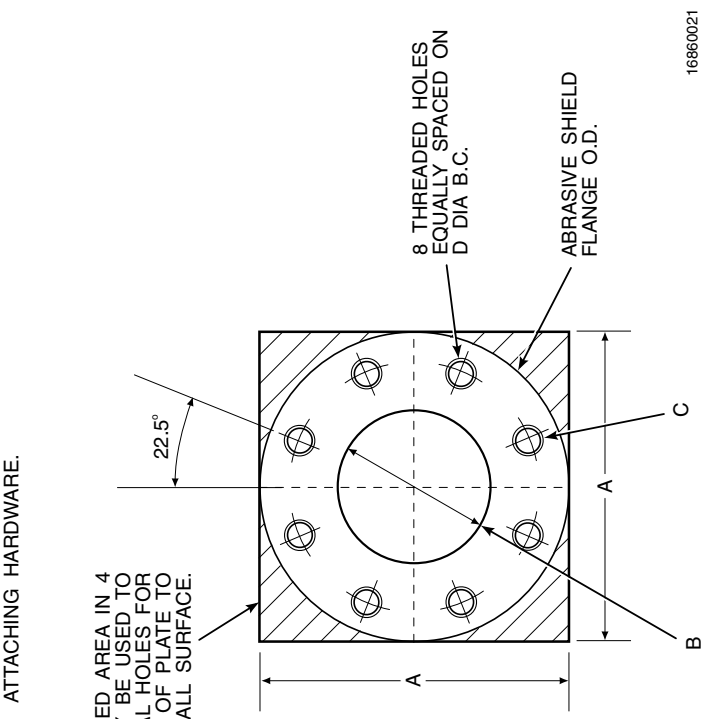
ADAPTOR PLATE OUTLINE

TABLE V. ADAPTOR PLATE DIMENSIONS FOR PROBE			
DIMENSIONS IN. (mm)	ANSI (P/N 4512C34G01)	DIN (P/N 4512C36G01)	JIS (P/N 4512C35G01)
"A"	6.00 (153)	7.5 (191)	6.50 (165)
"B" THREAD	0.625-11	(M-16 x 2)	(M-12 x 1.75)
"C" DIA	4.75 (121)	5.708 (145)	5.118 (130)

NOTE: PART NUMBERS FOR ADAPTOR PLATES INCLUDE ATTACHING HARDWARE.

TABLE VI. ADAPTOR PLATE DIMENSIONS FOR ABRASIVE SHIELD			
DIMENSIONS IN. (mm)	ANSI (P/N 3535B58G02)	DIN (P/N 3535B58G06)	JIS (P/N 3535B58G04)
"A"	9.00 (229)	9.25 (235)	9.25 (235)
"B" DIA	4.75 (121)	3.94 (100)	4.92 (125)
"C" THREAD	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.



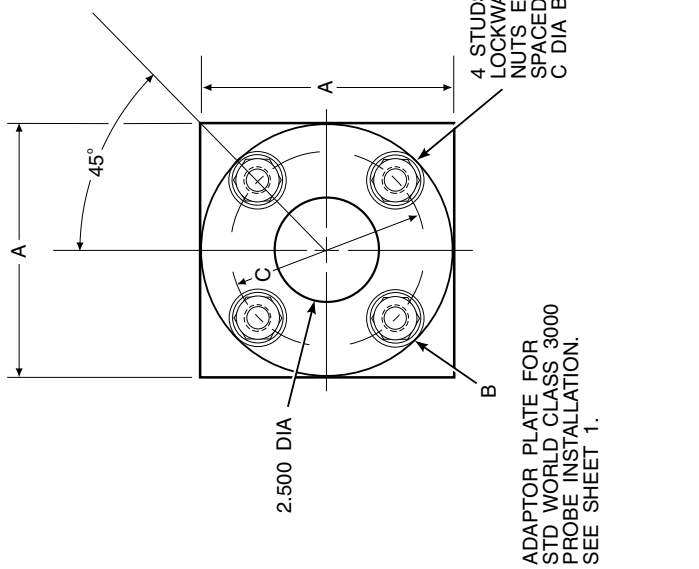
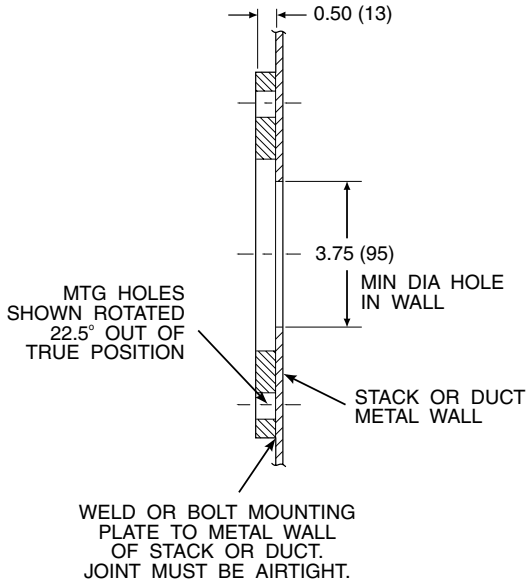
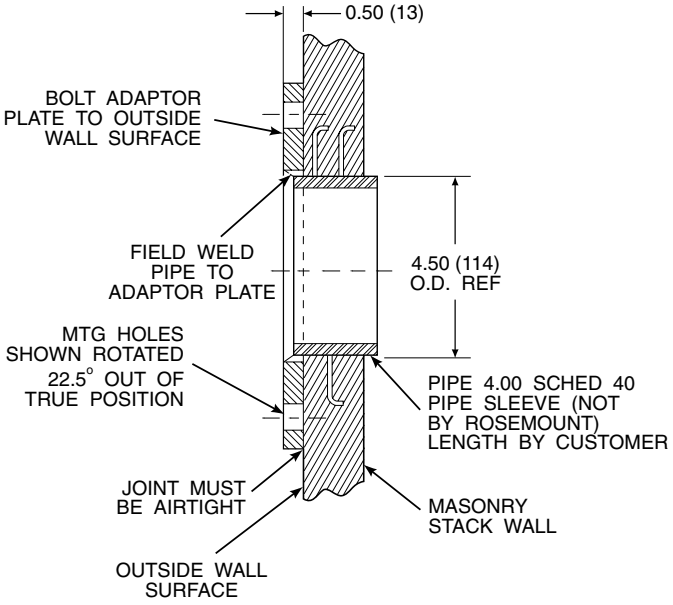


Figure 2-1. Probe Installation (Sheet 3 of 5)

INSTALLATION FOR METAL WALL STACK OR DUCT CONSTRUCTION

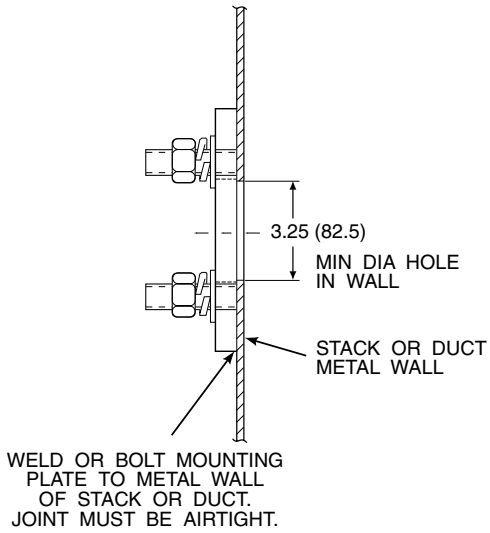


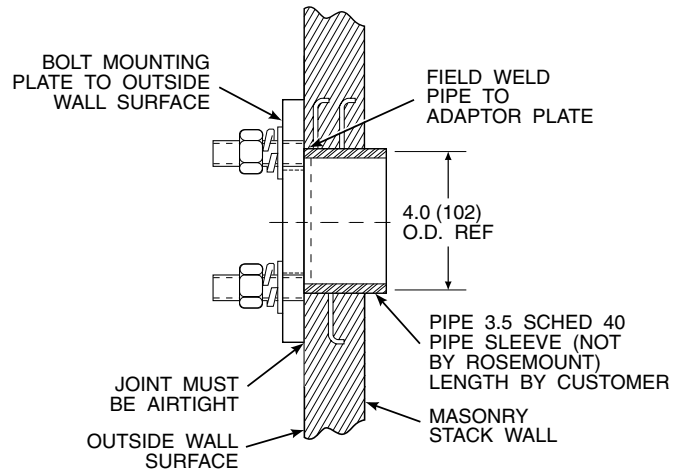
INSTALLATION FOR MASONRY WALL STACK CONSTRUCTION



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

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

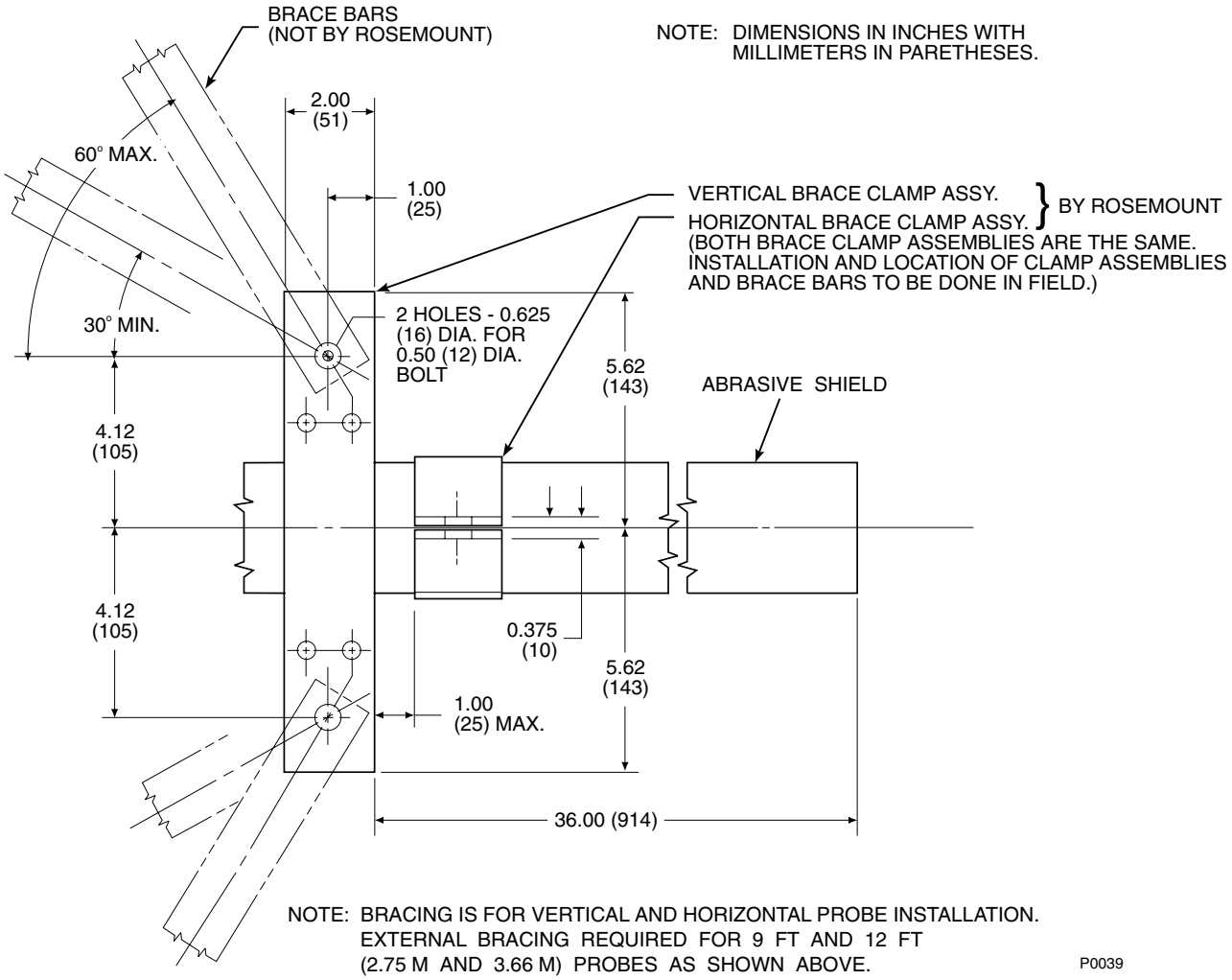


Figure 2-1. Probe Installation (Sheet 5 of 5)

4. If using the optional ceramic diffusor 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.

5. In horizontal installations, the probe junction box should be oriented so the system cable drops vertically from the probe junction box. In a vertical installation, the system cable can be oriented in any direction.

6. 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.

7. 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 feet (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.

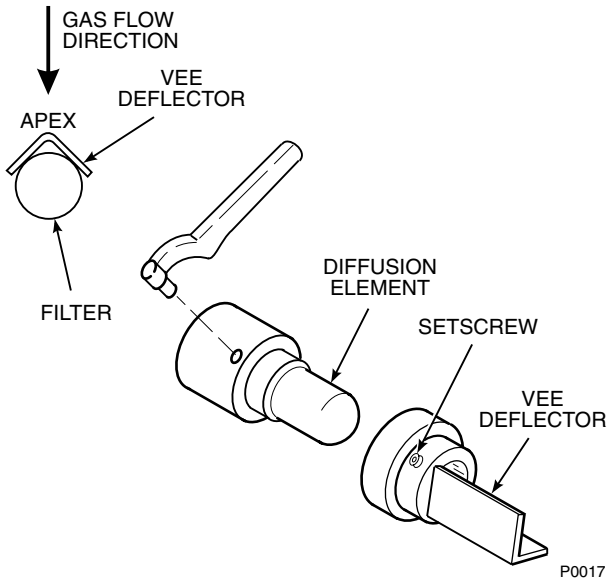


Figure 2-2. Orienting the Optional Vee Deflector

c. Service Required

1. Power input: 100, 115 or 220 Vac single phase, 50 to 60 Hz, 3 amp minimum. (See label.)

2. Compressed air: 10 psig (68.95 kPag) minimum, 225 psig (1551.38 kPag) 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).

   (a) Instrument air - clean, dry.

   (b) Bottled standard air with step-down regulator.

   (c) Bottled compressed gas mixture (20.95% oxygen in nitrogen).

   (d) Other equivalent clean, dry, oil-free air supply.

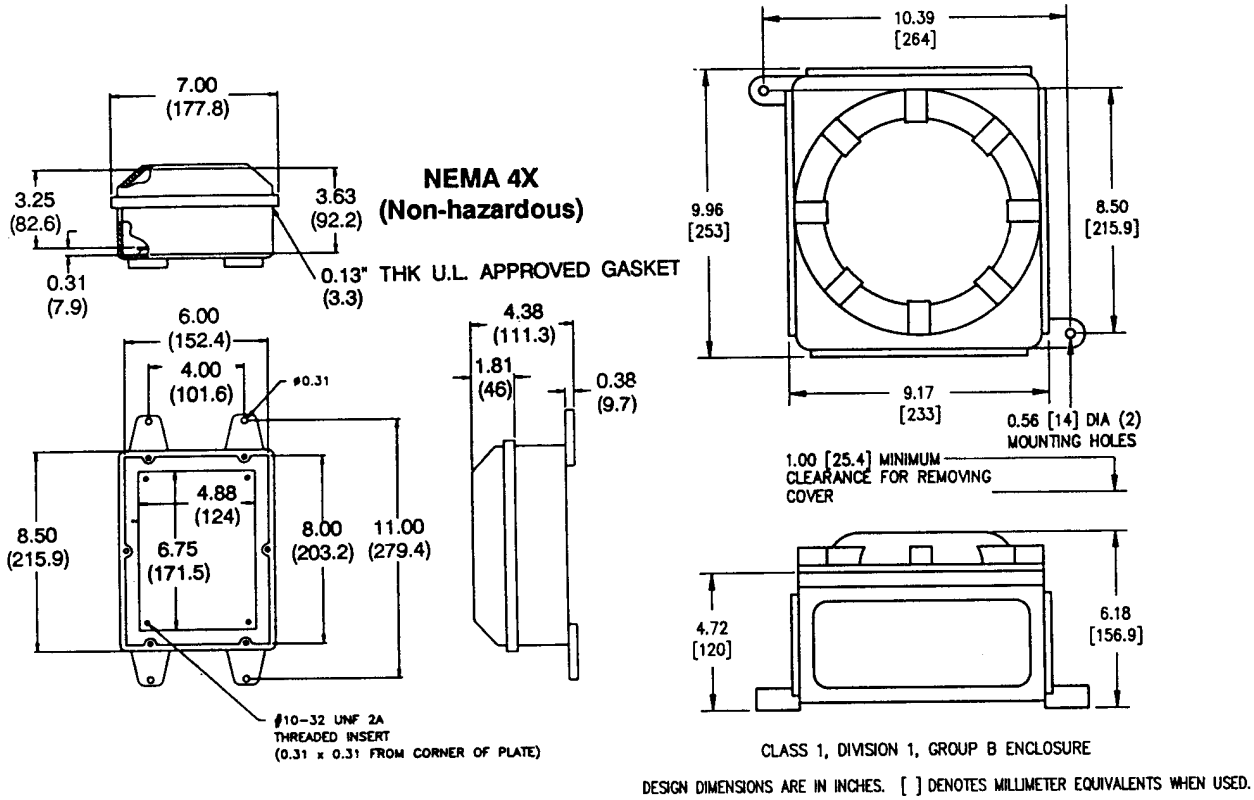


Figure 2-3. Outline of Heater Power Supply

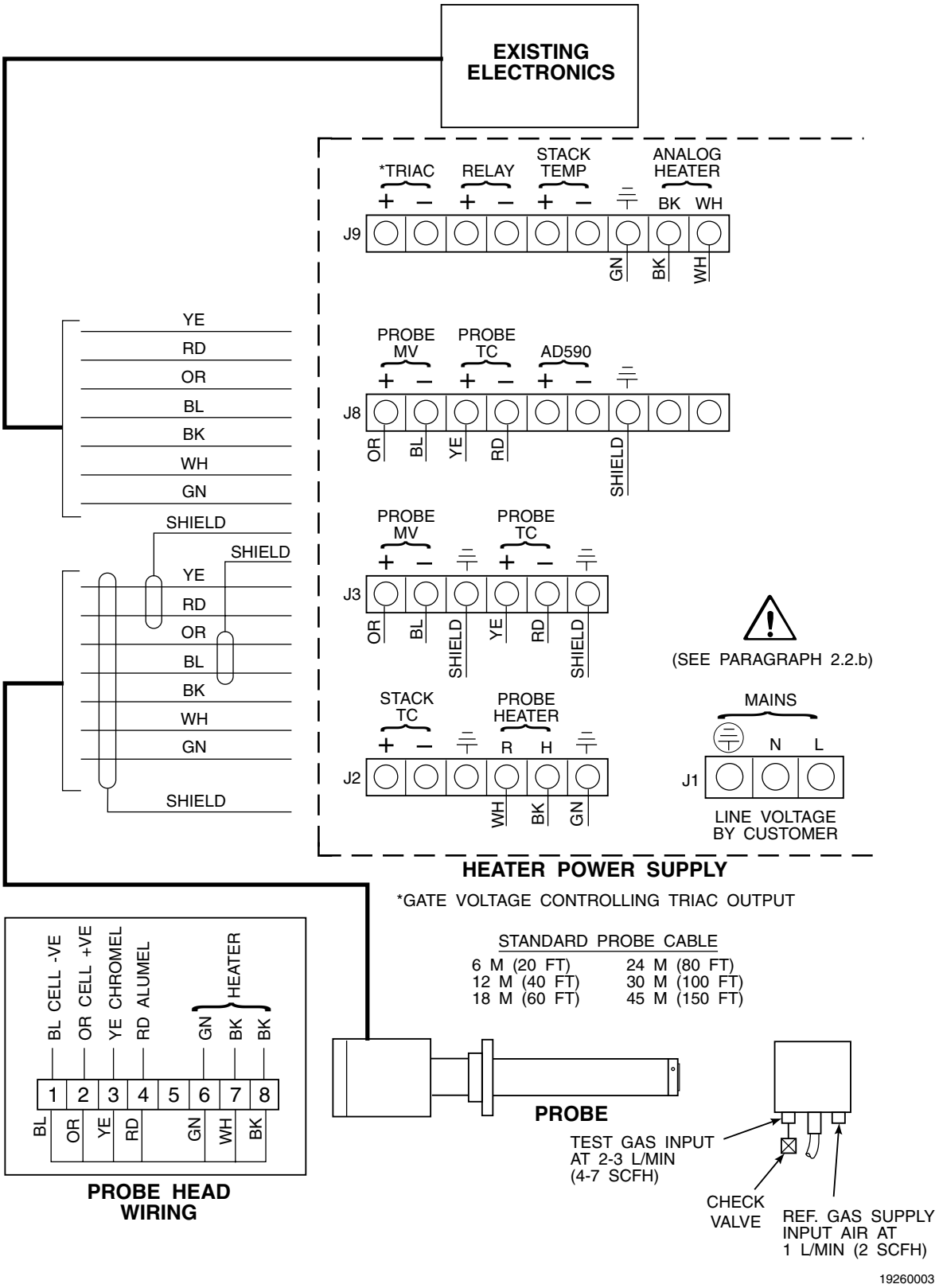


Figure 2-4. Electrical Installation of Heater Power Supply

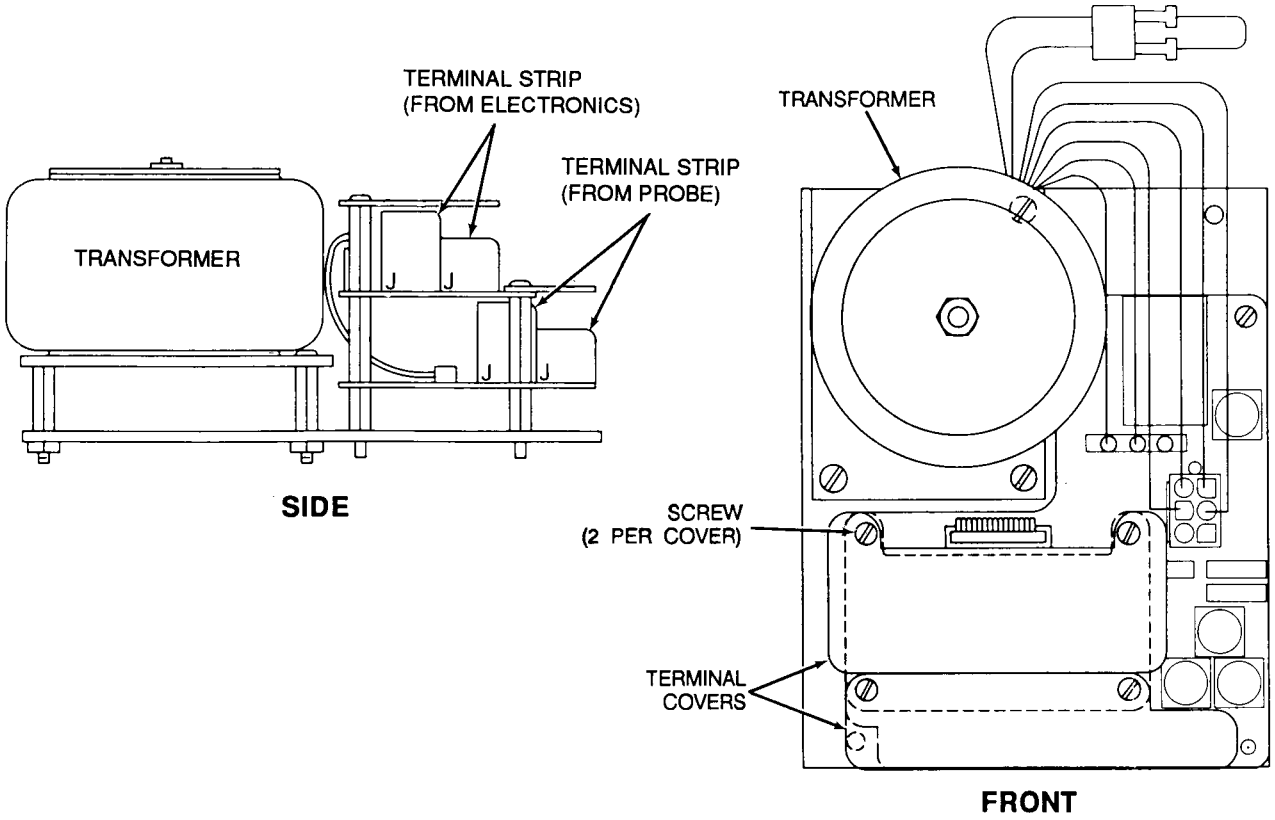


Figure 2-5. Heater Power Supply Wiring Connections

2-2 HEATER POWER SUPPLY INSTALLATION

WARNING

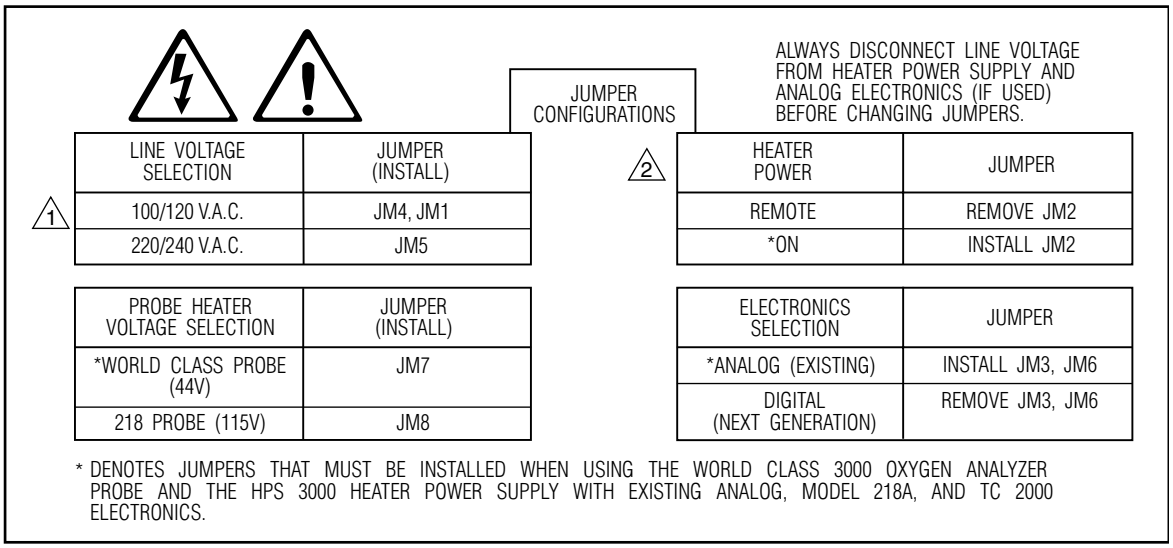
Install all protective equipment covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

a. Mechanical Installation

The outline drawing of the heater power supply enclosure, Figure 2-3, shows mounting centers and clearances. The NEMA 4X enclosure is designed to be mounted on a wall or bulkhead. The heater power supply should be installed no further than 150 feet (45 m) from the probe. The heater power supply must be located in a location free from significant ambient temperature changes and electrical noise. Ambient temperature must be between -20° to 140°F (-30° to 60°C).

b. Electrical Connections

1. Electrical connections should be made as described in the electrical installation diagram, Figure 2-4. The wiring terminals are divided into two layers; the bottom (FROM PROBE) terminals should be connected first, the top (FROM ELECTRONICS) terminals should be connected (Figure 2-5). Each terminal strip has a protective cover which must be removed when making connections. To remove the terminal covers, remove two slotted screws holding the cover in place. Always reinstall terminal covers after making connections.



JUMPER CONFIGURATIONS

ALWAYS DISCONNECT LINE VOLTAGE FROM HEATER POWER SUPPLY AND ANALOG ELECTRONICS (IF USED) BEFORE CHANGING JUMPERS.

LINE VOLTAGE SELECTION	JUMPER (INSTALL)
100/120 V.A.C.	JM4, JM1
220/240 V.A.C.	JM5

1

HEATER POWER	JUMPER
REMOTE	REMOVE JM2
*ON	INSTALL JM2

2

PROBE HEATER VOLTAGE SELECTION	JUMPER (INSTALL)
*WORLD CLASS PROBE (44V)	JM7
218 PROBE (115V)	JM8

ELECTRONICS SELECTION	JUMPER
*ANALOG (EXISTING)	INSTALL JM3, JM6
DIGITAL (NEXT GENERATION)	REMOVE JM3, JM6

* DENOTES JUMPERS THAT MUST BE INSTALLED WHEN USING THE WORLD CLASS 3000 OXYGEN ANALYZER PROBE AND THE HPS 3000 HEATER POWER SUPPLY WITH EXISTING ANALOG, MODEL 218A, AND TC 2000 ELECTRONICS.

NOTES:

1 100 V.A.C. OPERATION REQUIRES TRANSFORMER PART NUMBER 1M02961G02.

2 HEATER POWER IS ALSO REFERRED TO AS LINE VOLTAGE RELAY.

Figure 2-6. Jumper Selection Label

NOTE

Refer to Figure 2-7 for HPS unit fuse locations and specifications.

NOTE

Before supplying power to the heater power supply, verify that jumpers JM2, JM3, JM6, and JM7 are installed.

2. Power Input: 120, 220 or 240 Vac. For 120 Vac usage, install jumpers JM4 and JM1. For 220 or 240 Vac usage, install jumper JM5 (See label, Figure 2-6).

   For 100 Vac usage, the heater power supply is factory-supplied with a different transformer. When using the HPS with 100 Vac transformer, install jumpers JM1 and JM4.

3. The power cable should comply with all applicable codes and safety regulations in the user's country and should not be smaller than 16 gauge, 3 amp.

NOTE

"ANALOG" under ELECTRONICS SELECTION on the label refers to Models 218, 225, TC200, and Model 218A electronics.

4. Before supplying power to the heater power supply, verify that the jumpers on the mother board, Figure 2-7, are properly configured. Jumpers JM2, JM3, JM6, and JM7 should be installed. Additionally, make sure that the proper jumper for your line voltage is installed, Figure 2-6**.**

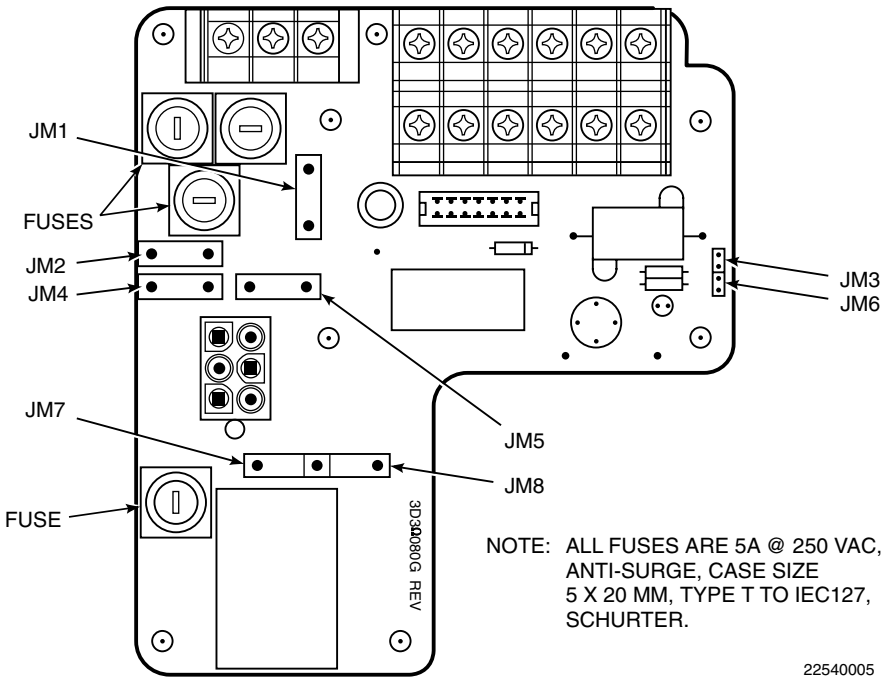


Figure 2-7. Jumpers on HPS Mother Board

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
SETUP

3-1 OVERVIEW

This section covers the setup procedures for the World Class 3000 Oxygen Analyzer with HPS 3000 Heater Power Supply Field Module. Since this equipment may be used with a number of different electronics packages, this section has been divided into three parts: Models 218, 225, and 132 (Analog) Electronics, Model 218A, Electronics, and Model TC200 Electronics. Each of the three parts contain setup information applicable to that electronics package.

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.

Models 218, 225, and 132 (Analog) Electronics refer to paragraph 3-2.

Model 218A Electronics refer to paragraph 3-3.

MODEL TC200 Electronics refer to paragraph 3-4.

Model 132 Digital Electronics refer to paragraph 3-5.

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

Before beginning operation, it is important that the probe heater set point of the existing electronics be changed to support the World Class 3000 probe. The set point 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.

e. Adjust potentiometer M110-1 to read -322.3 millivolts nominal.

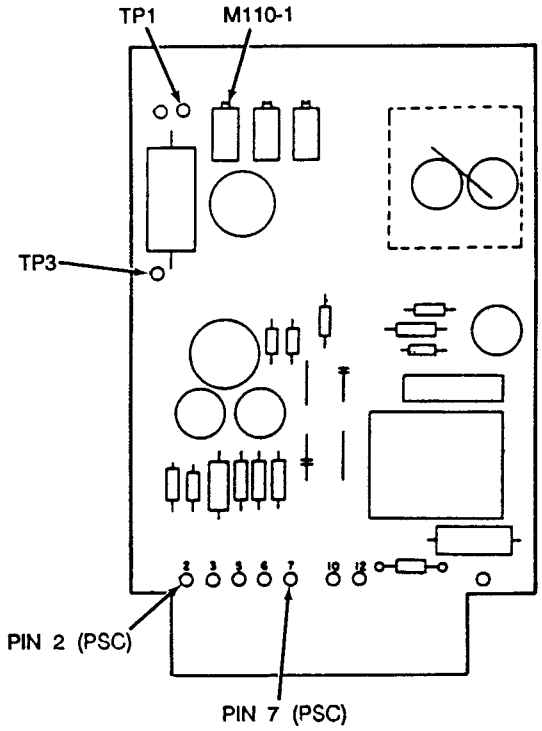


Figure 3-1. Temperature Controller Card Calibration Points

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 should be increased (made less negative) by 10 x 0.242 or 2.42 mV, making the adjusted nominal -319.9.

f. Remove voltmeter leads.

g. Remove jumper wire.

3-3 MODEL 218A ELECTRONICS SETUP

Before beginning operation, it is important that the probe heater set point 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 World Class 3000 Probe and Heater Power Supply, 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.

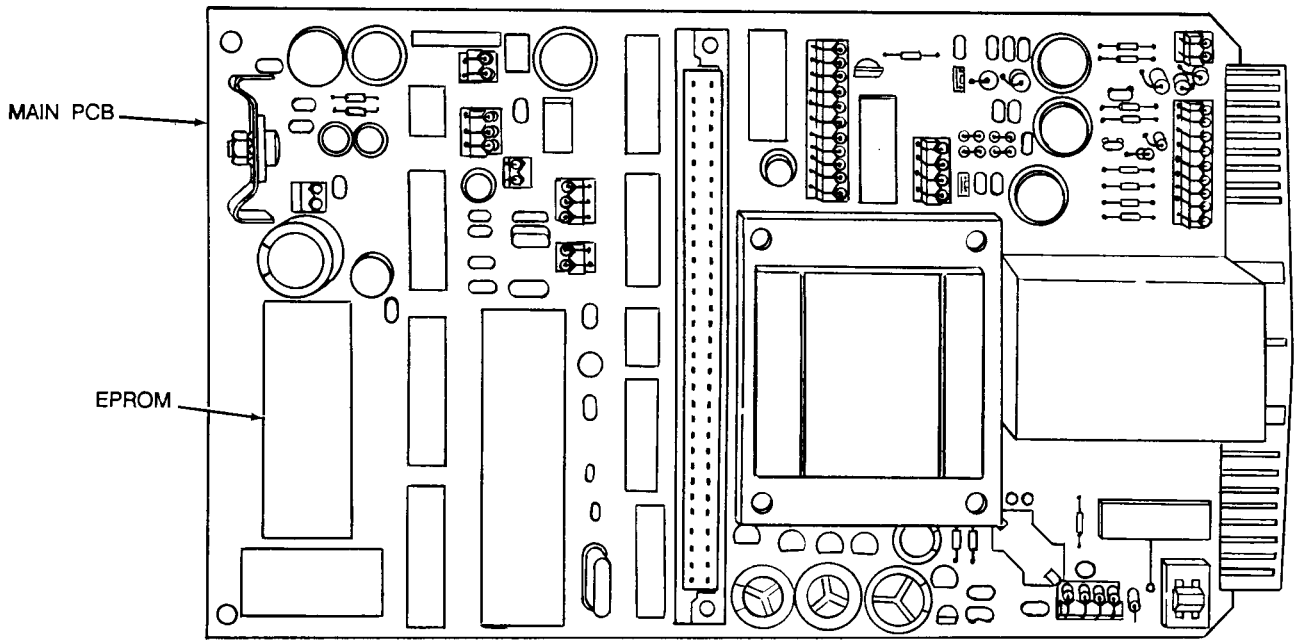


Figure 3-2. Main PCB (Model 218A) EPROM Replacement

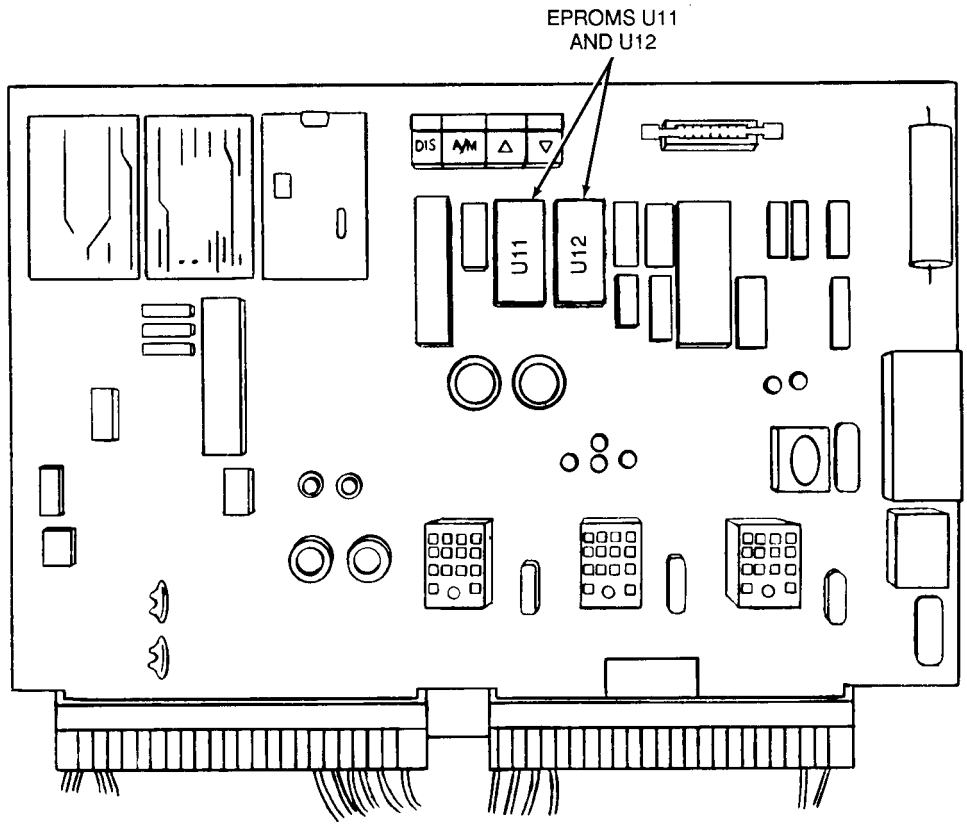


Figure 3-3. Main PCB (Model TC200) EPROM Replacement

3-4 MODEL TC200 VERITRIM ELECTRONICS SETUP

Before beginning operation, it is important that the probe heater set point of the existing electronics be changed to support the World Class 3000 Probe. To convert the Model TC200 Electronics Package for use with the World Class 3000 Probe and Heater Power Supply, 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 Set Point 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" "▲" "%O_2" "INC" "ACK" in sequence.
3. Depress "ACK" pushbutton to clear display.

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 set point 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 World Class 3000 Probe and Heater Power Supply, 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.

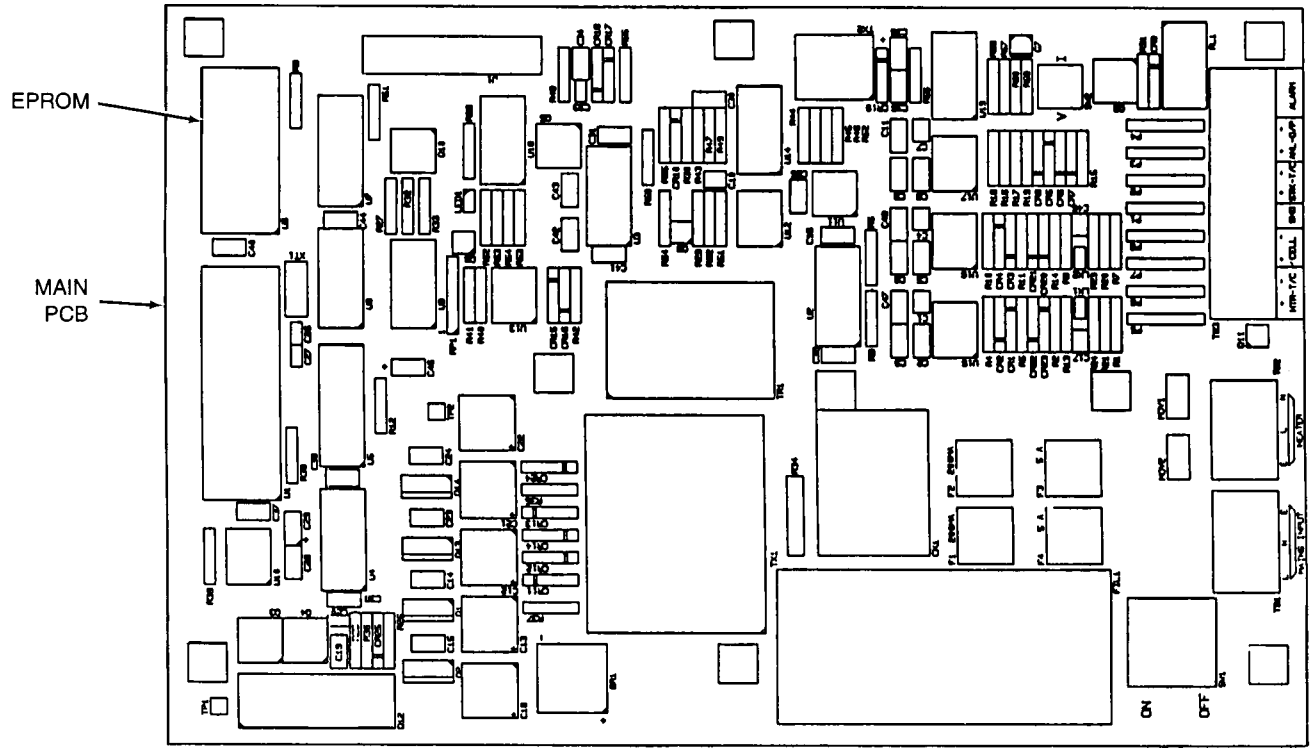


Figure 3-4. Main PCB (Model 132) EPROM Replacement

SECTION 4
TROUBLESHOOTING

4-1 OVERVIEW

Troubleshooting for the oxygen analyzer system is broken down to the main component level. Faults within the probe or heater power supply may cause symptoms which overlap.

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.

4-2 SYSTEM TROUBLESHOOTING

Troubleshooting of individual components within the oxygen analyzer system are contained in the following.

a. World Class 3000 Probe

Troubleshooting information for the World Class 3000 Probe is contained in Appendix A, Probe Troubleshooting.

b. HPS 3000 Heater Power Supply

Troubleshooting information for the HPS 3000 Heater Power Supply is contained in Appendix B, HPS 3000 Troubleshooting.

c. Model 218 and 225 (Analog) Electronics Package

Troubleshooting information for the Model 218 and 225 Electronics Package is contained in IB-106-101.

d. Model 218A Electronics Package

Troubleshooting information for the Model 218 Electronics Package is contained in IB-106-101A.

e. TC200 Veritrim Electronics Package

Troubleshooting information for the TC200 VeriTrim Electronics Package is contained in IB-107-020.

f. Model 132 Digital Electronics Package

Troubleshooting information for the Model 132 Electronics Package is contained in IB 106-106A.

SECTION 5
RETURN OF MATERIAL

5-1 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.

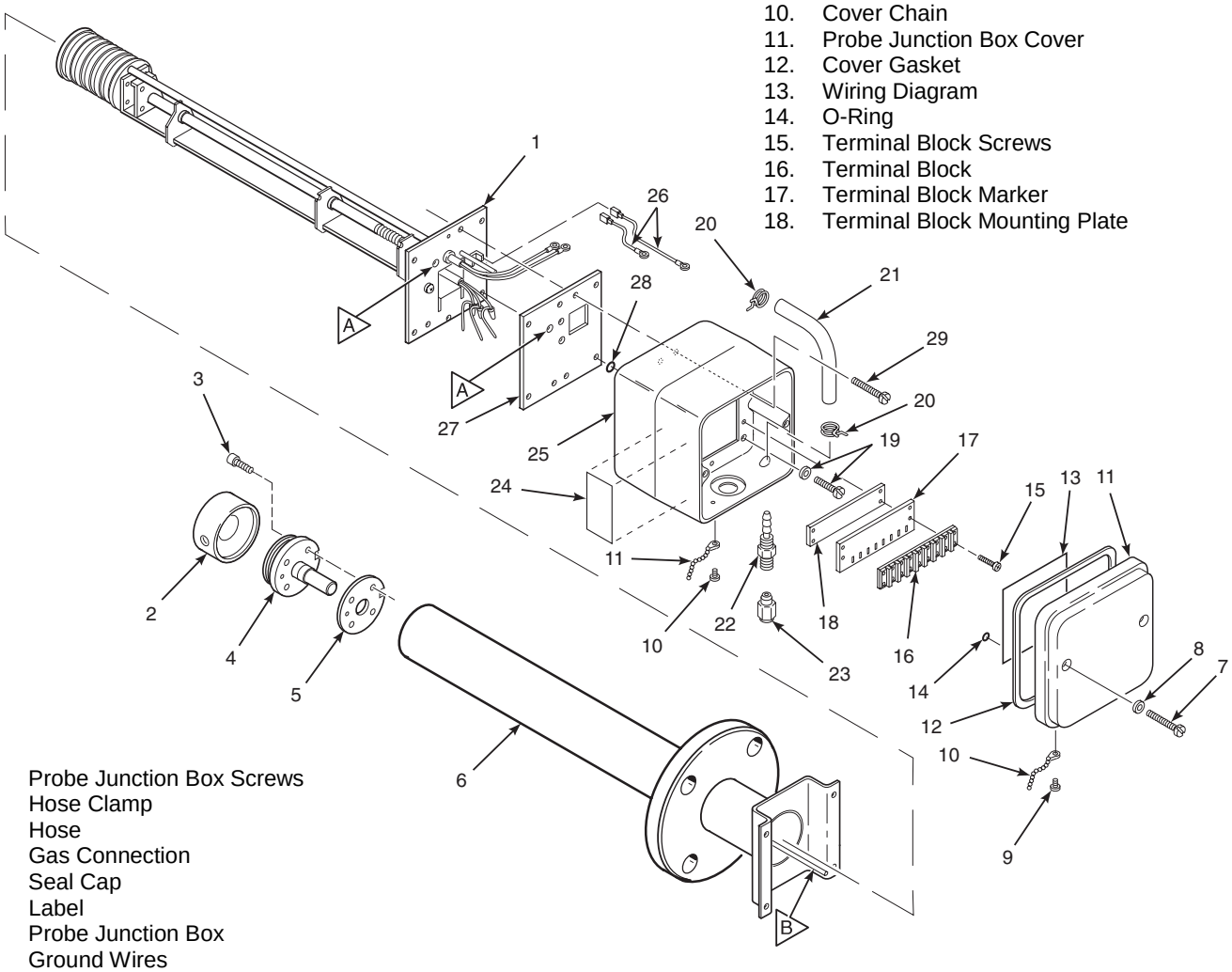
SECTION 6
APPENDICES

APPENDIX A. WORLD CLASS 3000 OXYGEN ANALYZER (PROBE)

APPENDIX B. HPS HEATER POWER SUPPLY FIELD MODULE

1. Heater, Strut, and Backplate Assembly
2. Diffusion Assembly
3. Retainer Screw
4. Cell and Flange
5. Corrugated Seal
6. Probe Tube Assembly
7. Screw
8. Washer
9. Cover Chain Screw
10. Cover Chain
11. Probe Junction Box Cover
12. Cover Gasket
13. Wiring Diagram
14. O-Ring
15. Terminal Block Screws
16. Terminal Block
17. Terminal Block Marker
18. Terminal Block Mounting Plate

NOTE: NOT ALL PARTS SHOWN ARE AVAILABLE FOR PURCHASE SEPARATELY. FOR LIST OF AVAILABLE PARTS, SEE TABLE A-3.



19. Probe Junction Box Screws
20. Hose Clamp
21. Hose
22. Gas Connection
23. Seal Cap
24. Label
25. Probe Junction Box
26. Ground Wires
27. Insulating Gasket
28. Washer
29. Screw

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

21240005

Figure A-1. Oxygen Analyzer (Probe) Exploded View

APPENDIX A, REV. 3.6
WORLD CLASS 3000 OXYGEN ANALYZER (PROBE)

DESCRIPTION

WARNING

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.

A-1 OXYGEN ANALYZER (PROBE) - GENERAL

The Oxygen Analyzer (Probe), Figure A-1, consists of three component groups: probe exterior, inner probe, and probe junction box, Figure A-2.

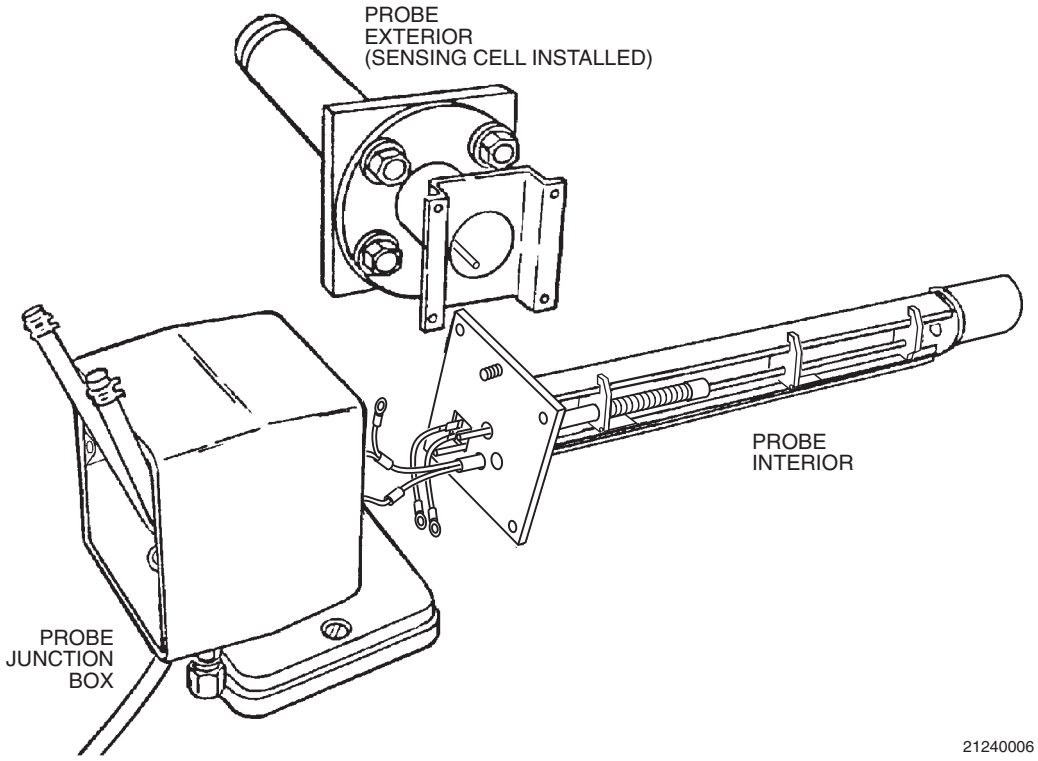


Figure A-2. Main Probe Components

Table A-1. Specifications for Oxygen Analyzing Equipment.[1, 2]

Probe lengths, nominal	18 inches (457 mm), 3 feet (0.91 m), 6 feet (1.83 m), 9 feet (2.74 m), or 12 feet (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 calibration gases
System speed of response	less than 3 seconds (amplifier output)
Resolution sensitivity	0.01% O_2 transmitted signal
HPS 3000 housing	NEMA 4X (IP56)
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 Calibration Gas Kit Part No. 6296A27G01 contains 0.4% O_2N_2 Nominal and 8% O_2N_2 Nominal
Calibration gas flow	5 scfh (141.6 L/hr)
HPS 3000 Power supply	100/110/220 ±10% Vac at 50/60 Hz
HPS 3000 Power requirement	200 VA
HPS 3000 Ambient Operating Temperature	32° to 120°F (0° to 50°C)
Ambient operating temperature (Probe Junction Box)	300°F (150°C) max
Approximate shipping weights:	
18 inch (457 mm) package	55 pounds (24.97 kg)
3 foot (0.91 m) package	60 pounds (27.24 kg)
6 foot (1.83 m) package	65 pounds (29.51 kg)
9 foot (2.74 m) package	72 pounds (32.66 kg)
12 foot (3.66 m) package	78 pounds (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.

A-2 PROBE ASSEMBLY 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 A-3, is a yttria-stabilized zirconium oxide cell. It 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 A-3, 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 A-2). Studs on the stack flange make installation easy. There is also a tube to carry calibration gas from the probe junction box to the process side of the cell during calibration.

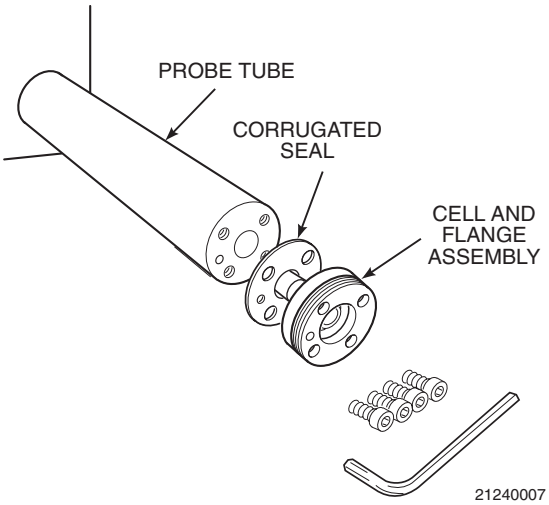


Figure A-3. Cell and Tube Assemblies

c. Snubber Diffusion Assembly

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

An optional ceramic diffusor element and vee deflector, shown in Figure A-4, is available. The ceramic diffusor assembly is also available in a flame arresting version to keep heat from the cell from igniting flue gases.

Systems that use an abrasive shield require a special snubber diffusion 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, section A-6.

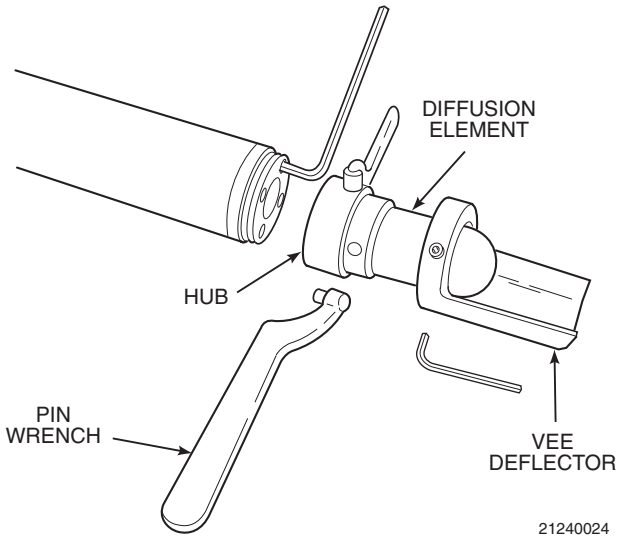


Figure A-4. Optional Ceramic Diffusor and Vee Deflector Assembly

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.

A-3 INNER PROBE ASSEMBLY

The inner probe assembly, Figure A-5, 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 A-5; 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 A-5; located at end of ceramic support rod.) The pad is attached to an inconel wire which carries the signal to the terminal strip.

e. A V-strut assembly to give support to the inner probe assembly.

f. A tube to carry reference air to the cell.

Turn to Service and Normal Maintenance, for repair procedures for probe components.

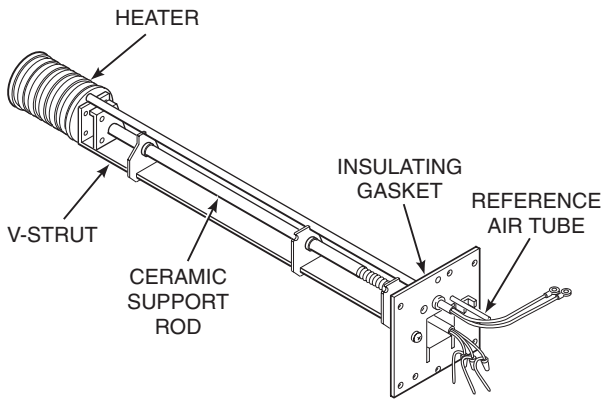


Figure A-5. Inner Probe Assembly

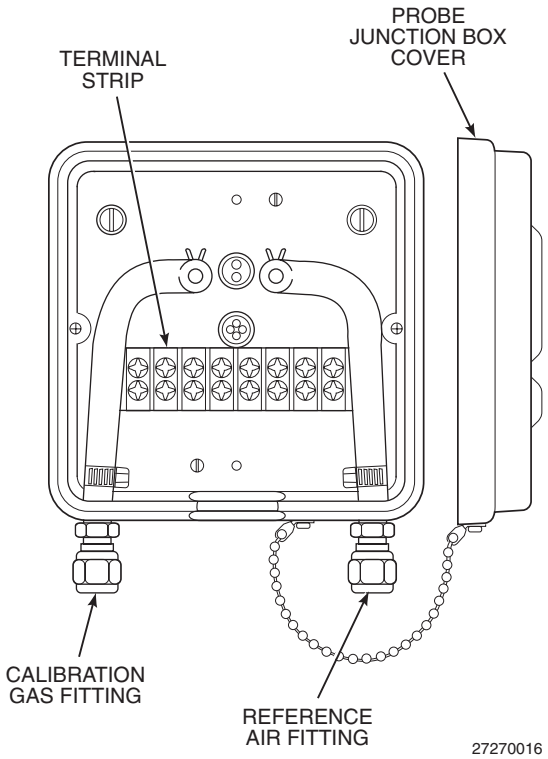


Figure A-6. Probe Junction Box

A-4 PROBE JUNCTION BOX

The probe junction box, Figure A-6, is positioned at the external end of the probe and contains a terminal strip for electrical connections and fittings for reference air and calibration gases. Fittings are for 0.250 inch stainless steel tubing on American units and 6 mm 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 air is supplied through the reference air fitting to the reference side of the cell. This gives the 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 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 probe junction box.

A-5 CABLE ASSEMBLY

The system uses a 7-conductor cable to connect the probe to the electronics package. Standard length for this cable is 20 feet (6 m), but lengths up to 150 feet (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 type K 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.

A-6 PROBE OPTIONS

a. Abrasive Shield Assembly

The abrasive shield assembly, Figure A-7, 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 diffusor and vee deflector assembly, fitted with dual dust seal packing.

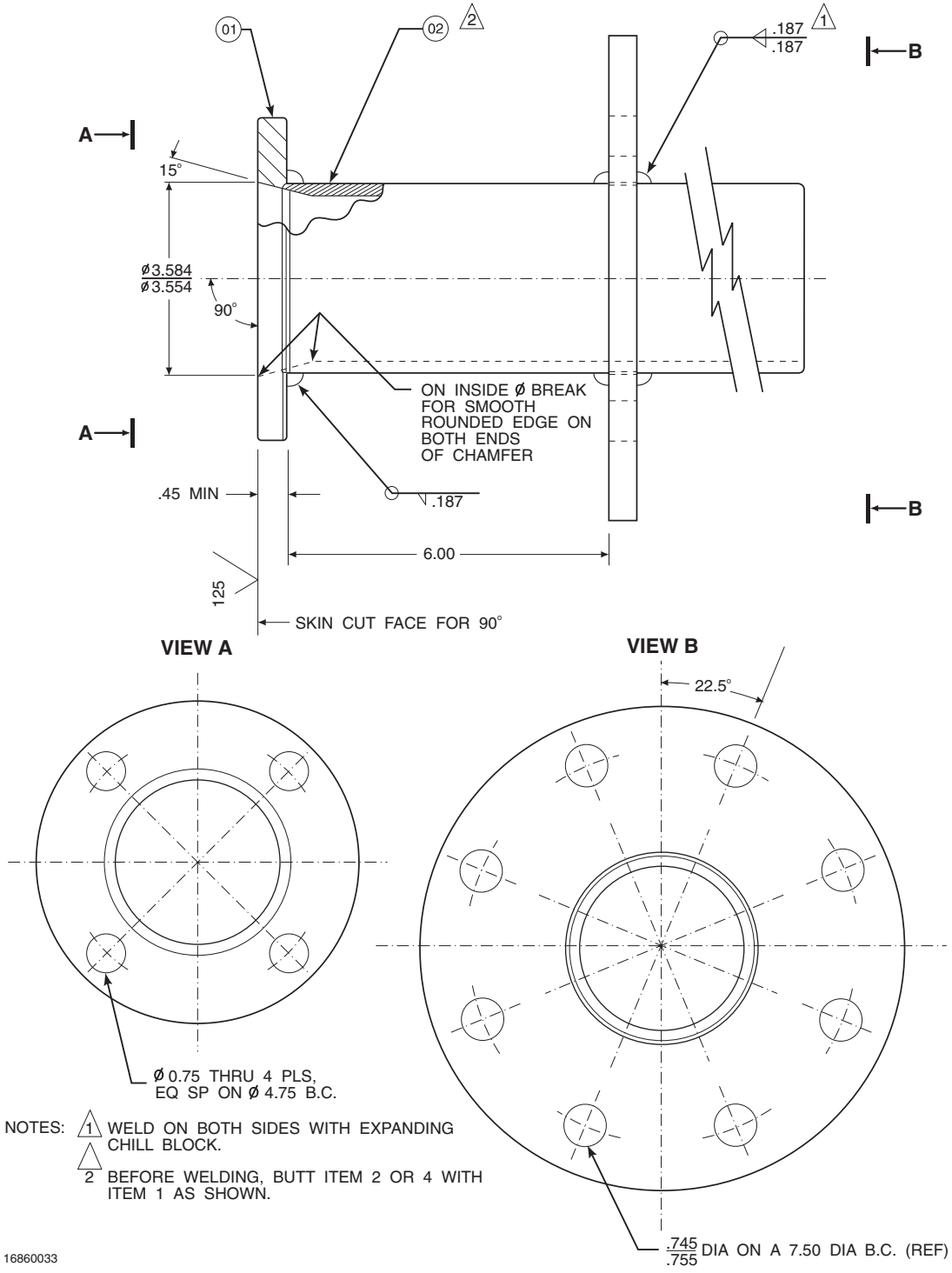


Figure A-7. Abrasive Shield Assembly

NOTE

In highly abrasive applications, rotate the shield 90 degrees at normal service intervals to present a new wear surface to the abrasive flow stream.

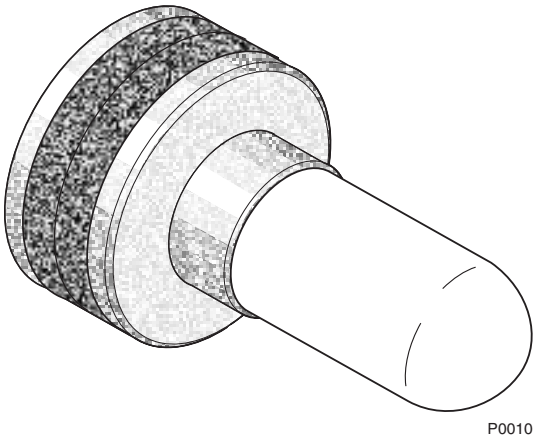


Figure A-8. Ceramic Diffusion/Dust Seal Assembly

These modified diffusion and vee deflector assemblies are available in standard, Figure A-8, and flame arrestor version, Figure A-9.

b. Ceramic Diffusion Assembly

The ceramic diffusion assembly, Figure A-10, 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.

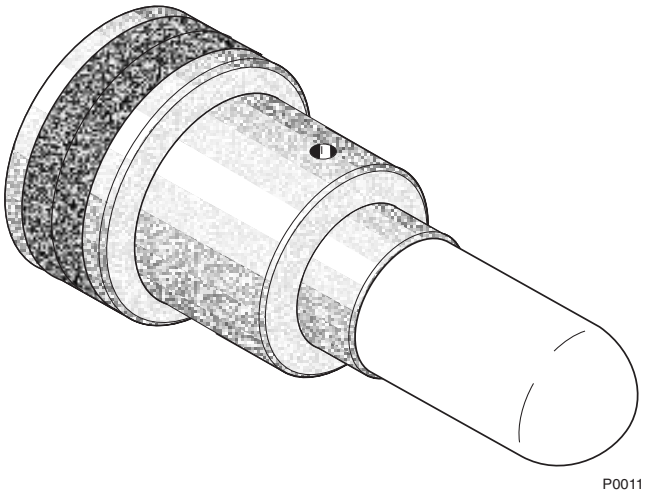


Figure A-9. Flame Arrestor Diffusion/Dust Seal Assembly

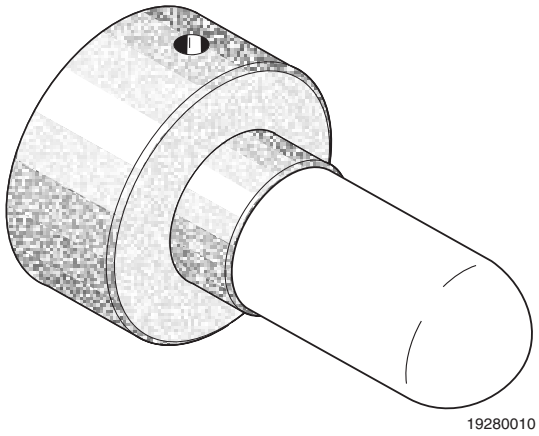


Figure A-10. Ceramic Diffusion Assembly

c. Flame Arrestor Diffusion Assembly

Where a high concentration of unburned fuel is present in the exhaust gases, a flame arrestor diffusion assembly, Figure A-9 and Figure A-11 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.

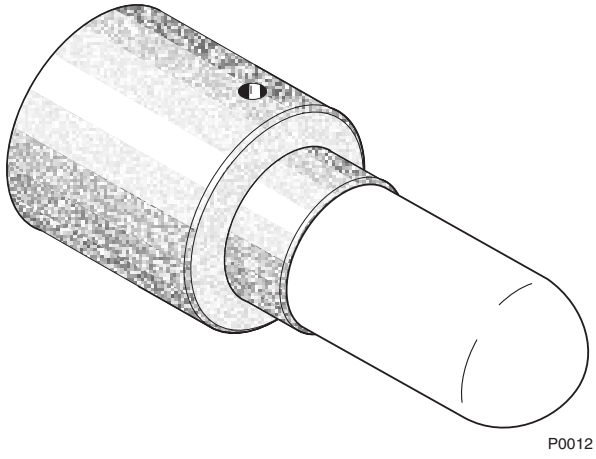


Figure A-11. Flame Arrestor Diffusion Assembly

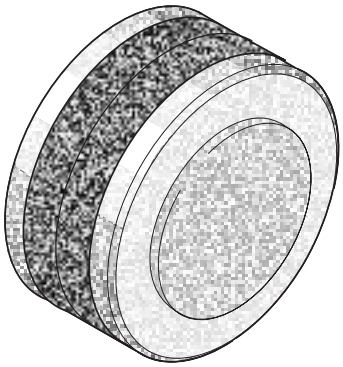


Figure A-12. Snubber Diffusion/Dust Seal Assembly

d. Snubber Diffusion/Dust Seal Assembly

The snubber diffusion/dust seal assembly, Figure A-12, 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 A-13.

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.

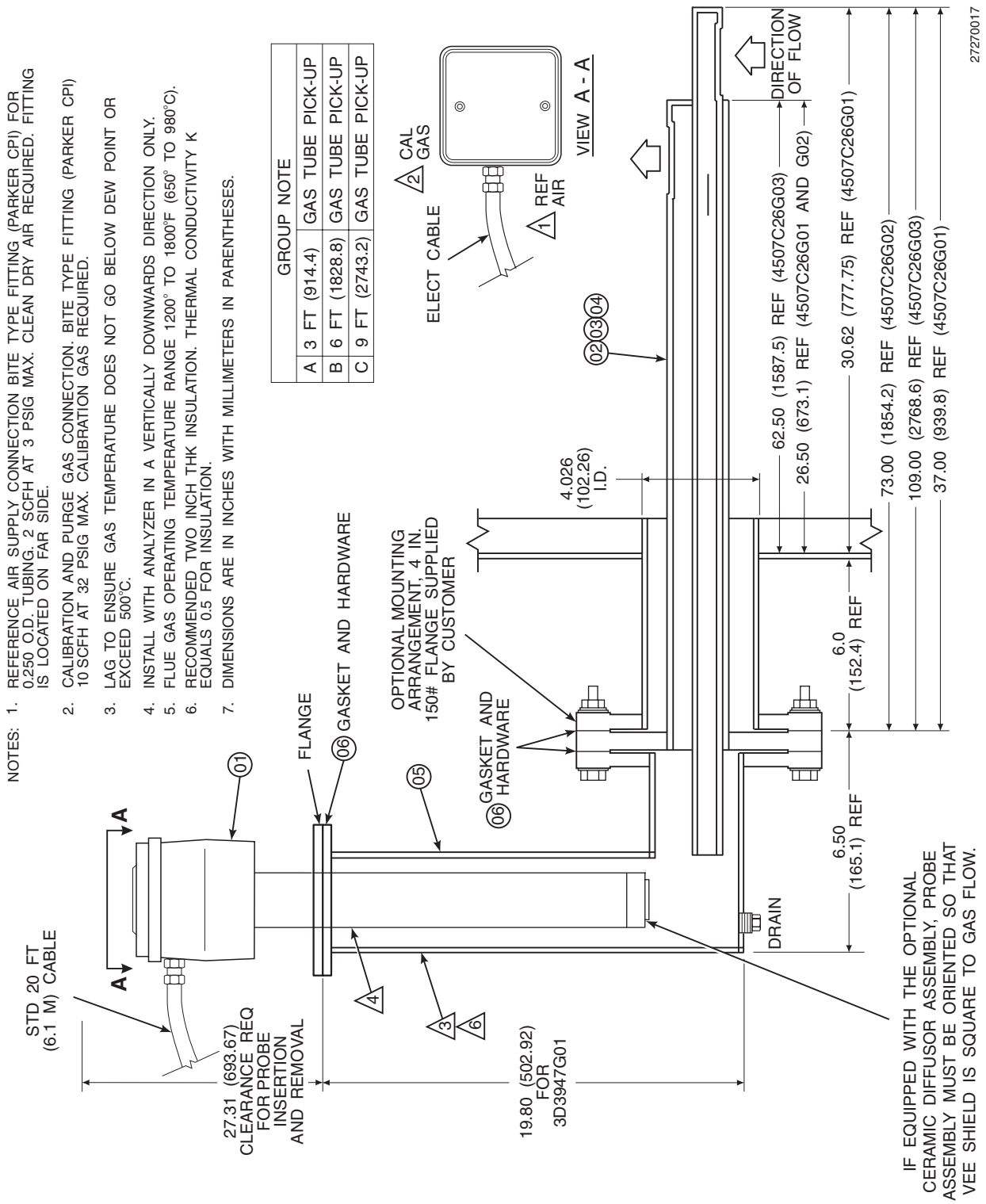


Figure A-13. Bypass Probe Option (Sheet 1 of 3)

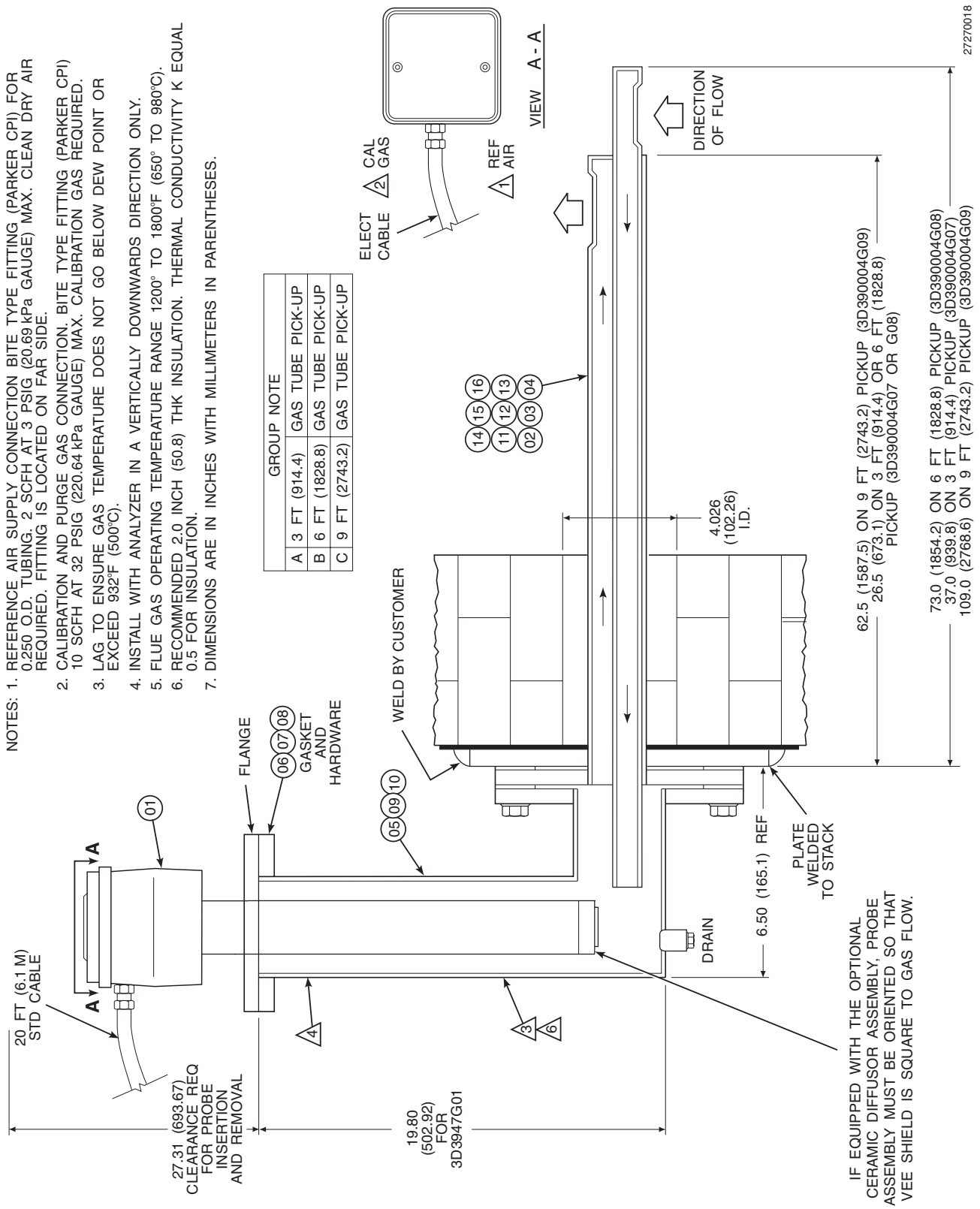


Figure A-13. Bypass Probe Option (Sheet 2 of 3)

PARTS LIST			PARTS LIST UNITS: INCHES		FLANGE STYLE	ANSI			JIS			DIN		
					GROUP NOTE	A	B	C	A	B	C	A	B	C
NOTE			DEFINER			3D39004 GROUP								
ITEM		PART NAME		SIZE-REFERENCE INFORMATION	MAIL CODE PART NUMBER OR REF DWG	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 A-13. Bypass Probe Option (Sheet 3 of 3)

PROBE TROUBLESHOOTING

A-7 OVERVIEW

The probe troubleshooting section describes how to identify and isolate faults which may develop in the probe assembly.

WARNING

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

A-8 PROBE TROUBLESHOOTING

a. Probe Faults

Listed below are the four 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 calibration gas being applied during calibration.
4. The system takes a long time to return to the flue gas value after the calibration gas is turned off.

b. Table A-2 provides a guide to fault finding for the above symptoms.

c. Figure A-14 and Figure A-15 provide an alternate approach to finding probe related problems.

Table A-2. Fault Finding

Symptom	Check	Fault	Remedy
1. No response to oxygen concentration change when:			
Heater is cold and TC mV output is less than set point	Thermocouple continuity	Thermocouple failure	Replace thermocouple or return probe to Rosemount.
	Heater cold resistance to be 11 ohm to 14 ohm	Heater failure	Replace heater or return probe to Rosemount.
	Triac O/P to heater	Failure of electronics	Check HPS and electronics package.
Heater is hot and T/C mV output is at set point ±0.2 mV	Recorder chart	Recorder failure	See Recorder Instruction Manual.
	Cell mV input to electronics and cell mV at probe junction box	No cell mV at probe when calibration gas applied	Replace cell or return probe to Rosemount.
		Probe cell mV OK but no input to electronics	Check out cable connection.
		Cell mV satisfactory both at probe junction box and input to electronics - failure of electronics	Check electronics package.

Table A-2. Fault Finding (Continued)

Symptom	Check	Fault	Remedy
2. System responds to oxygen concentration changes but does not give correct indication			
Good response, with incorrect indication	Recorder or remote indicator	Calibration error	Recalibrate recorder or indicator. Reference Recorder Instruction Manual.
	System calibration	Calibration error	Recalibrate system.
	Probe mounting and condition of duct	Air ingress into duct	Stop air leaks or resite probe.
	Cell mV input to electronics	Failure of electronics	Check electronics package.
3. System does not give accurate indication of applied calibration gas	Calibration gas input port	Blocked port	Clean port. If the flue gas is condensing in the calibration gas line, insulate the back of the probe. Make sure that the calibration gas line is capped between calibrations, or a check valve is installed.
	Ceramic diffusion element	Diffusion element cracked, broken, or missing	Replace diffusion element.
4. System takes a long time to return to flue gas value after calibration gas is turned off	Diffusion element	Plugged diffusion element	Change diffusion element or snubber diffusion element.

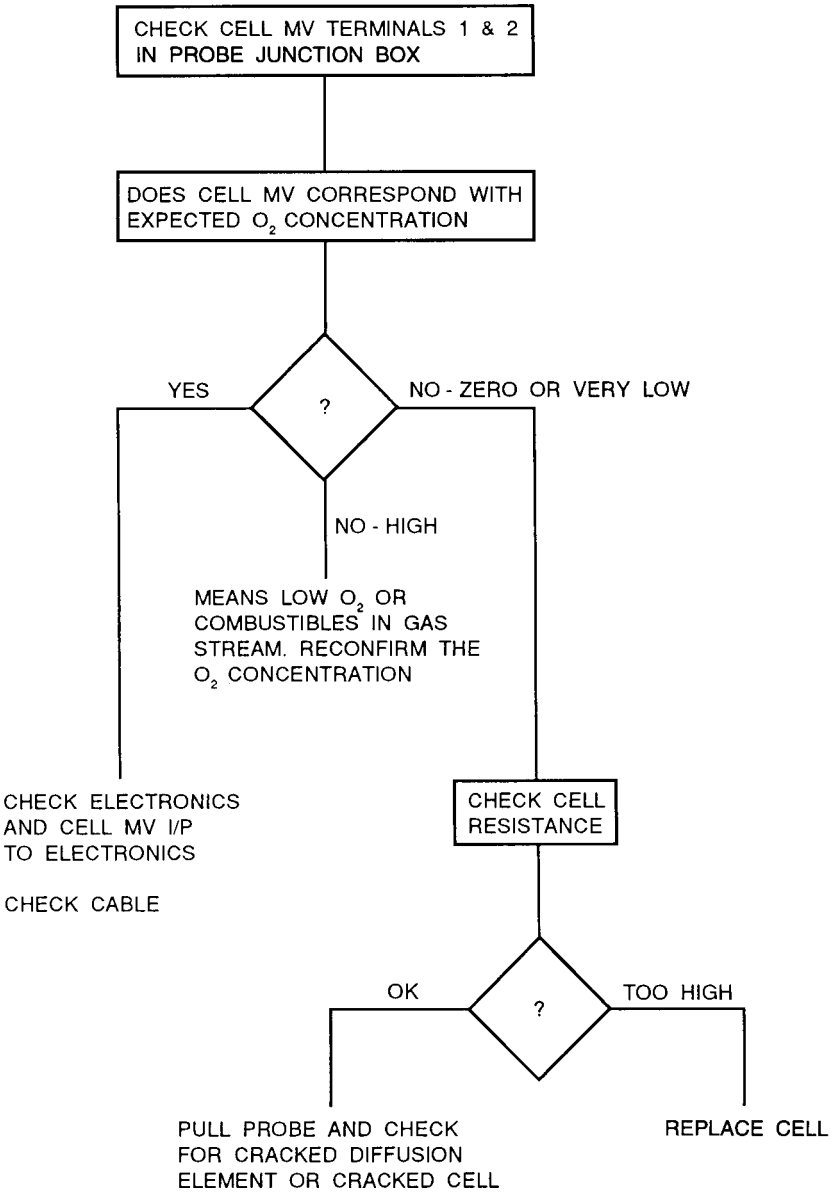


Figure A-14. Flowchart of Probe Related Problems, #1

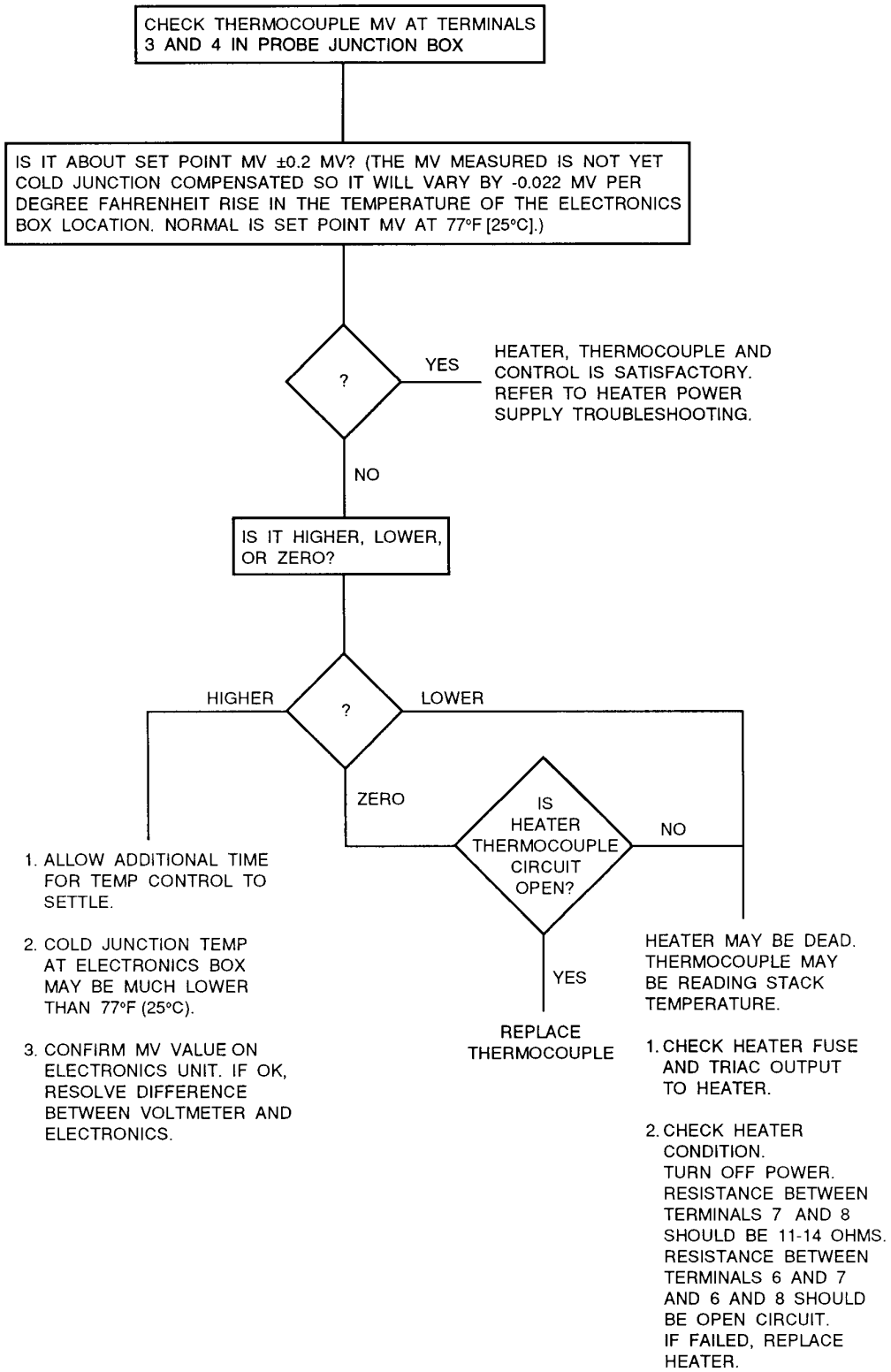


Figure A-15. Flowchart of Probe Related Problems, #2

SERVICE AND NORMAL MAINTENANCE

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.

A-9 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 the following section of this appendix for part numbers and ordering information.

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.

A-10 PROBE RECALIBRATION

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.

A-11 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 A-3.

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 A-3.

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.

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

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.

a. Disconnect and lock out power to electronics. Shut off and disconnect reference air and calibration gas supplies from probe junction box, Figure A-16. 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.

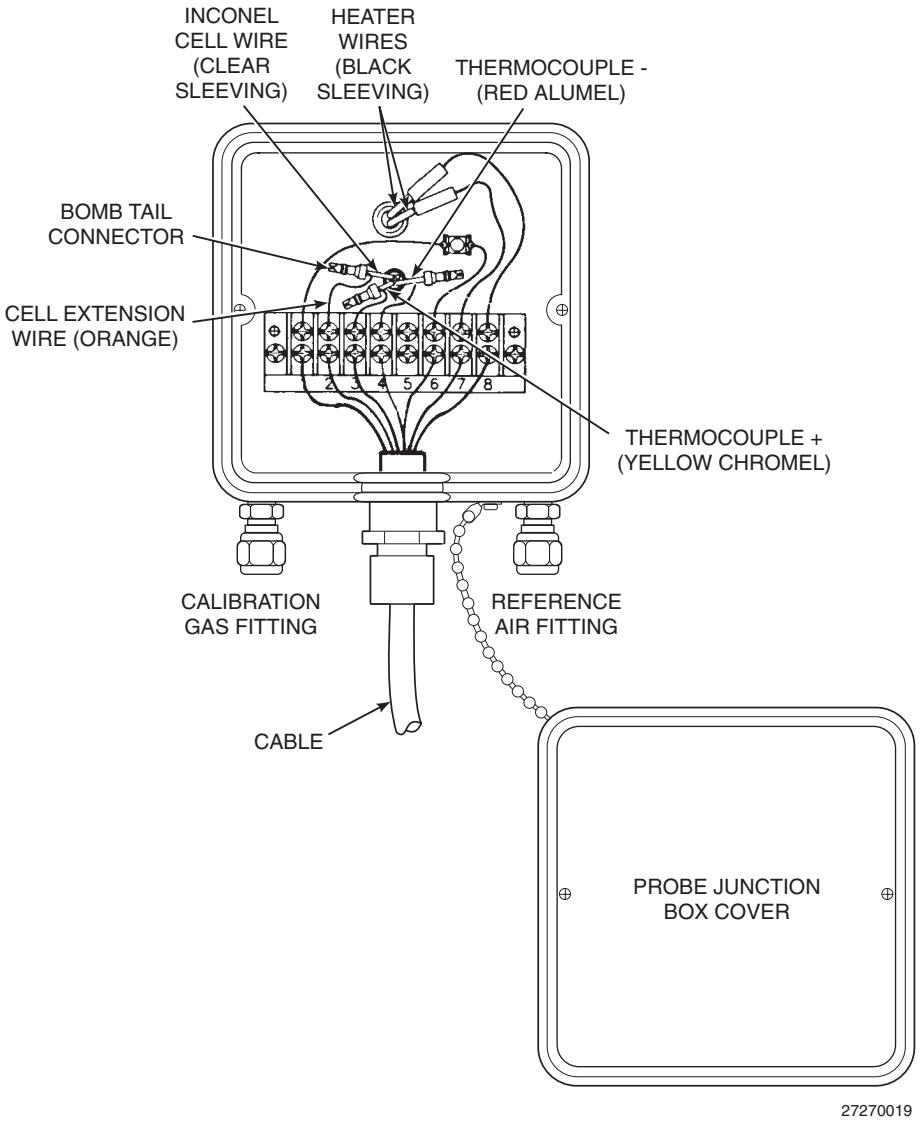


Figure A-16. Cell Wiring Connection

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 diffusor assembly, remove and discard setscrews, Figure A-17, and remove vee deflector. Use spanner wrenches from probe disassembly kit, Table A-3, 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 A-13).

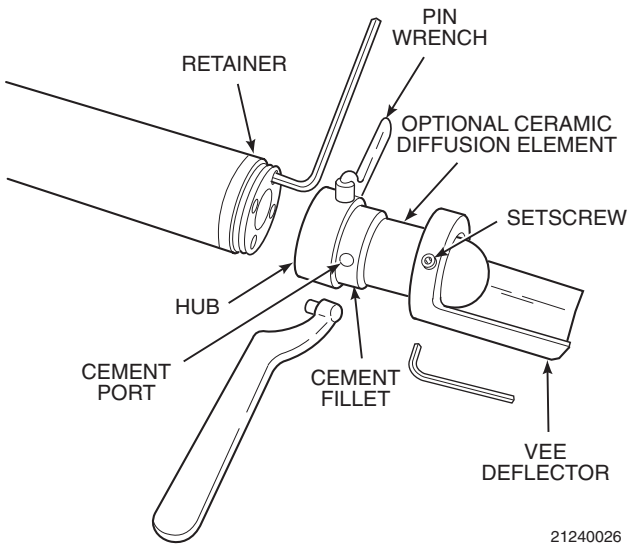


Figure A-17. Removal of Optional Diffusor and Vee Deflector

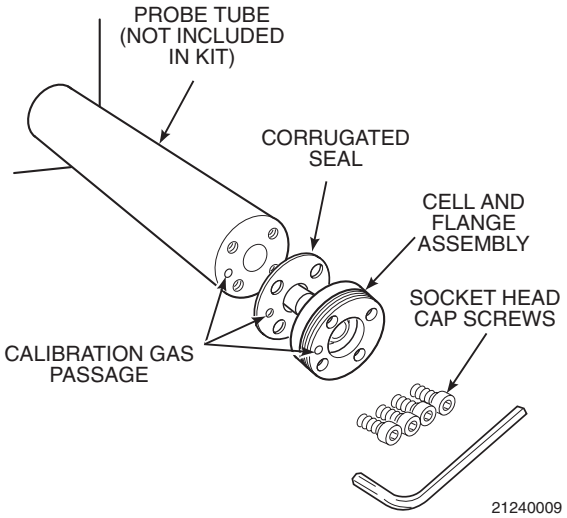


Figure A-18. Cell Replacement Kit

e. If contact assembly is damaged, replace contact and thermocouple according to paragraph A-13, 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 new 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 55 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).

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.

A-12 OPTIONAL CERAMIC DIFFUSION ELEMENT REPLACEMENT

a. General

The 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 A-3.

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). They can cause severe burns.

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

CAUTION

It is not necessary to remove the cell unless it is certain that replacement is necessary. Cell cannot be removed for inspection without damaging it. Refer to paragraph A-11, Cell Replacement.

b. Replacement Procedure

1. Shut off power to electronics. Disconnect cable conductors and remove cable, Figure A-16. Shut off and disconnect reference air and calibration gas supplies from probe junction box. 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 A-17, using hex wrench from special tools kit, Table A-3, 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 tools kit, Table A-3, 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 A-3. 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-13 REPLACEMENT OF CONTACT AND THERMOCOUPLE ASSEMBLY

WARNING

Use heat resistant gloves and clothing when removing probe 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.

a. Disconnect and lock out power to electronics. Using heat resistant gloves and clothing, remove probe junction box cover. Squeezing tabs on hose clamps, remove hoses from probe junction box, Figure A-19. Remove four screws in corners of probe junction box. Pull probe 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 A-16.

c. Remove two screws, Figure A-19, lockwashers, and flat washers that connect probe junction box to inner probe assembly. Pull heater, V-strut and backplate assembly away from probe junction box. Inspect all O-rings and insulating gasket; replace if worn or damaged.

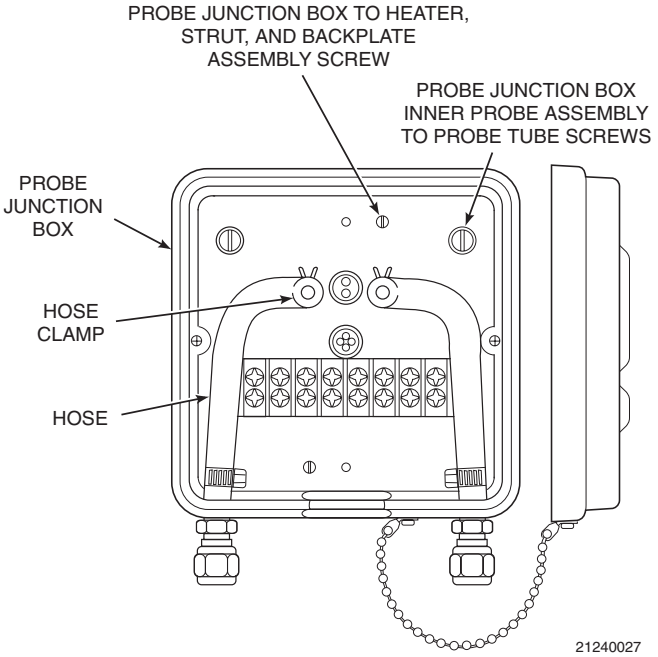


Figure A-19. Probe Junction Box Mechanical Connections

d. Use a pencil to mark locations of spring clip on ceramic rod, Figure A-20.

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.

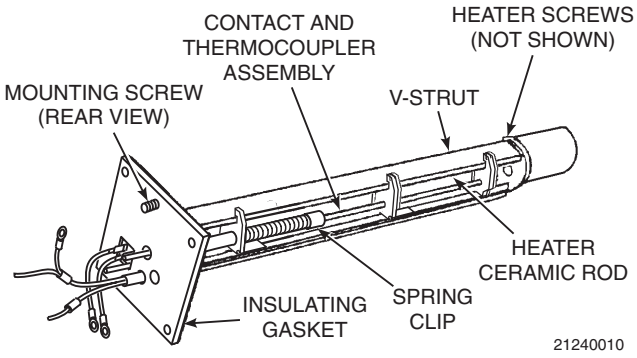


Figure A-20. Inner Probe Replacement (Heater, V-Strut, and Backplate Assembly)

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 A-21), spring (9), spring clip (10) (held open by squeezing tabs), and tube supports (11, 13) until spring clip reaches pencil mark.

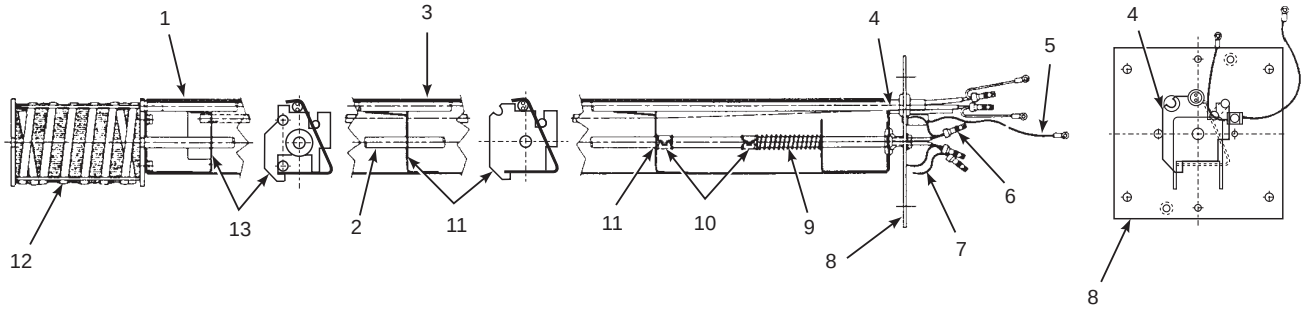
i. Reinstall insulating gasket on backplate, replace two screws, O-rings, lockwashers and flat washers connecting probe junction box to inner probe assembly.

CAUTION

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

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

k. Connect color coded wires to proper terminals as shown in Figure A-16. 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



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

Figure A-21. Heater, Strut, and Backplate Assembly (Inner Probe Assembly)

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 inch (6.4 mm) from end of ceramic rod. Dress wires so they do not touch sides of probe junction box.

l. Slide assembled probe junction box and inner probe assembly into probe tube. To align calibration gas tube with corresponding hole in backplate (A, B, Figure A-1), insert scriber through hole in backplate and into calibration gas tube. Secure with screws. Reinstall hoses and probe junction box cover.

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

A-14 REPLACEMENT OF HEATER, V-STRUT AND BACKPLATE ASSEMBLY (INNER PROBE ASSEMBLY; INCLUDES CONTACT AND THERMOCOUPLE ASSEMBLY)

WARNING

Use heat resistant gloves and clothing when removing probe 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° (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.

NOTE

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

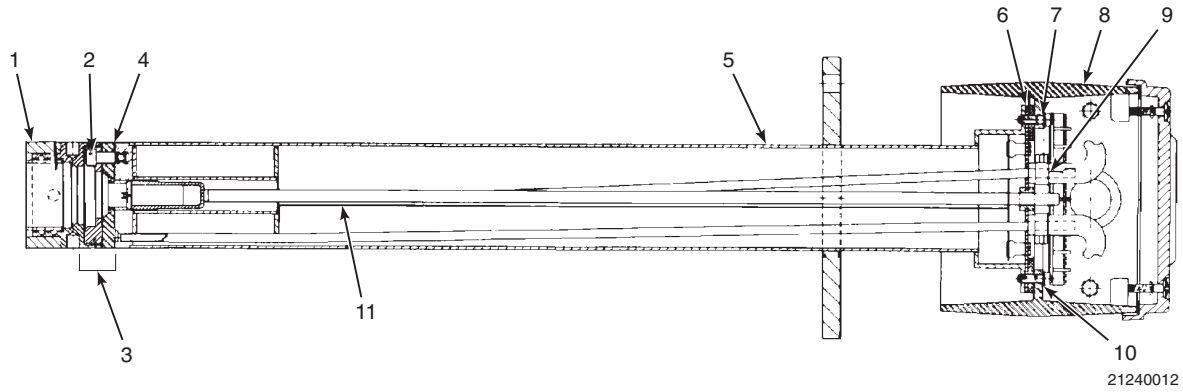
a. Disconnect and lock out power to electronics. Using heat resistant gloves and clothing, remove probe cover. Squeezing tabs on hose clamps and remove hoses from probe junction box, Figure A-19. Remove four screws and lockwashers (7, 10, Figure A-22) that hold probe junction box and inner probe assembly to probe tube. Pull probe 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 A-16.

c. Remove two screws, lockwashers, and flat washers that connect probe 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.

d. Connect color coded wires to proper terminals as shown in Figure A-16. 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 inch (6.4 mm) from end of ceramic rod. Dress wires so they do not touch sides of probe junction box.



1. Snubber Diffusion Element
2. Socket Hd Cap Screw [0.25 in.-28 x 0.063 (16 mm)]
3. Cell and Flange Assembly
4. Corrugated Seal
5. Probe Tube Assembly
6. Gasket [4.0 in. (102 mm) x 4.0 in. x 0.12 in. (3 mm)]
7. Fillister Hd Screw [8-32 x 0.5 in. (12.7 mm)]
8. Cover Head Assembly
9. Hose Clamp
10. Lockwasher (#8 Split)
11. Heater Strut Assembly

Figure A-22. Oxygen Analyzer (Probe), Cross-Sectional View

e. Slide assembled probe junction box and inner probe assembly into probe tube. To align calibration gas tube with corresponding hole in backplate (A, B, Figure A-1), 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 junction box 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.

A-15 CALIBRATION GAS AND REFERENCE AIR 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 probe junction box. The kit part number is 4843B93G01.

a. Installation Procedure

WARNING

Use heat resistant gloves and clothing when removing probe 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 probe junction box (Figure A-19).

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 probe junction box. Install the other end of the stainless steel tube onto the tube going to the probe (Figure A-23).

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.

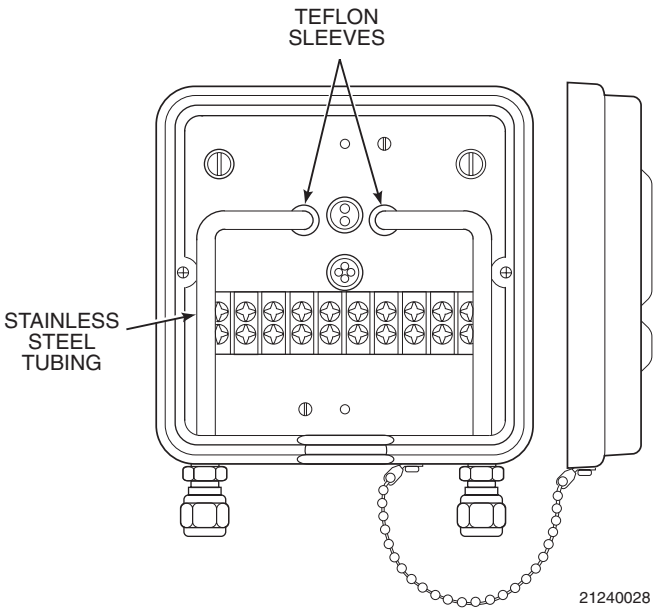


Figure A-23. High Temperature - Corrosive Environment Kit

REPLACEMENT PARTS

Table A-3. Replacement Parts for Probe

Figure and Index No.	Part Number	Description
Figure A-20	3D39441G06[1]	Heater, V-Strut, and Backplate Assembly, 18 in. (45.6 cm)
Figure A-20	3D39441G07[1]	Heater, V-Strut, and Backplate Assembly, 3 ft (0.9 m)
Figure A-20	3D39441G08[1]	Heater, V-Strut, and Backplate Assembly, 6 ft (1.8 m)
Figure A-20	3D39441G09[1]	Heater, V-Strut, and Backplate Assembly, 9 ft (2.7 m)
Figure A-20	3D39441G10[1]	Heater, V-Strut, and Backplate Assembly, 12 ft (3.6 m)
Figure A-21, 2	3534B56G04[2]	Contact and Thermocouple Assembly, 18 in. (45.6 cm)
Figure A-21, 2	3534B56G05[2]	Contact and Thermocouple Assembly, 3 ft (0.9 m)
Figure A-21, 2	3534B56G06[2]	Contact and Thermocouple Assembly, 6 ft (1.8 m)
Figure A-21, 2	3534B56G07[2]	Contact and Thermocouple Assembly, 9 ft (2.7 m)
Figure A-21, 2	3534B56G08[2]	Contact and Thermocouple Assembly, 12 ft (3.6 m)
Figure A-7	3D39003G01[3]	Abrasive Shield Assembly, 3 ft (0.9 m)
Figure A-7	3D39003G02[3]	Abrasive Shield Assembly, 6 ft (1.8 m)
Figure A-7	3D39003G07[3]	Abrasive Shield Assembly, 9 ft (2.7 m)
Figure A-7	3D39003G08[3]	Abrasive Shield Assembly, 12 ft (3.6 m)
Figure A-18	4847B61G01	Cell Replacement Kit, ANSI, No Lead Wire
Figure A-18	4847B61G02	Cell Replacement Kit, ANSI 18 in. (45.6 cm)
Figure A-18	4847B61G03	Cell Replacement Kit, ANSI 3 ft (0.9 m)
Figure A-18	4847B61G04	Cell Replacement Kit, ANSI 6 ft (1.8 m)
Figure A-18	4847B61G05	Cell Replacement Kit, ANSI 9 ft (2.7 m)
Figure A-18	4847B61G06	Cell Replacement Kit, ANSI 12 ft (3.6 m)
Figure A-18	4847B61G07	Cell Replacement Kit, JIS, No Lead Wire
Figure A-18	4847B61G08	Cell Replacement Kit, JIS 18 in. (45.6 cm)
Figure A-18	4847B61G09	Cell Replacement Kit, JIS 3 ft (0.9 m)
Figure A-18	4847B61G10	Cell Replacement Kit, JIS 6 ft (1.8 m)
Figure A-18	4847B61G11	Cell Replacement Kit, JIS 9 ft (2.7 m)
Figure A-18	4847B61G12	Cell Replacement Kit, JIS 12 ft (3.6 m)
Figure A-18	4847B61G13	Cell Replacement Kit, DIN, No Lead Wire
Figure A-18	4847B61G14	Cell Replacement Kit, DIN 18 in. (45.6 cm)
Figure A-18	4847B61G15	Cell Replacement Kit, DIN 3 ft (0.9 m)
Figure A-18	4847B61G16	Cell Replacement Kit, DIN 6 ft (1.8 m)
Figure A-18	4847B61G17	Cell Replacement Kit, DIN 9 ft (2.7 m)
Figure A-18	4847B61G18	Cell Replacement Kit, DIN 12 ft (3.6 m)
Figure A-18	3535B42G01	Probe Disassembly Kit
Figure A-10	3534B18G01	Diffuser Assembly
Figure A-8	3535B60G01	Diffuser Dust Seal Hub Assembly (For use with Abrasive Shield)

Table A-3. Replacement Parts for Probe (Continued)

Figure and Index No.	Part Number	Description
Figure A-10	4841B03G02	Stainless Steel Diffuser Assembly
Figure A-9	3535B63G01	Flame Arrestor Diffuser Dust Seal
Figure A-11	3535B62G01	Flame Arrestor Diffuser
Figure A-4	3534B48G01	Vee Deflector Assembly (For use with standard or dust seal type ceramic diffusers)
Figure A-17	6292A74G02	Diffusion Element Replacement Kit
	1537B70G03	Horizontal and Vertical Brace Clamp Assembly, 9 and 12 foot (2.7 and 3.6 m) probe
Figure A-23	4843B93G01	High Temperature - Corrosive Environment Kit
Figure A-1, 2	4843B37G01	Snubber Diffusion Assembly
Figure A-12	4843B38G02	Dust Seal/Snubber Diffusion Assembly

[1]Heater, V-strut, and backplate assembly includes contact and thermocouple assembly.
[2]Contact and thermocouple assembly includes platinum pad and inconel wire.
[3]Abrasive shield assembly includes accessories necessary for its use and a mounting plate and gasket.

APPENDIX B, REV. 2.2
HPS 3000 HEATER POWER SUPPLY

DESCRIPTION

WARNING

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.

B-1 DESCRIPTION

The Rosemount HPS 3000 Heater Power Supply Field Module acts as an interface between probe and electronics, and supplies power to the probe heater. The unit allows the use of probes with a number of different electronics packages.

The HPS is available in a NEMA 4X (IP56) non-hazardous enclosure or an optional Class 1, Division 1, Group B (IP56) explosion-proof enclosure, Figure B-1.

The heater power supply, Figure B-2, consists of a mother board, daughter board, and a transformer for supplying correct voltage to the probe heater. The mother and daughter boards contain terminal strips for connecting probe, electronics, and power supply.

The HPS is jumper configurable for 120, 220, or 240 Vac. For 100 Vac usage, the HPS is factory-supplied with a special transformer. The 100 Vac transformer can also be easily field installed. Refer to paragraph B-7, Transformer Replacement for installation procedure; refer to Table B-2, for transformer part numbers.

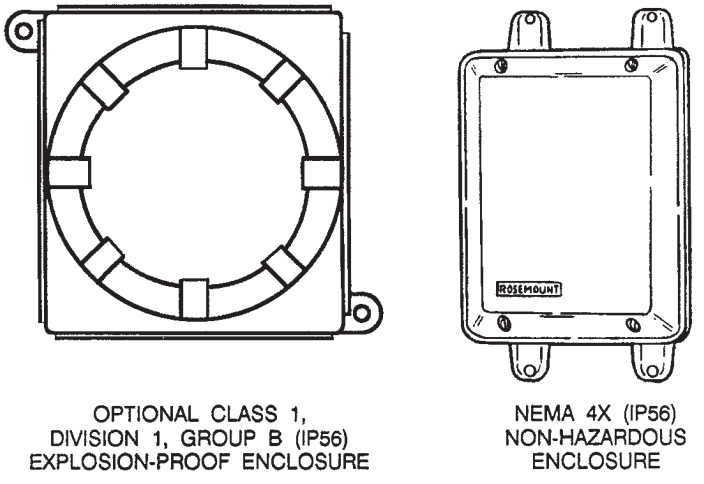


Figure B-1. HPS 3000 Heater Power Supply Field Module

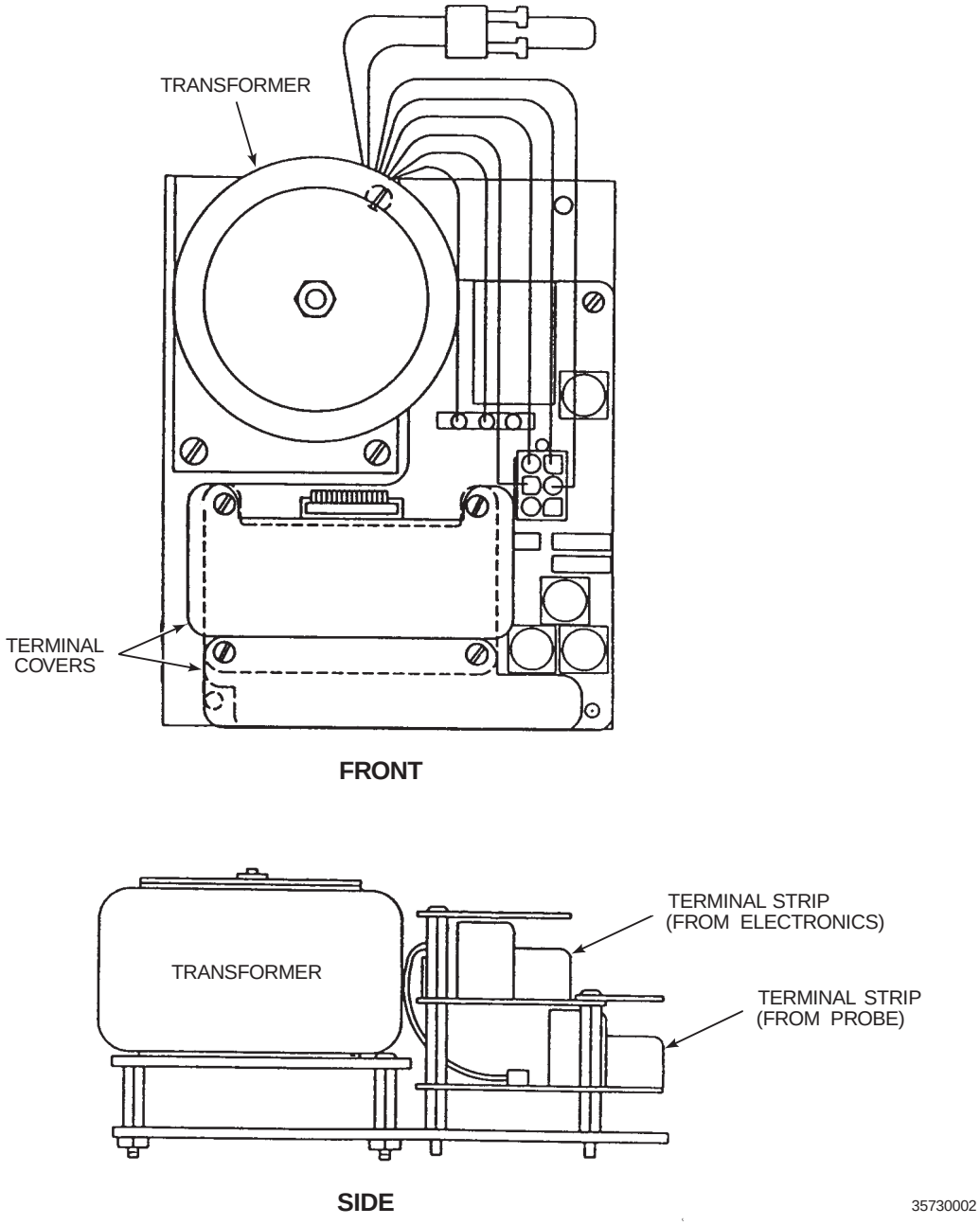


Figure B-2. Heater Power Supply, Interior

Table B-1. Specifications for Heater Power Supply

Environmental Classification	NEMA 4X (IP56) Optional - Class 1, Division 1, Group B (IP56)
Electrical Classification	Category II
Humidity Range	95% Relative Humidity
Ambient Temperature Range	-20° to 140°F (-30° to 60°C)
Vibration	5 m/sec2, 10 to 500 xyz plane
Cabling Distance Between HPS 3000 and Probe	Maximum 150 feet (45 m)
Cabling Distance Between HPS 3000 and CRE 3000	Maximum 1200 feet (364 m)
Cabling Distance Between HPS 3000 and IFT 3000	Maximum 1200 feet (364 m)
Approximate Shipping Weight	12 pounds (5.4 kg)

B-2 THEORY OF OPERATION

The HPS 3000 Heater Power Supply may perform slightly different functions, depending upon which electronics package it is used with. Figure B-3 shows a functional block diagram of the unit. The HPS contains a transformer for converting line voltage to 44 volts needed to power the probe heater. The relay, Figure B-3, can be used to remotely turn the probe on or off manually. A triac module is used to turn the heater on or off, depending on probe temperature.

When used with the CRE 3000 Control Room Electronics or IFT 3000 Intelligent Field Transmitter, the HPS uses a cold junction temperature compensation feature. This allows for the use of a less expensive cable between the HPS and CRE or HPS and IFT. The HPS and electronics package can be located up to 1200 feet (364 m) apart.

The standard cable, between probe and HPS, is thermocouple compensated. This prevents the additional junctions between thermocouple and cable from producing a voltage which would affect the thermocouple output signal. A temperature sensor in the HPS monitors the temperature at the junction and sends a voltage signal to the CRE and IFT. The CRE and IFT uses this signal to compensate the probe thermocouple reading for the temperature at the junction between the compensated and uncompensated cables.

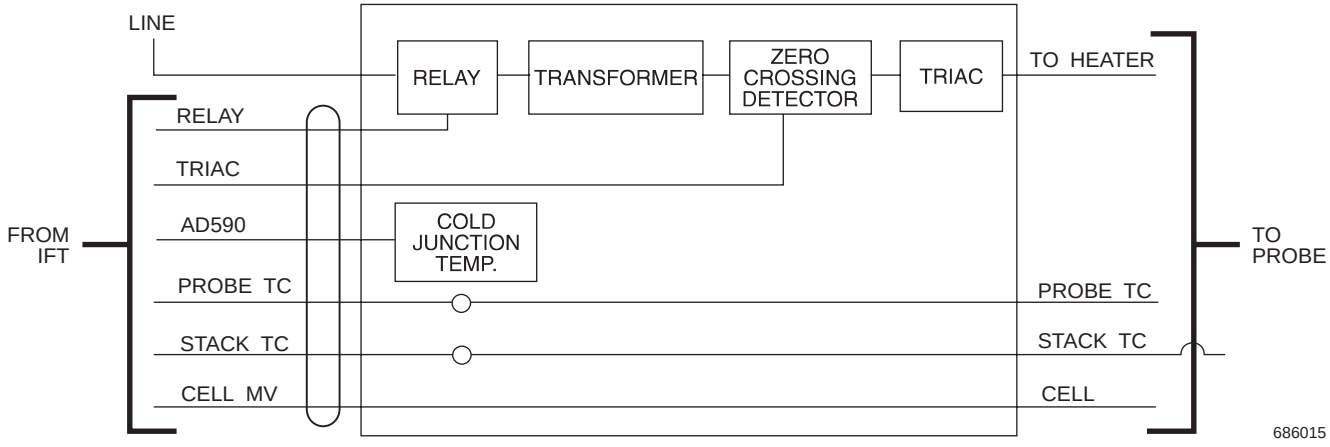


Figure B-3. Heater Power Supply Block Diagram

In operation, when connected to the CRE 3000 Control Room Electronics, line voltage passes through the relay (when on) and is converted into 44 volts by the transformer. If the probe thermocouple indicates that the probe has dropped below operating temperature, a signal from the CRE triggers the triac. The triac then supplies voltage to the probe heater, warming the cell. Conversely, if the probe thermocouple indicates that the probe heater has reached the upper limit of operating temperature, the CRE deactivates the triac, shutting off power to the heater.

NOTE

When using the HPS 3000 with an existing electronics package, such as Models 218, 218A, 225, or TC200, the electronics will not have the input/output capacity to support all of the functions mentioned in this section. Refer to Instruction Bulletin IB-106-300NE.

HPS 3000 TROUBLESHOOTING

B-3 OVERVIEW

The HPS 3000 troubleshooting section describes how to identify and isolate faults which may develop in the HPS 3000 assembly.

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.

B-4 HPS 3000 TROUBLESHOOTING

The HPS 3000 troubleshooting may overlap with the probe in use in the system. Faults in either system may cause an error to be displayed in the electronics package. Figure B-4, Figure B-5, and Figure B-6 provide troubleshooting information.

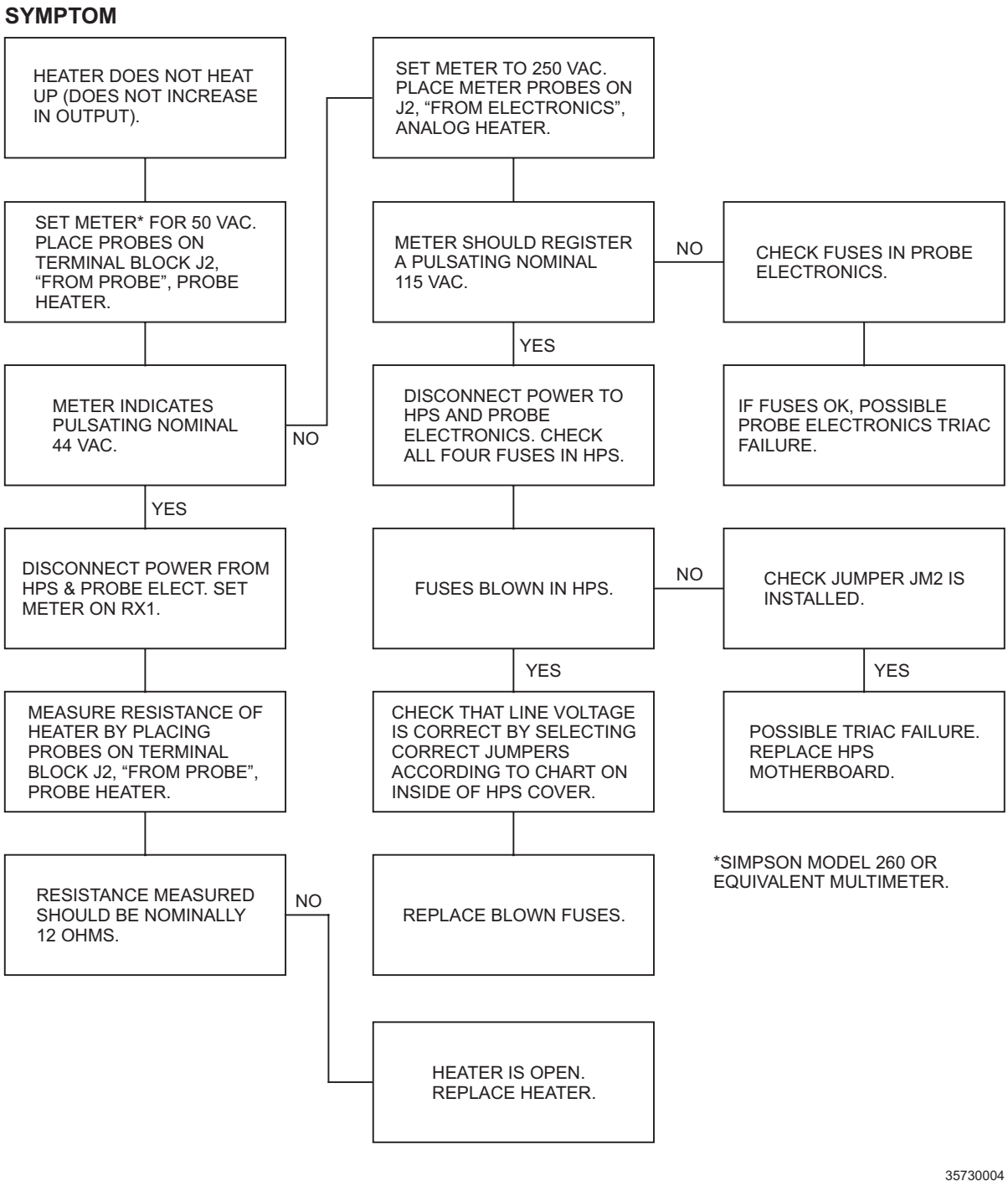


Figure B-4. HPS Troubleshooting Flowchart, #1

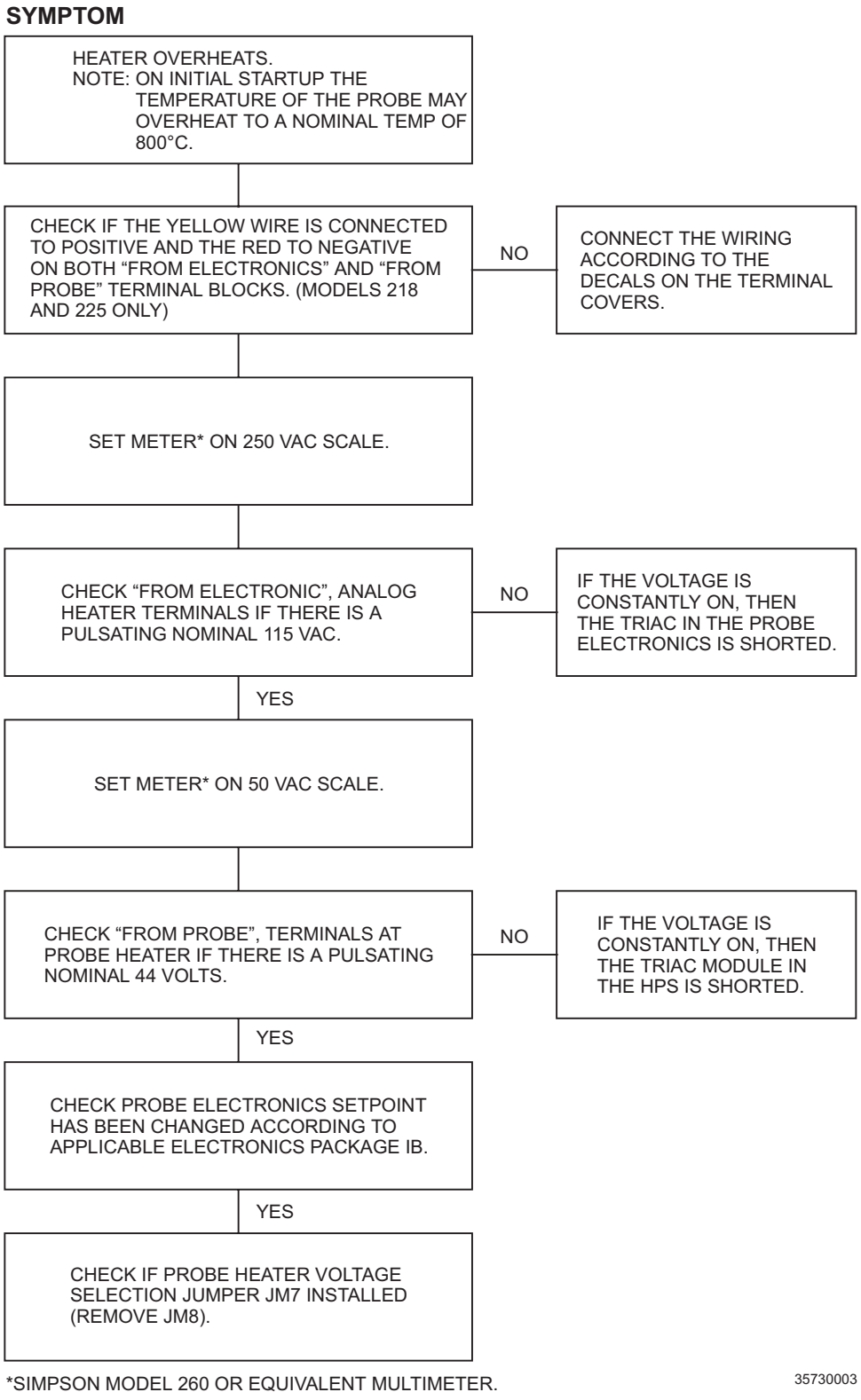


Figure B-5. HPS Troubleshooting Flowchart, #2

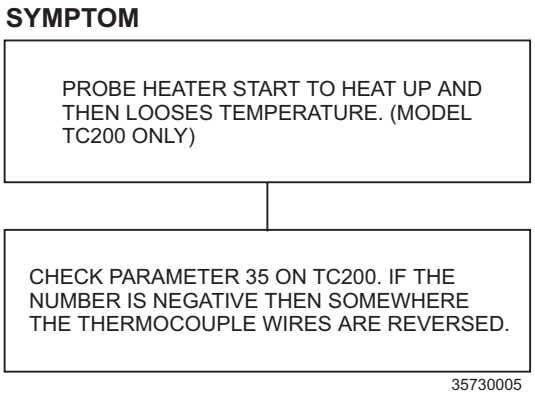


Figure B-6. HPS Troubleshooting Flowchart, #3

SERVICE AND NORMAL MAINTENANCE

B-5 OVERVIEW

This section describes service and routine maintenance of the HPS 3000 Heater Power Supply Field Module. Replacement parts referred to are available from Rosemount. Refer to Table B-2 of this manual for part numbers and ordering information.

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.

B-6 FUSE REPLACEMENT

The heater power supply mother board (12, Figure B-7) contains four identical 5 amp fuses. Refer to Table B-1 for replacement fuse specifications. To check or replace a fuse, simply unscrew the top of the fuseholder with a flat head screwdriver and remove fuse. After checking or replacing a fuse, reinstall fuseholder top.

B-7 TRANSFORMER REPLACEMENT

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.

a. Turn off power to system.

b. Loosen captive screws retaining HPS cover. Remove cover.

c. Remove hex nut (25, Figure B-7) from top of transformer assembly. Remove retaining plate (24) and gasket (22).

d. Disconnect transformer harness plug from mother board.

e. Remove old transformer. Place new transformer in position and reconnect harness plug as noted in step d.

f. Place gasket and retaining plate on transformer.

g. Tighten hex nut only enough to firmly hold transformer in place.

h. Reinstall HPS cover.

B-8 MOTHER BOARD REPLACEMENT

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.

a. Turn off power to system.

b. Loosen captive screws retaining HPS cover. Remove cover.

c. Remove hex nut (25, Figure B-7) from top of transformer assembly. Remove retaining plate (24) and gasket (22).

d. Disconnect transformer harness plug from mother board.

e. Remove screws on either side of terminal strip covers (2). Remove terminal strip covers (4 and 8).

f. Unplug ribbon cable from the receptacle on the daughter board (7).

g. Unscrew stand offs on either side of the daughter board. Remove daughter board (7).

h. Unscrew four stand offs that supported the daughter board.

i. Making a note of the location and color of each wire, disconnect wires from terminal strip on mother board.

j. Remove four screws (9) holding mother board to stand offs (10) on subplate (14).

k. Remove mother board (12).

l. Position new mother board on stand offs and reinstall screws removed in step j.

m. Reconnect wires to terminal strip in positions noted in step i.

n. Reinstall four stand offs removed in step h. Position daughter board on stand offs and reinstall stand offs removed in step g.

o. Plug ribbon cable back into receptacle on daughter board. Reinstall terminal covers.

p. Reinstall transformer, tightening hex nut only enough to hold transformer firmly in position. Reconnect transformer harness plug to mother board.

q. Reinstall HPS cover.

B-9 DAUGHTER BOARD REPLACEMENT

CAUTION

When turning power off at the HPS, also turn off the respective probe at associated electronics. When service on the HPS is completed, restore power at the HPS and the associated electronics.

a. Turn off power to system.

b. Loosen captive screws retaining HPS cover. Remove cover.

c. Remove screws on either side of terminal strip covers (2, Figure B-7). Remove terminal strip covers (4 and 8).

d. Making a note of the location and color of each wire, disconnect wires from the terminal strip on the daughter board (7).

e. Unplug ribbon cable from receptacle on daughter board.

f. Unscrew two stand offs from daughter board. Remove daughter board (7).

g. Position new daughter board on four stand offs on mother board. Reinstall the stand offs removed in step f.

h. Plug ribbon cable into receptacle on daughter board.

i. Reconnect wires to terminal strip in positions noted in step d. Reinstall terminal covers.

j. Reinstall HPS cover.

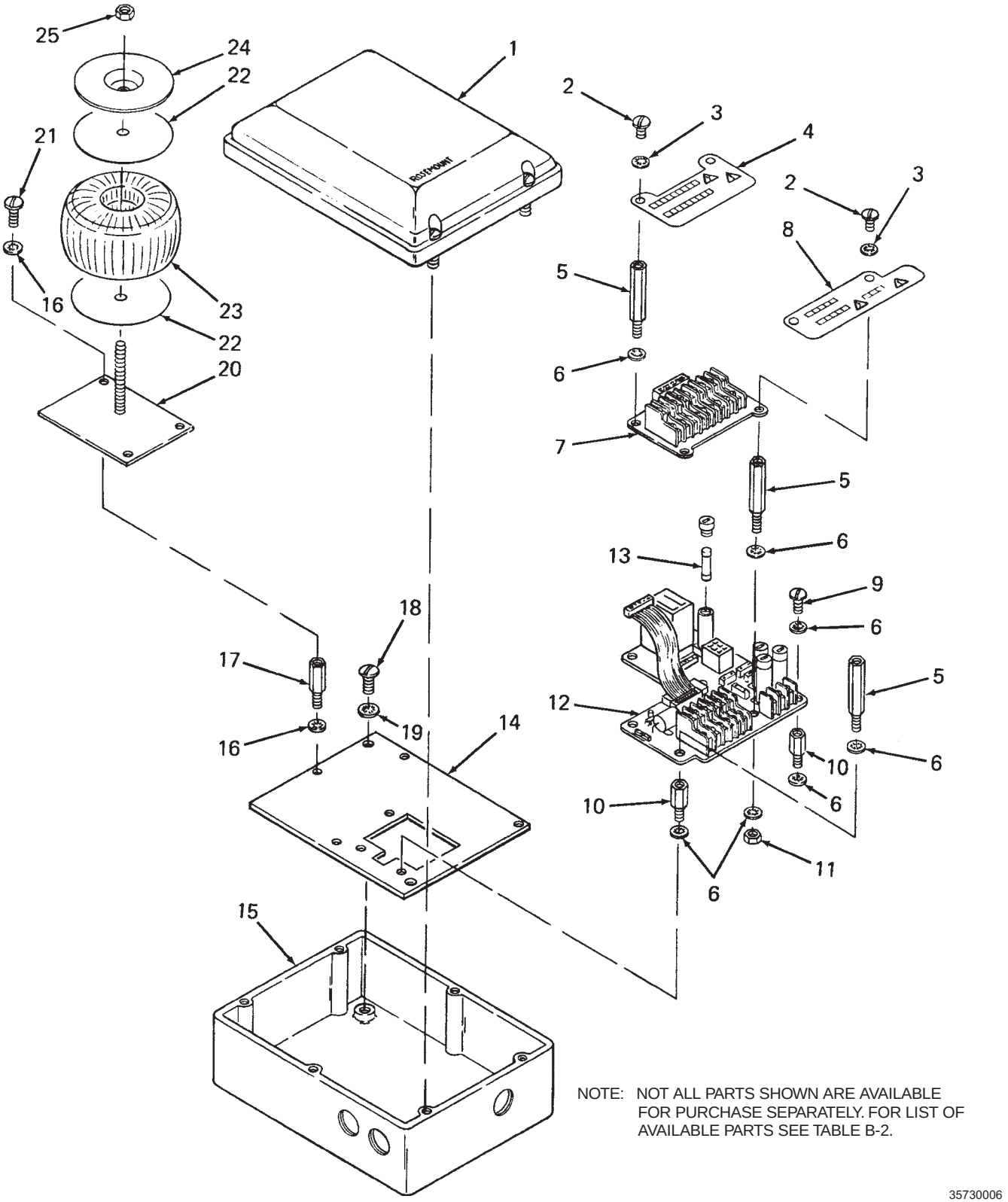


Figure B-7. Heater Power Supply, Exploded View

LEGEND FOR FIGURE B-7

1. Enclosure Cover
2. Screw
3. Lockwasher
4. Terminal Cover
5. Stand Off
6. Lockwasher
7. Daughter Board
8. Terminal Cover
9. Screw
10. Stand Off
11. Hex Nut
12. Mother Board
13. Fuse
14. Subplate
15. Enclosure Box
16. Lockwasher
17. Stand Off
18. Screw
19. Lockwasher
20. Mounting Plate
21. Screw
22. Gasket
23. Transformer
24. Retaining Plate
25. Hex Nut

REPLACEMENT PARTS

Table B-2. Replacement Parts for Heater Power Supply

FIGURE and INDEX NO.	PART NUMBER	DESCRIPTION
Figure B-1	3D39129G01	Non-Hazardous HPS (120 Vac)
Figure B-1	3D39129G02	Non-Hazardous HPS (100 Vac)
Figure B-1	3D39129G03	Non-Hazardous HPS (220, 240 Vac)
Figure B-1	1U05667G01	Explosion-Proof HPS (120 Vac)
Figure B-1	1U05667G02	Explosion-Proof HPS (100 Vac)
Figure B-1	1U05667G03	Explosion-Proof HPS (220, 240 Vac)
Figure B-7, 13	1L01293H02	Fuse, 5A @ 250 Vac, anti-surge, case size; 5 x 20 mm, type T to IEC127, Schurter
Figure B-7, 12	3D39080G02	Mother Board
Figure B-7, 7	3D39078G01	Daughter Board
Figure B-7, 23	1M02961G01	Transformer (120, 220, 240 Vac)
Figure B-7, 23	1M02961G02	Transformer (100 Vac)

SECTION 7
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.

WARRANTY

Goods and part(s) (excluding consumables) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Consumables, glass electrodes, membranes, liquid junctions, electrolyte, o-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. Goods, part(s) and consumables proven by Seller to be defective in workmanship and/or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, part(s) or consumables are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) month period of warranty in the case of goods and part(s), and in the case of consumables, within the ninety (90) day period of warranty. This warranty shall be in effect for replacement or repaired goods, part(s) and the remaining portion of the ninety (90) day warranty in the case of consumables. A defect in goods, part(s) and consumables of the commercial unit shall not operate to condemn such commercial unit when such goods, part(s) and consumables are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or to any other person, for the loss or damage directly or indirectly, arising from the use of the equipment or goods, from breach of any warranty, or from any other cause. All other warranties, expressed or implied are hereby excluded.

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Force Majeure. Seller shall not be liable for failure to perform due to labor strikes or acts beyond Seller's direct control.

Instruction Manual
106-300NE Rev. 3.4
May 2000

World Class 3000

World Class 3000 Probe	HPS 3000
Part No. _____ Serial No. _____ Order No. _____	Part No. _____ Serial No. _____ Order No. _____

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