

SBX 1000

In-Situ Oxygen Transmitter



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SBX 1000 In-Situ Oxygen Transmitter

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.

PREFACE

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of the SBX 1000.

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.

SYMBOLS

 : EARTH (GROUND) TERMINAL

 : PROTECTIVE CONDUCTOR TERMINAL

 : RISK OF ELECTRICAL SHOCK

 : WARNING: REFER TO INSTRUCTION BULLETIN

NOTE TO USERS

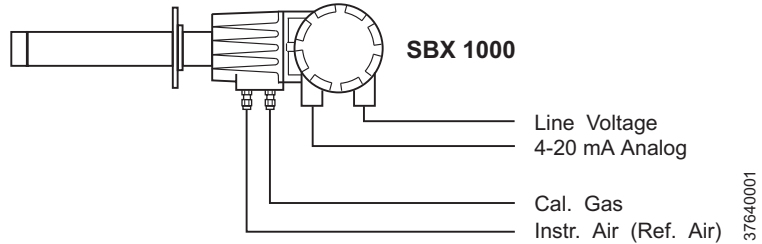
The number in the lower right corner of each illustration in this publication is a manual illustration number. It is not a part number, and is not related to the illustration in any technical manner.

QUICK START GUIDE

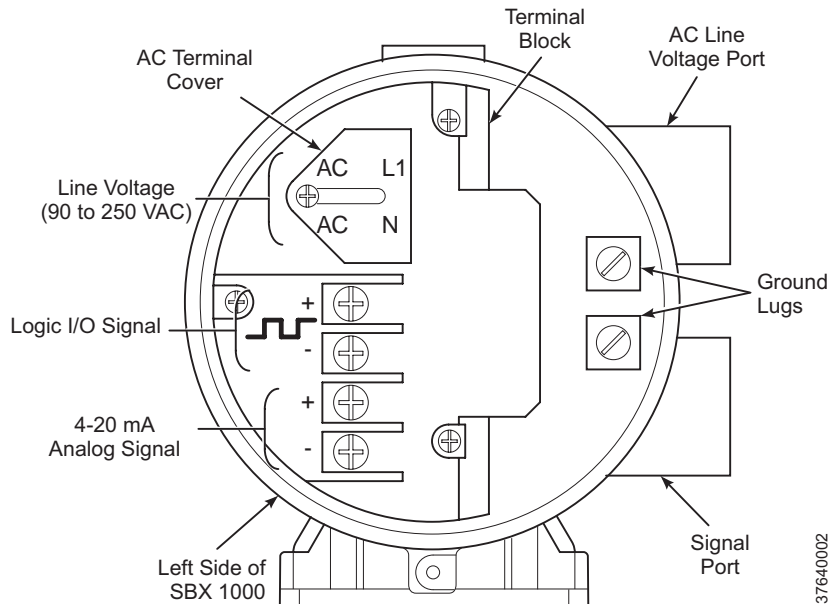
Use the following Quick Start Guide only if you are familiar with the installation requirements for the SBX 1000 In-Situ Oxygen Transmitter.

If you cannot use the Quick Start Guide, turn to Section 2, Installation, in this Instruction Manual.

The following drawing shows a simplified installation diagram for the SBX 1000.



1. Install the SBX 1000 in an appropriate location on the stack or duct. Refer to Selecting Location in Section 2, Installation, for information on selecting a location for the SBX 1000.
2. Connect reference air to the SBX 1000 as shown in the figure above.
3. Connect the line voltage and 4-20 mA analog output as shown in the figure below.



4. Verify the SBX 1000 switch configuration is as desired. Refer to Configuration in Section 3, Configuration and Startup.
5. Apply power to the SBX 1000; the cell heater will turn on. Allow approximately one half hour for the cell to heat to operating temperature. Once the ramp cycle has completed and the SBX 1000 is at normal operation, proceed with step 6.
6. Perform a manual calibration per the following procedure. Refer to Section 4, Calibration for more information regarding calibration.

Manual Calibration Quick Reference Guide

Perform a Manual Calibration as follows:

1. Place the control loop in manual.
2. Press the **CAL** key. The Cal LED will remain lit.
3. Apply the first calibration gas.
4. Press the **CAL** key. When the unit has taken the readings using the first calibration gas, the Cal LED will flash continuously.
5. Remove the first calibration gas and apply the second calibration gas.
6. Push the **CAL** key. The Cal LED will remain lit. When the unit has taken the readings using the second calibration gas, the Cal LED will flash a two-pattern flash or a three-pattern flash. A two-pattern flash equals a valid calibration, three-pattern flash equals an invalid calibration.
7. Remove the second calibration gas and cap off the calibration gas port.
8. Press the **CAL** key. The Cal LED will remain lit as the unit purges. When the purge is complete, the Cal LED will turn off.
9. If the calibration was valid, the DIAGNOSTIC ALARMS LEDs indicate normal operation. If the new calibration values are not within the parameters, the DIAGNOSTIC ALARMS LEDs will indicate an alarm.
10. Place the control loop in automatic.

Technical Support Hotline

For assistance with technical problems, please call the Customer Support Center (CSC). The CSC is staffed 24 hours a day, 7 days a week.

Phone: 1-800-433-6076

In addition to the CSC, you may also contact Field Watch. Field Watch coordinates Rosemount Analytical field service throughout the U.S. and abroad.

Phone: 1-800-654-RSMT (1-800-654-7768)

Rosemount Analytical may also be reached via the Internet through e-mail and the World Wide Web:

e-mail: GAS.CSC@emersonprocess.com

World Wide Web: www.raihome.com

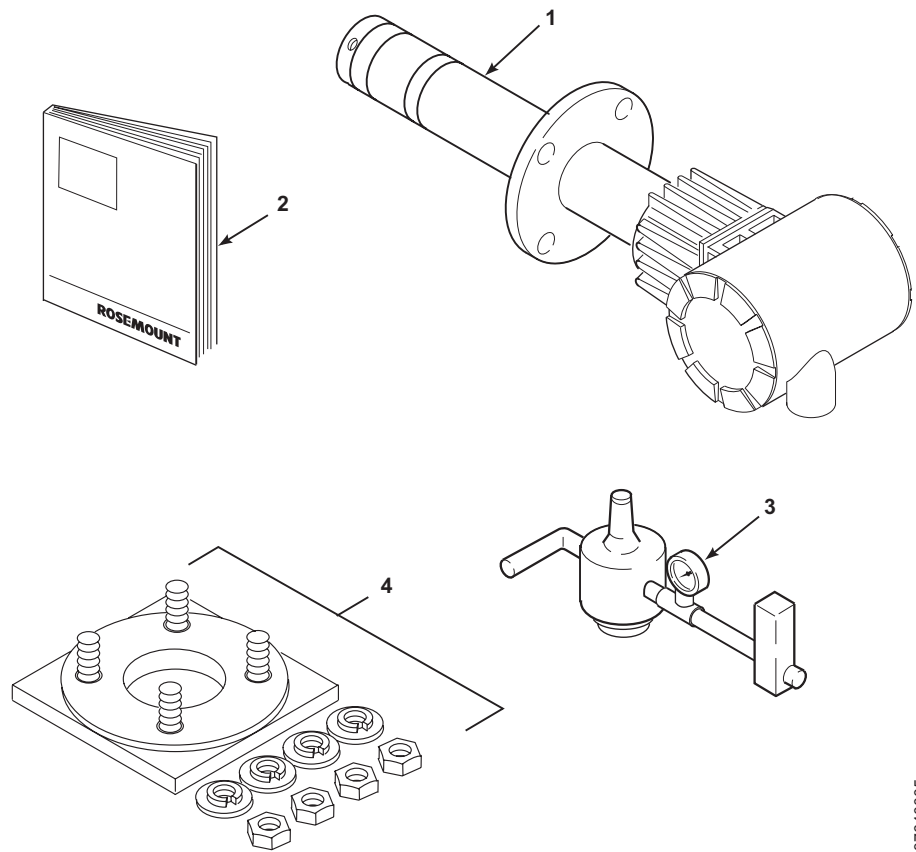
Section 1 Description and Specifications

Component Checklist	page 1-1
System Overview	page 1-2
Specifications	page 1-5

COMPONENT CHECKLIST

A typical Rosemount Analytical SBX 1000 In-Situ Oxygen Transmitter should contain the items in Figure 1-1. The Reference Air Set (item 1) and Mounting Plate with Hardware (item 2) are optional items. Record the part number, serial number, and order number for each component of your system.

Figure 1-1. Typical System Package



1. SBX 1000
2. Instruction Manual
3. Reference Air Set (not included, see Section 10, Optional Accessories)
4. Mounting Plate with Mounting Hardware and Gasket (not included, see Section 10, Optional Accessories)

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SYSTEM OVERVIEW

Scope

This Instruction Manual is designed to supply details needed to install, start up, operate, and maintain the SBX 1000. Signal conditioning electronics outputs a 4-20 mA signal representing an oxygen value. The electronics package includes a membrane keypad for setup, calibration, and diagnostics.

System Description

The SBX 1000 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.

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:

- P_2 is the partial pressure of the oxygen in the measured gas on one side of the cell.
- P_1 is the partial pressure of the oxygen in the reference air on the opposite side of the cell.
- T is the absolute temperature.
- C is the cell constant.
- K is an arithmetic constant.

NOTE

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

When the cell is at operating temperature and there are unequal oxygen concentrations across the cell, oxygen ions will travel from the high oxygen partial pressure side to the low oxygen partial pressure side of the cell. The resulting logarithmic output voltage is approximately 50 mV per decade. The output is proportional to the inverse logarithm of the oxygen concentration. Therefore, the output signal increases as the oxygen concentration of the sample gas decreases. This characteristic enables the SBX 1000 to provide exceptional sensitivity at low oxygen concentrations.

The SBX 1000 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 portable 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.

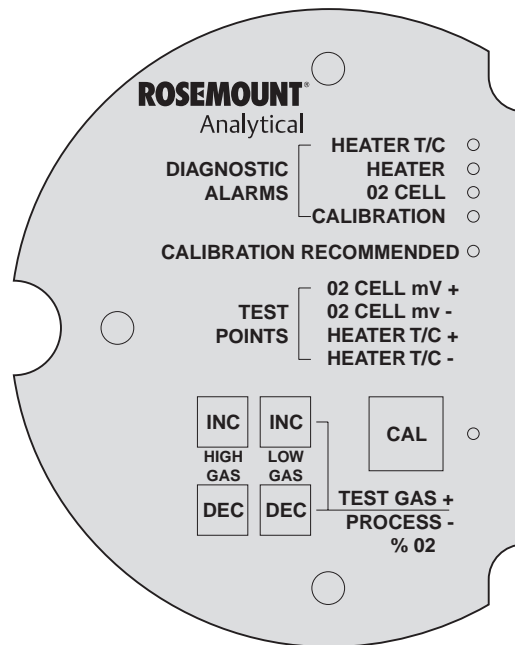
System Configuration

The SBX 1000 is equipped with a 12 inch probe. The electronics control instrument temperatures, provide an isolated 4-20 mA output proportional to the measured oxygen concentration, and control the Logic I/O output contact. The power supply can accept voltages of 90-250 VAC and 48/62 Hz; no power supply setup procedures are required. The oxygen sensing cell is maintained at a constant temperature by modulating the duty cycle of the probe heater portion of the electronics. The electronics accepts millivolt signals generated by the oxygen sensing cell and produces the outputs for controlling remote user devices.

System Features

- The CALIBRATION RECOMMENDED feature detects when the sensing cell is likely out of limits. This may eliminate the need to calibrate on a "time since last cal" basis.
- The cell output voltage and sensitivity increase as the oxygen concentration decreases.
- The oxygen cell, heater, thermocouple and diffusion element are field replaceable.
- The SBX 1000 is constructed of rugged 316 L stainless steel for all wetted parts.
- The SBX 1000 automatically adapts to line voltages from 90-250 VAC; no input power configuration or setup is necessary.
- An operator can calibrate and diagnostically troubleshoot the SBX 1000 using the integral membrane keypad shown in Figure 1-2.

Figure 1-2. Membrane Keypad



- The membrane keypad, housed within the electronics housing, provides fault indication by way of flashing LEDs. Calibration can be performed from the membrane keypad.

Handling the SBX 1000

CAUTION

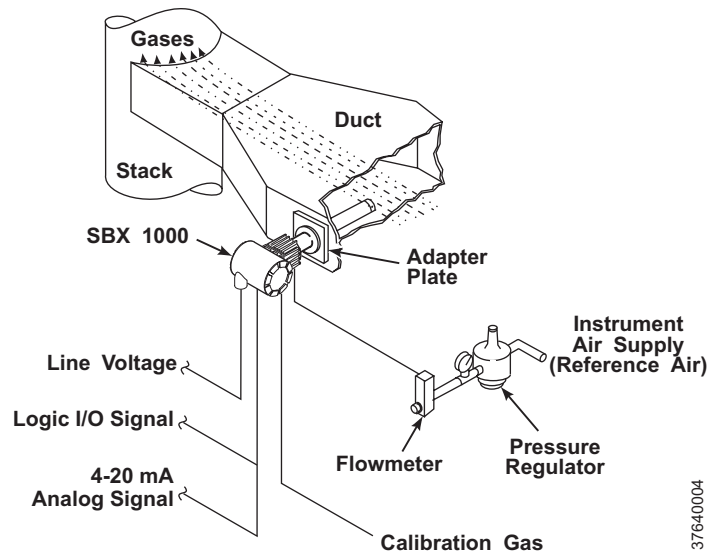
It is important that printed circuit boards and integrated circuits are handled only when adequate antistatic precautions have been taken to prevent possible equipment damage.

The SBX 1000 is designed for industrial applications. Treat each component of the system with care to avoid physical damage. Some probe components are made from ceramics, which are susceptible to shock when mishandled

System Considerations

Prior to installing your SBX 1000, make sure you have all the components necessary for system installation. Ensure all the components are properly integrated to make the system functional. After verifying that you have all the components, select mounting locations and determine how each component will be placed in terms of available line voltage, ambient temperatures, environmental considerations, convenience, and serviceability. A typical installation for an SBX 1000 is shown in Figure 1-3.

Figure 1-3. Typical SBX 1000 Installation



A source of instrument air is optional at the SBX 1000 for reference air use. Since the unit is equipped with an in-place calibration feature, provisions can be made to permanently connect calibration gas bottles to the SBX 1000. If the calibration gas bottles, Table 1-2, will be permanently connected, a check valve is required next to the calibration fittings on the integral electronics. This check valve is to prevent breathing of the calibration gas line and subsequent flue gas condensation and corrosion.

NOTE

The electronics is rated NEMA 4X (IP66) and is capable of operation at temperatures up to 158°F (70°C).

Retain the packaging in which the SBX 1000 arrived from the factory in case any components are to be shipped to another site. This packaging has been designed to protect the product.

SPECIFICATIONS

SBX 1000 Specifications	
O₂ Range	
Standard	0 to 10% O ₂ , 0 to 25% O ₂
Accuracy	Typically ±1.5% of reading or 0.1% O ₂ , whichever is greater
Lowest detectable limit	0.1% O ₂
System Response to Calibration Gas	Initial – less than 3 seconds, T90 – less than 8 seconds
Temperature Limits	
Process	32° to 1300°F (0° to 704°C)
Electronics Housing	-40° to 158°F (-40° to 70°C) ambient
Probe Lengths	12 in. (305 mm)
Mounting and Mounting Position	Vertical or horizontal
Materials	
Probe	Wetted or welded parts - 316L stainless steel (SS) Non-wetted parts - 304 SS, low-copper aluminum
Electronics Enclosure	Low-copper aluminum
Calibration	Manual
Calibration Gas Mixtures Recommended	0.4% O ₂ , Balance N ₂ 8% O ₂ , Balance N ₂
Calibration Gas Flow	5 scfh (2.5 l/m)
Reference Air (optional)	2 scfh (1 l/m), clean, dry, instrument-quality air (20.95% O ₂), regulated to 5 psi (34 kPa)
Electronics	NEMA 4X, IP66 with fitting and pipe on reference exhaust port to clear dry atmosphere
Electrical Noise	Meets EN 55022 Generic Emissions Std. Includes EN 61000-4-2 for Electrostatic Discharge Includes EN 61000-4-3 for RFI Includes EN 61000-4-4 for Fast Transient Immunity Includes EN 61000-4-6 for RFI
Line Voltage	90-250 VAC, 48/62 Hz. No configuration necessary. 3/4 in. - 14 NPT conduit port
Signals	
Analog Output	4-20 mA isolated from power supply, 950 ohms max. load
Logic I/O	Two-terminal logic contact for alarm output
Conduit Ports	3/4 in.-14 NPT (one threaded hole for both analog output and logic I/O)
Power Requirements	
Probe Heater	175 W nominal
Electronics	10 W nominal
Certifications	General Purpose



Table 1-1. Product Matrix

SBX1000	In-Situ Oxygen Transmitter (SBX 1000)										
	Code		Sensing Probe Type								
	0		Snubber Diffusion Element								
	Code		Probe Assembly								
	0		12 in. (305 mm) Probe Length								
	Code		Mounting Hardware - Stack Side								
	0		Ordered Separately PN 4512C34G01 (ANSI)								
	Code		Mounting Hardware - Probe Side								
	0		Universal Flange (ANSI/DIN)								
	Code		Electronics Housing								
	0		Housing and Filtered Customer Termination - NEMA 4X, IP66								
	Code		Electronics Mounting								
	0		Integral to Probe with Transient Protected Filtered Termination								
	Code		Signal Output								
	0		One 4-20mA								
	Code		Alarm Output								
	0		One Self Powered (+5V) 340 ohm resistance								
SBX1000	0	0	0	0	0	0	0	0	0	0	Example

Table 1-2. Calibration Gas Bottles

Part Number	Description
1A99119G01	Two disposable calibration gas bottles - 0.4% and 8% O ₂ , balance nitrogen - 550 liters each, includes bottle rack*
1A99119G02	Two pressure regulators for calibration gas bottles
1A99119G03	Gas bottle rack

Notes:

**Calibration gas bottles cannot be shipped via airfreight.*

When the bottles are used with CALIBRATION RECOMMENDED features, the bottles should provide 2 to 3 years of calibrations in normal service.

Section 2 Installation

Mechanical Installation	page 2-2
Electrical Installation	page 2-6
Pneumatic Installation	page 2-8
Initial Power Up	page 2-9

WARNING

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

WARNING

The SBX 1000 and probe is heavy. Use proper lifting and carrying procedures to avoid personal injury.

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.

MECHANICAL INSTALLATION

Selecting Location

1. The location of the SBX 1000 in the stack or flue is most important for maximum accuracy in the oxygen analyzing process. The SBX 1000 must be positioned so the gas it measures is representative of the process. A point too near the wall of the duct, or the inside radius of a bend, may not provide a representative sample because of the very low flow conditions. The sensing point should be selected so the process gas temperature falls within a range of 32° to 1300°F (0° to 704°C). Figure 2-1 through Figure 2-3 provide mechanical installation references. The ambient temperature of the integral electronics housing must not exceed 158°F (70°C).
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 the necessary repairs or install the SBX 1000 upstream of any leakage.
3. Ensure the area is clear of internal and external obstructions that will interfere with installation and maintenance access to the membrane keypad. Allow adequate clearance for removal of the SBX 1000.

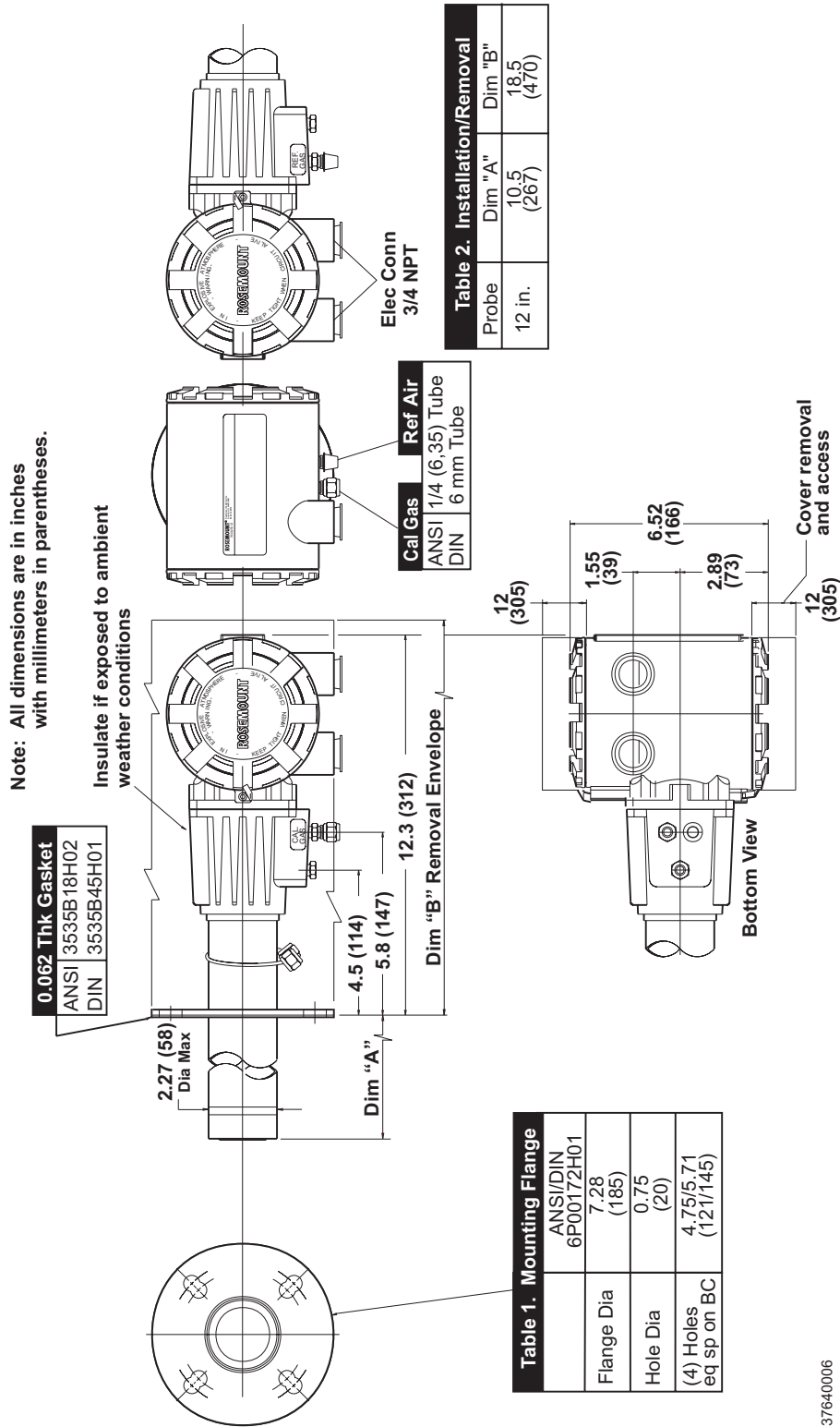
⚠ CAUTION

Do not allow the temperature of the SBX 1000 electronics to exceed 158°F (70°C) or damage to the unit may result.

Probe Installation

1. Ensure all components are available to install the SBX 1000. If equipped with the optional ceramic diffusion element, ensure it is not damaged.
2. The SBX 1000 may be installed intact as it is received.
3. Weld or bolt adapter plate, Figure 2-2, onto the duct.

Figure 2-1. SBX 1000 Probe Installation

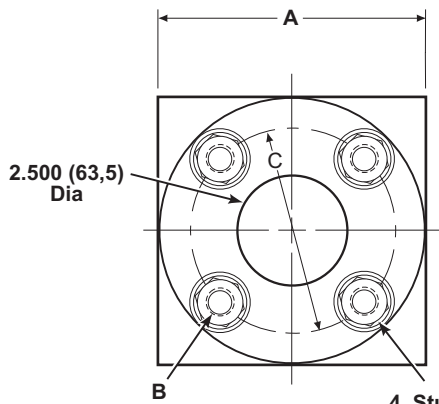


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Figure 2-2. Adapter Plate
 Dimensions and Installation

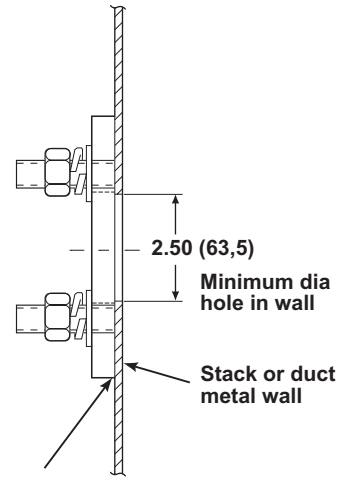
ADAPTER PLATE OUTLINE

Table 3. Mounting Plate Dimensions for SBX 1000	
"A"	6.00 (153)
"B" Stud Size	0.625-11
"C" Dia B.C.	4.75 (121)



4 Studs, lockwashers, and nuts equally spaced on "C" dia B.C.

INSTALLATION FOR METAL WALL STACK OR DUCT CONSTRUCTION



Weld or bolt adapter plate to metal wall of stack or duct. Joint must be air tight.

Note: Dimensions are in inches with millimeters in parentheses.

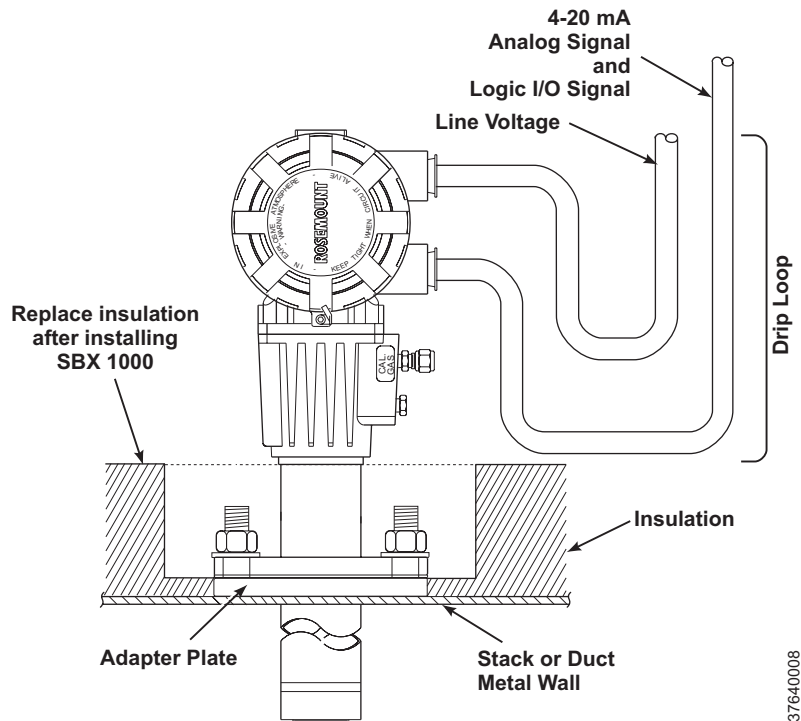
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- In vertical installations, ensure the system cable drops vertically from the SBX 1000 and the conduit is routed below the level of the electronics housing. This drip loop minimizes the possibility that moisture will damage the electronics. See Figure 2-3.
- Insert probe through the opening in the mounting plate and bolt the unit to the plate. (Two mounting flange gaskets are provided. Use the ANSI or DIN gasket applicable to your installation.)

NOTE

To maintain CE compliance, ensure a good connection exists between the mounting plate studs or earthing screws on electronics housing and earth.

Figure 2-3. Drip Loops and Insulation Removal



6. Ensure the SBX 1000 is properly grounded (earthed) by way of both internal and external points.

CAUTION

Uninsulated stacks or ducts may cause ambient temperatures around the electronics to exceed 158°F (70°C), which may cause overheating damage to the electronics.

7. If duct work insulation is removed for probe mounting, make sure the insulation is replaced. See Figure 2-3.
8. Make sure the probe installation does not obscure the warnings on the housing covers.

ELECTRICAL INSTALLATION

All wiring must conform to local and national codes.

⚠ WARNING

Disconnect and lock out power before connecting the unit to the power supply.

⚠ 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.

⚠ WARNING

To meet the Safety Requirements of IEC 1010 (EC requirement), and ensure safe operation of this equipment, connection to the main electrical power supply must be made through a circuit breaker (min 10 A) which will disconnect all current-carrying conductors during a fault situation. This circuit breaker should also include a mechanically operated isolating switch. If not, then another external means of disconnecting the supply from the equipment should be located close by. Circuit breakers or switches must comply with a recognized standard such as IEC 947.

⚠ WARNING

The probe is heavy. Use proper lifting and carrying procedures to avoid personnel injury.

NOTE

To maintain CE compliance, ensure a good connection exists between the mounting flange bolts and earth.

Connect Line Voltage

1. See Figure 2-4. Using both hands or strap wrench, turn cover counterclockwise to loosen. Remove cover.
2. See Figure 2-5. Connect line (L1 wire) to L1 terminal.
3. Connect the neutral (L2 wire) to the N terminal. The SBX 1000 automatically will configure itself for 90-250 VAC line voltage and 50/60 Hz. To avoid a shock hazard, the power terminal cover must be installed.
4. Connect ground wire (green wire) to one of two ground lugs.

Figure 2-4. Remove/Install Terminal Cover

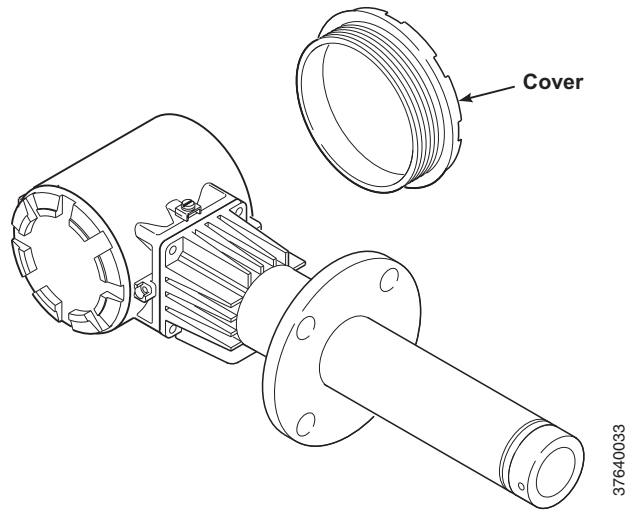
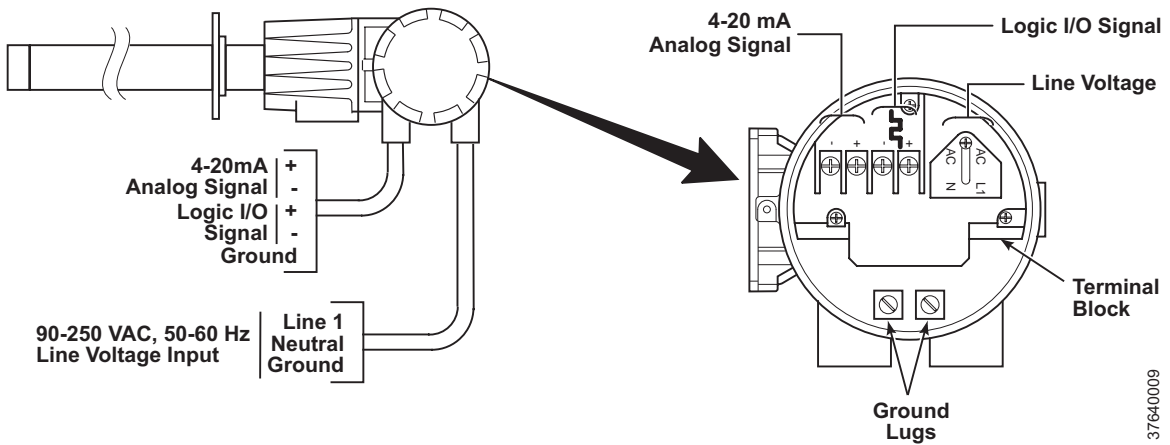


Figure 2-5. Electrical Installation



Connect O₂ Signal and Logic I/O Signal

1. 4-20 mA O₂ Signal. The 4-20 mA signal represents the O₂ value. Connect the signal wiring as shown in Figure 2-5.
2. Connect the Logic I/O signal wiring as shown in Figure 2-5. The Logic I/O contact is a self-powered, +5 VDC, 340 Ohm series resistance. An interposing relay will be required if this contact is to be utilized to annunciate a higher voltage device, such as a light or horn, and may also be required for certain DCS input cards. A Potter & Brumfield R10S-E1Y1-J1.0K 3.2 mA DC or equivalent interposing relay will be mounted where the contact wires terminate in the control/relay room.
3. See Figure 2-4. Install and hand-tighten cover.

PNEUMATIC INSTALLATION

Optional Reference Air Package

Connect the reference air set, Figure 2-6. The reference air should be clean, dry, instrument-quality air (20.95% O₂), with less than 40 ppm total hydrocarbons.

In most applications, ambient air is an adequate reference air source. For optimal performance a Rosemount Analytical reference air package is recommended. Refer to Section 10, Optional Accessories.

Regulator Inlet

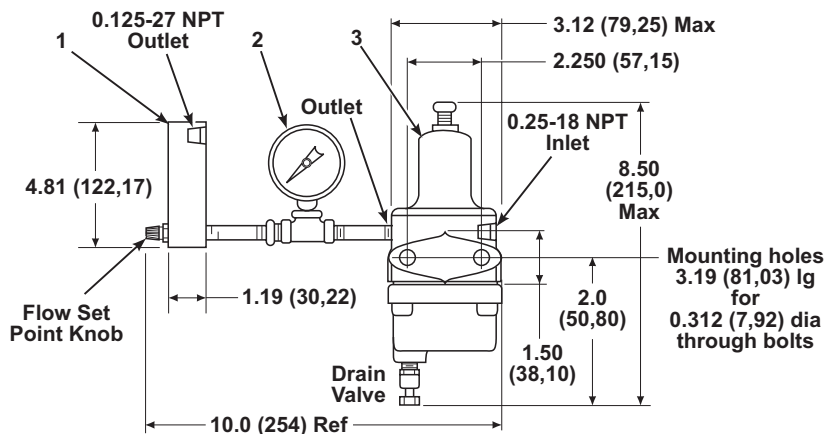
Air pressure on the supply side of the reference air set must be regulated from 10 psig (68,95 kPa gage) to 225 psig (1551,38 kPa gage) maximum.

Regulator Outlet

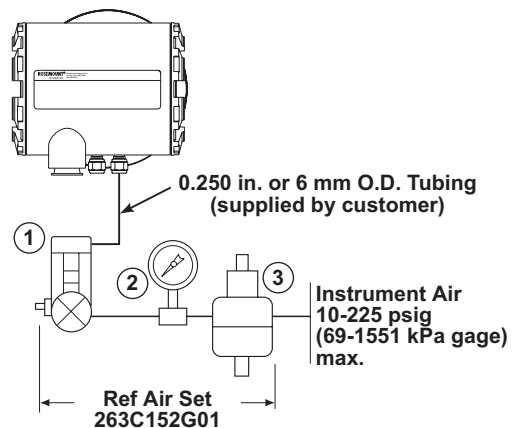
Set the reference air flow to 2 scfh (1 l/hr) maximum, regulated at 5 psig (34 kPa gage).

Figure 2-6. Reference Air Set, Plant Air Connection

Note: Dimensions are in inches with millimeters in parentheses. All piping specified in U.S. standards.



SCHEMATIC HOOKUP FOR REFERENCE AIR SUPPLY TO SBX 1000 PROBE HEAD



Replacement Parts			
1	Flowmeter	0.2-2.0 scfh (0,006-0,057 scmh)	771B635H02
2	Pressure Gage	0-15 psig (0-103 kPa gage)	275431-006
3	Combination Filter-Reg.	0-30 psig (0-207 kPa gage)	4505C21G01

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Calibration Gas

CAUTION

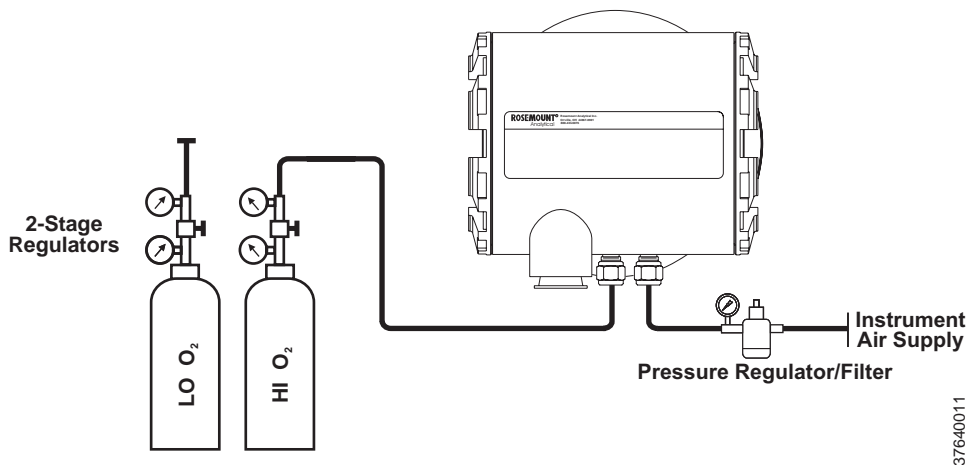
Do not use 100% nitrogen as a low gas (zero gas). It is suggested that gas for the low (zero) be between 0.4% and 2.0% O₂. Do not use gases with hydrocarbon concentrations of more than 40 parts per million. Failure to use proper gases will result in erroneous readings.

Two calibration gas concentrations are used with the SBX 1000, Low Gas - 0.4% O₂ and High Gas - 8% O₂. See Figure 2-7 for a diagram showing the typical calibration gas connection to the SBX 1000.

Cal Gas Check Valve

Whenever the calibration gas lines are permanently connected to the SBX 1000, be sure to install a check valve at the cal gas inlet to the SBX 1000. The check valve is to prevent the breathing of flue gasses, and subsequent corrosion of the cal gas plumbing and regulator equipment.

Figure 2-7. Calibration Gas Connections



INITIAL POWER UP

CAUTION

Upon completing installation, make sure that the SBX 1000 is turned on and operating prior to firing up the combustion process. Damage can result from having a cold SBX 1000 exposed to the process gases.

During outages, and if possible, leave all SBX 1000 units running to prevent condensation and premature aging from thermal cycling. If the ducts will be washed down during outage, MAKE SURE to power down the SBX 1000 units and remove them from the wash area.

Do not power up the SBX 1000 at this time. The installation must be checked carefully before power is applied. Refer to Section 3, Configuration and Startup, for the installation check procedures and for initial power up instructions.

Section 3 Configuration and Startup

Verify Installation	page 3-1
Configuration	page 3-2
Startup	page 3-4

VERIFY INSTALLATION

Prior to performing the configuration and startup procedures, you should verify that the mechanical and electrical installations are complete and done correctly.

Mechanical Installation

Ensure the SBX 1000 is installed correctly. Check all mechanical fasteners, pneumatic connections, and conduit connections. See Section 2, Installation.

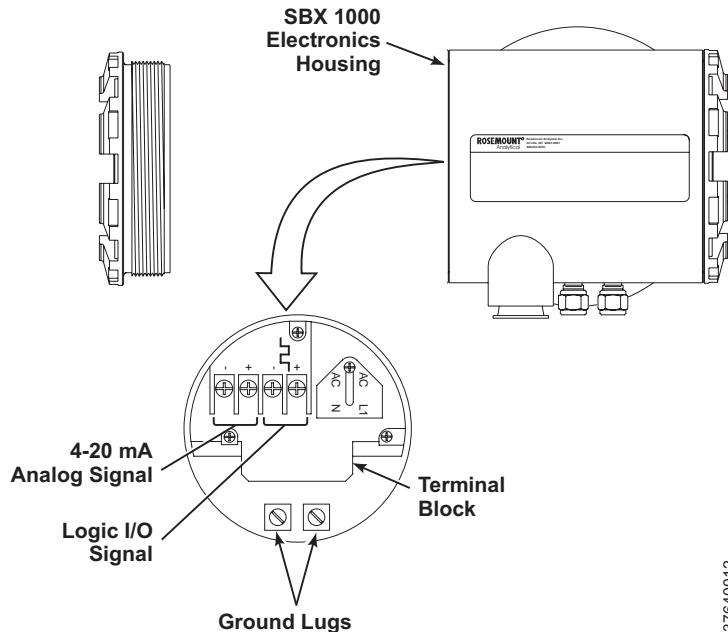
Reference Air

If using a piped reference air source, make sure the reference air is set to 2 scfh (1 l/hr) maximum, 5 psig (34 kPa gage), at the reference air inlet.

Terminal Block Wiring

1. Remove the cover from left side of the electronics housing.
2. Refer to Figure 3-1. Be sure the input line voltage wiring, the oxygenoxygen signal wiring, and the Logic I/O signal wiring are properly connected and secure.
3. Reinstall and secure the terminal block cover.

Figure 3-1. Electronics Housing Terminals



37640012

CONFIGURATION

Verify Configuration

Located in the electronics stack are two switches that configure outputs for the SBX 1000 (Figure 3-2).

To verify the setting of these switches, unfasten and lift the electronics stack part way out of the housing. Refer to Section 6, SBX 1000 Repair Procedures.

⚠ CAUTION

Remove power from the SBX 1000 before changing switch positions. If switch positions are changed under power, damage to the electronics package may occur.

SW1 Setting

The two settings are for internally or externally powering the 4-20 mA signal. The factory setting is for the 4-20 mA signal to be internally powered.

SW2 Setting

The factory sets this switch as follows:

1. Positions 1 and 4 are for factory use only. They must be in the position shown in Figure 3-2.
2. Position 2 determines the oxygen range. This can be set to either 0 to 10% O₂ or 0 to 25% O₂. The factory setting is 0 to 10% oxygen.
3. Position 3 determines the output at startup or when the device goes into an alarm state. The settings are 3.5 mA or 21.6 mA. The factory setting is 3.5 mA. If the oxygen measurement is being utilized as part of an automatic control loop, the loop should be placed in manual upon this failure event, or other appropriate actions should be taken.

Read O₂ Concentration

Once the cell is up to operating temperature, the oxygen percentage can be read using one of the following methods:

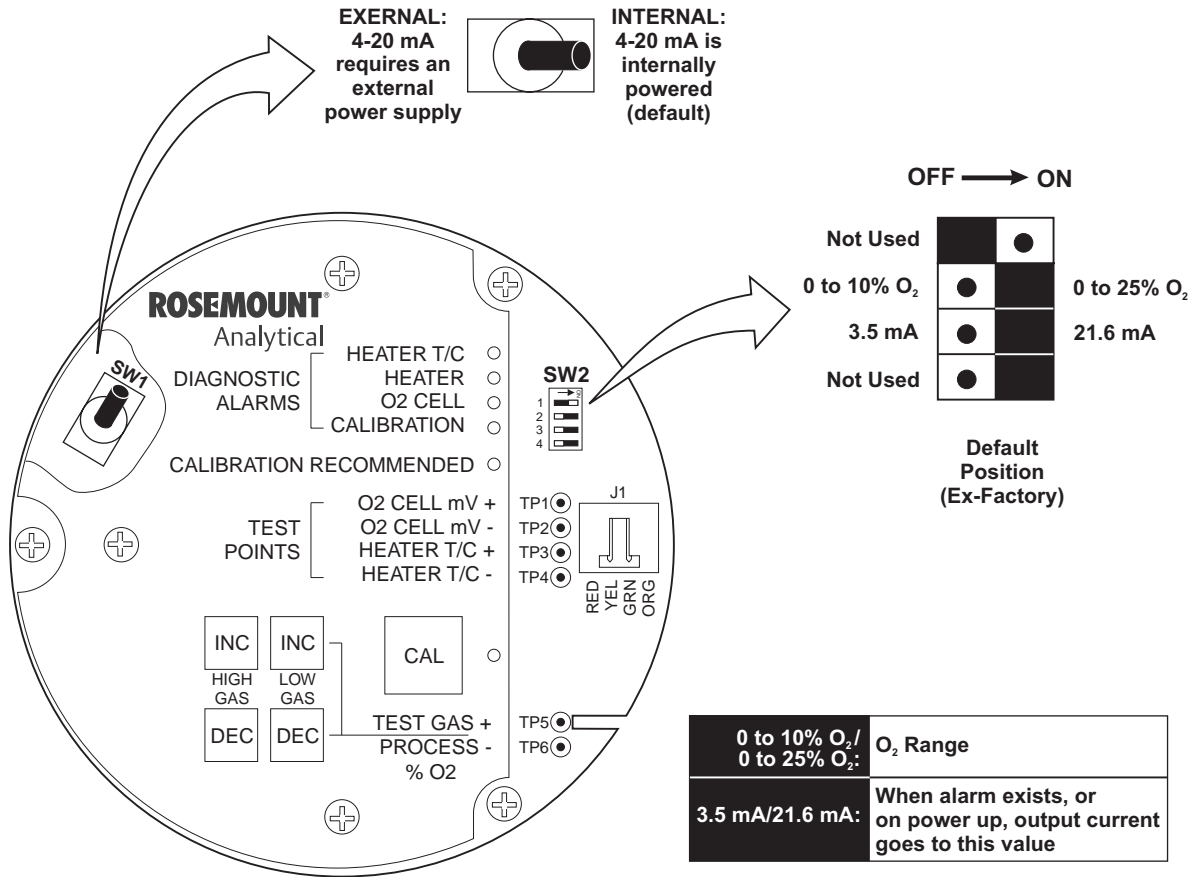
1. Membrane Keypad - Access TP5 and TP6 on the microprocessor board. Attach a multimeter across TP5 and TP6. The calibration and process gases can now be monitored. Pressing INC or DEC once will cause the output to switch from the process gas to the calibration gas. Pressing INC or DEC a second time will increase or decrease the calibration gas parameter. If the keys have been inactive for one minute, the output reverts to the process gas. When a calibration has been initiated, the value at TP5 and TP6 is the percent oxygen seen by the cell. Oxygen levels, as seen on the multimeter, are:

8.0% O₂ = 8.0 VDC

0.4% O₂ = 0.4 VDC

2. 4-20mA output signal

Figure 3-2. Default Configuration Settings



37640013

STARTUP

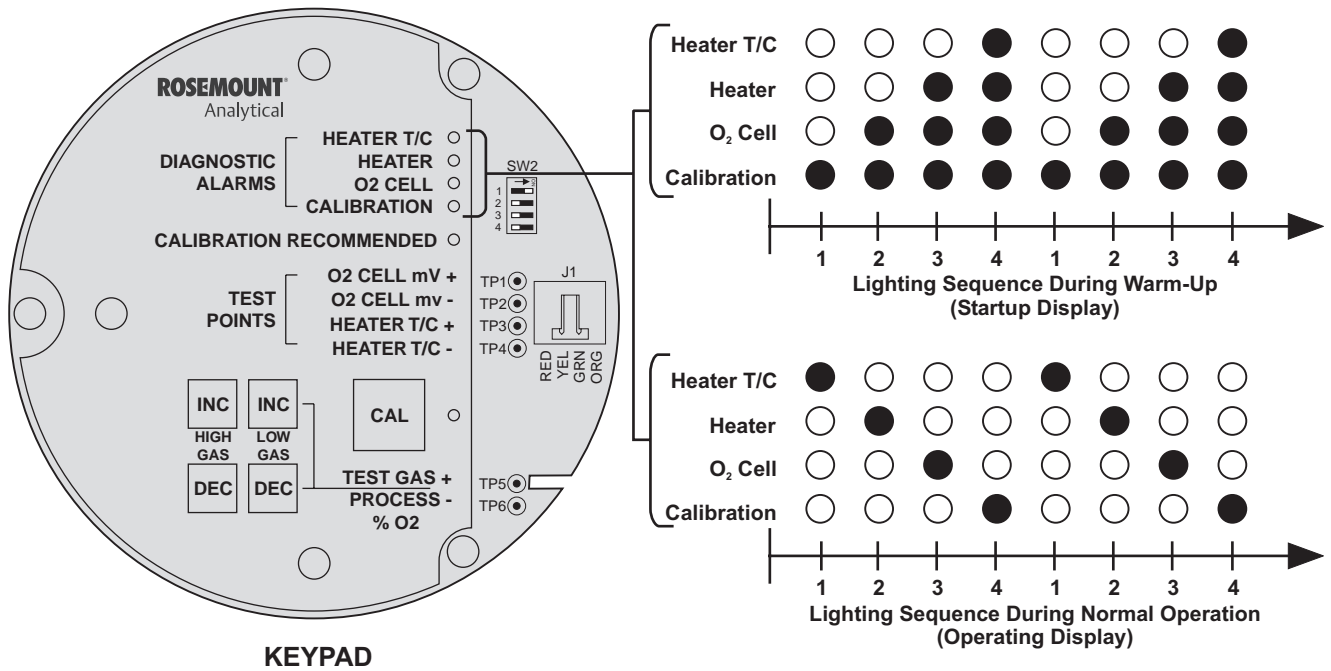
Startup Display

When power is applied to the probe, the cell heater turns on. It takes approximately one half hour for the cell to heat to operating temperature. This condition is indicated by the top four LEDs (DIAGNOSTIC ALARMS) on the membrane keypad (Figure 3-3). Starting with the **CALIBRATION** LED, the LEDs light in ascending order until all four LEDs are on. At this point, all four turn off and the cycle starts again. This ramp cycle continues until the cell is up to operating temperature.

Operating Display

The ramp cycle turns into a cycle where the diagnostic LEDs light in sequence from the top to the bottom, one at a time. After the bottom LED turns on, the sequence starts again at the top with the **HEATER T/C** LED (Figure 3-3).

Figure 3-3. Startup and Normal Operation



37640014

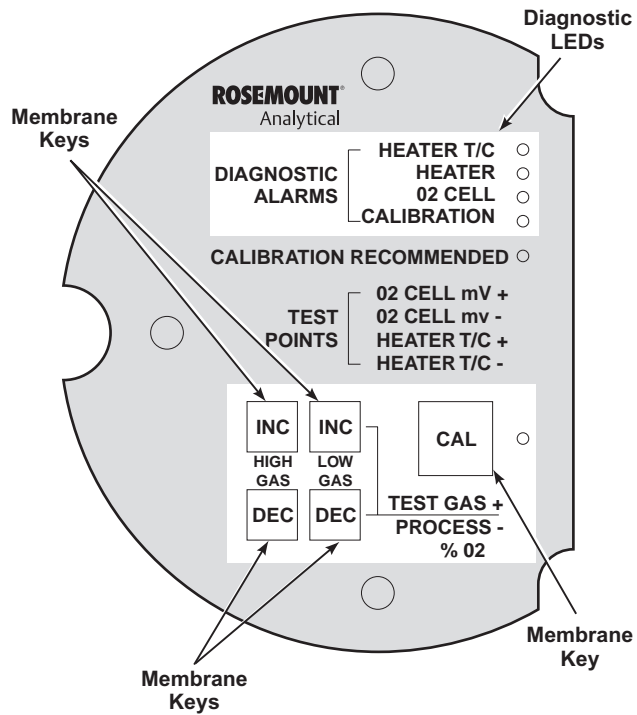
Error Display

If there is an error condition at startup, one of the diagnostic LEDs (Figure 3-4) will be blinking. Refer to Section 7, Troubleshooting, to determine the cause of the error. Clear the error, cycle power, and the operating display should return.

Membrane Keypad

The five membrane keys on the membrane keypad (Figure 3-4) are only used during calibration to adjust the high and low gas and to initiate the calibration sequence.

Figure 3-4. Membrane Keypad



37640015

Section 4 Calibration

Overview	page 4-1
Manual Calibration	page 4-3

OVERVIEW

This section identifies the calibration methods available and related calibration requirements for the SBX 1000.

⚠ WARNING

When working on this equipment on the laboratory bench, be aware that the SBX 1000, probe tube, and flame arrestor hub can be hot [up to 572°F (300°C)] in the region of the probe heater.

⚠ 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.

During a calibration, two calibration gases with known oxygen concentrations are applied to the SBX 1000. Slope and constant values calculated from the two calibration gases determine if the SBX 1000 is correctly measuring the net concentration of oxygen in the industrial process.

Before calibrating the SBX 1000, you should verify that the calibration gas parameters are correct by setting the calibration gas flowmeter. The calibration gas flowmeter regulates the calibration gas flow and must be set to 5 scfh. After extended use of the SBX 1000 in the process, only adjust the flowmeter after installing a new diffuser on the end of the probe. Adjusting the flowmeter with a partially plugged diffuser can pressurize the cell and bias the calibration.

In applications with a heavy dust loading, the oxygen probe diffusion element may become plugged over time, causing a slower speed of response. The best way to detect a plugged diffusion element is to note the time it takes the SBX 1000 to return to the normal process reading after the last calibration gas is removed and the calibration gas line is blocked off. A plugged diffusion element can also be indicated by a slightly lower reading on the calibration gas flowmeter.

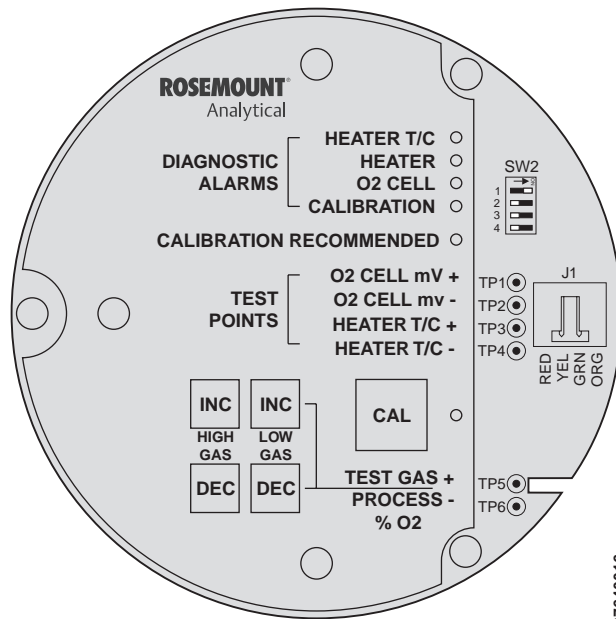
Change the diffusion element when the calibration gas flowmeter reads slightly lower during calibration or when response to the process flue gases becomes very slow. Each time the diffusion element is changed, reset the calibration gas flowmeter to 5 scfh and calibrate the SBX 1000. To change the diffusion element, refer to Section 6, Maintenance/Service.

NOTE

A calibration can be aborted any time during the process. Press the **CAL** key (Figure 4-1) on the SBX 1000 keypad three times within three seconds. An aborted calibration will retain the values of the previous good calibration.

A calibration record sheet is provided on the last page of this section. Use photocopies of the calibration record sheet to track transmitter performance.

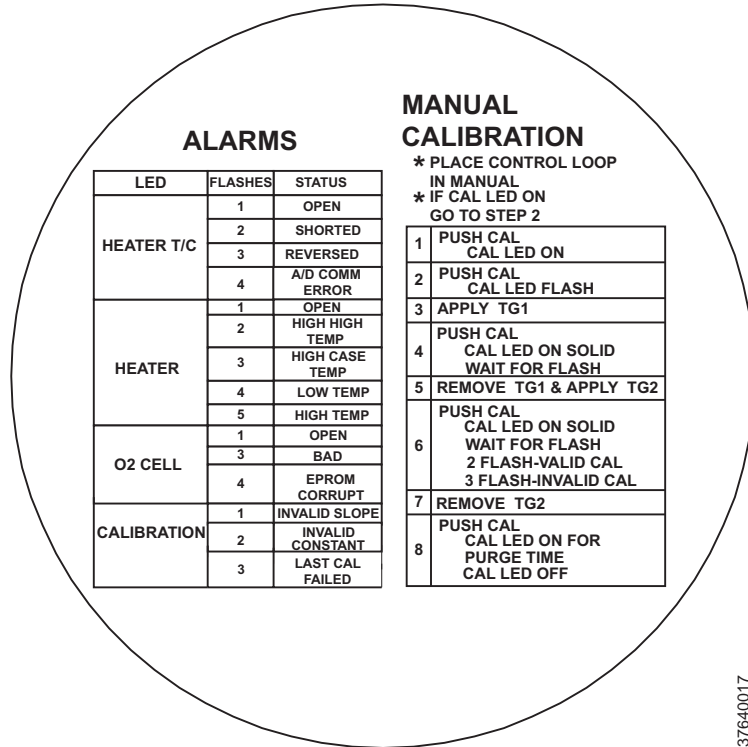
Figure 4-1. Membrane Keypad



MANUAL CALIBRATION

Manual calibrations must be performed at the SBX 1000 site and require operator intervention throughout the process. Manual calibration instructions, in condensed form, can also be found on the inside of the right electronics housing cover. See Figure 4-2.

Figure 4-2. Inside Right Cover



37640017

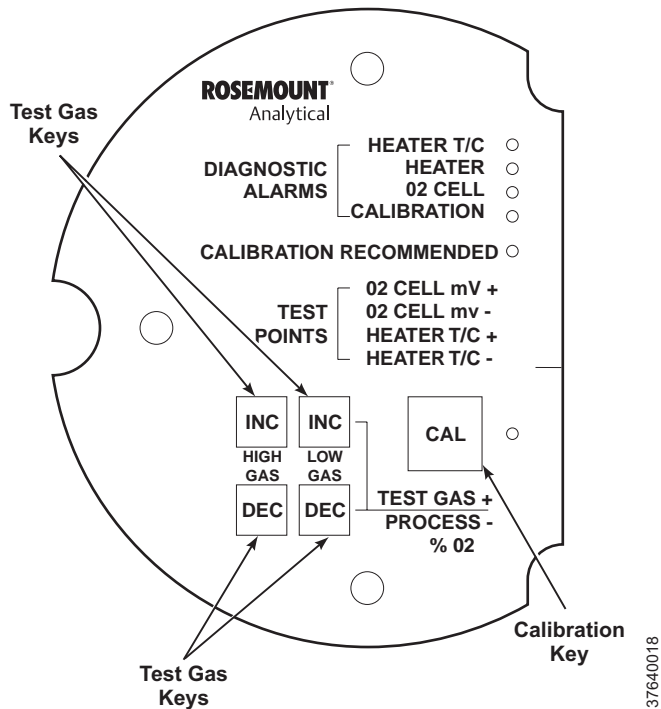
Section 5 Using the Membrane Keypad

Keypad Controls page 5-1
Manual Calibration page 5-3

KEYPAD CONTROLS

The membrane keypad, Figure 5-1, is the standard interface for the SBX 1000. There are five membrane keypad keys. Four keys are for the test gas value increment and decrement. The other key is for calibrating the SBX 1000.

Figure 5-1. Membrane Keypad



Test Gas Keys

The test gas keys are used for setting the test gas values in the SBX 1000 for calibrations. Pressing the **INC** or **DEC** once will cause the output to switch from the process gas to the test gas. Pressing **INC** or **DEC** a second time will increase or decrease the test gas parameter. If the keys have been inactive for one minute, the output reverts to the process gas concentration. When a calibration has been initiated, the millivolt value at TP5 and TP6 represents the percentage of oxygen seen by the cell.

- Increment High Gas (**INC**). The first key push changes the mode of TP5 and TP6 from a process gas to a test gas value. The second push increases the high test gas value by 0.1%.
- Decrement High Gas (**DEC**). The first key push changes the mode of TP5 and TP6 from a process gas to a test gas value. The second push decreases the high test gas value by 0.1%.
- Increment Low Gas (**INC**). The first key push changes the mode of TP5 and TP6 from a process gas to a test gas value. The second push increases the low test gas value by 0.1%.
- Decrement Low Gas (**DEC**). The first key push changes the mode of TP5 and TP6 from a process gas to a test gas value. The second push decreases the low test gas value by 0.1%.

Calibration Key

The **CAL** key can:

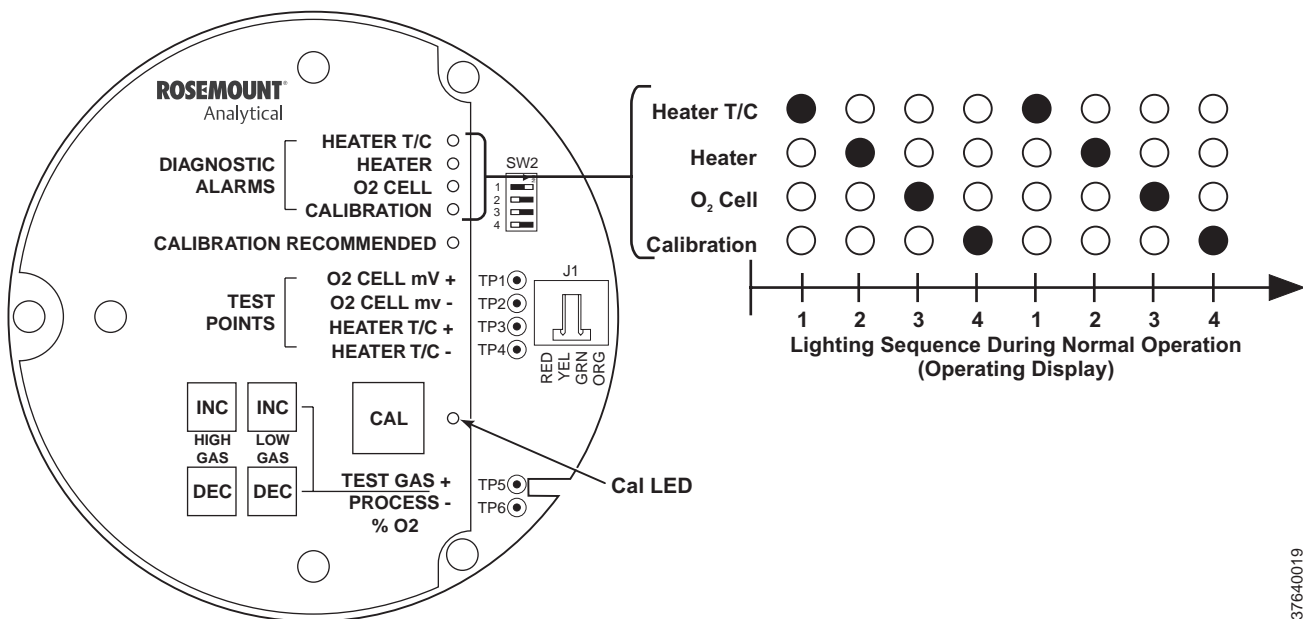
- Initiate a calibration
- Sequence through a calibration
- Abort a calibration

Display LEDs

The LEDs located on the membrane keypad, Figure 5-2, serve several functions:

- Indicate normal operation
- Indicate start-up
- Indicate alarms
- Indicate calibration status

Figure 5-2. LED Flash Sequence - Normal Operation

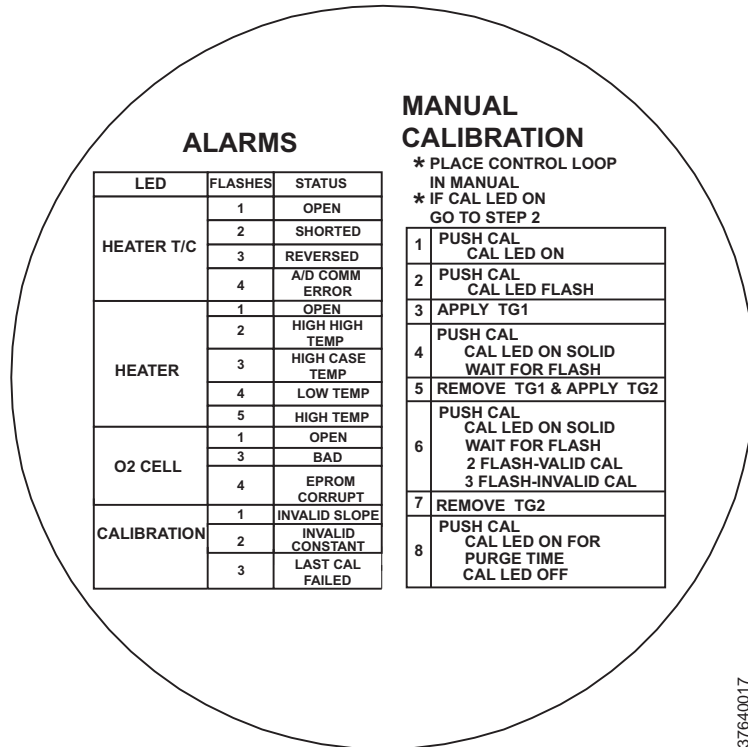


37640019

MANUAL CALIBRATION

Manual calibrations with the membrane keypad must be performed at the SBX 1000 site and will require operator intervention throughout the process. Manual calibration instructions, in condensed form, can also be found on the inside of the right electronics housing cover. See Figure 5-3.

Figure 5-3. Inside Right Cover



To perform a manual calibration, place control loop in manual and verify the calibration gas parameters are correct per Section 3, Configuration and Startup. If performing a calibration with the **CALIBRATION RECOMMENDED** and **Cal** LEDs off, start at step 1. If performing a calibration with the **CALIBRATION RECOMMENDED** and **Cal** LEDs on, start at step 2.

1. Push the **CAL** key. The **CALIBRATION RECOMMENDED** LED will come on and the **Cal** LED will remain lit. If a multimeter is attached across **TP5** and **TP6**, the reading will display the percentage of oxygen seen by the cell.
2. Push the **CAL** key. The **CALIBRATION RECOMMENDED** LED will turn off and the **Cal** LED will flash continuously. The SBX 1000 can be configured so that the 4-20 mA signal will hold the last value. The default condition is for the output to track. A flashing LED indicates that the SBX 1000 is ready to accept the first calibration gas.
3. Apply the first calibration gas. (Electronics will abort the calibration if step 4 is not done within 30 minutes).

4. Push the **CAL** key; the **Cal** LED will be on solid. A timer is activated to allow the calibration gas adequate time to flow (default time of five minutes). When the timer times out, the SBX 1000 has taken the readings using the first calibration gas and the **Cal** LED will flash continuously. The flashing indicates the SBX 1000 is ready to take readings using the second calibration gas.
5. Remove the first calibration gas and apply the second calibration gas. (Electronics will abort the calibration if step 6 is not done within 30 minutes).
6. Push the **CAL** key; the **Cal** LED will remain lit. The timer is activated for the second calibration gas flow. When the timer times out, the **Cal** LED will flash a 2 pattern flash or a 3 pattern flash (2 pattern flash equals a valid calibration, 3 pattern flash equals an invalid calibration). If the slope or the constant is out of specification, a diagnostic alarm LED will be flashing. The diagnostic alarm will remain active until the purge cycle is over. If the three pattern flash of the **Cal** LED occurs without a diagnostic alarm, the calibration gases could be the same or the calibration gas was not turned on. A flashing **Cal** LED indicates the calibration is done. See Section 7, Troubleshooting, for an explanation of the flash patterns.
7. Remove the second calibration gas and cap off the calibration gas port.
8. Push the **CAL** key; the **Cal** LED will remain lit as the unit purges. (Default purge time is three minutes). When the purge is complete, the **Cal** LED will turn off and the SBX 1000 output unlocks from its held value and begins to read the process O₂. If the calibration was valid, the **DIAGNOSTIC ALARMS** LEDs will indicate normal operation. If either new calibration value (slope or constant) is not within parameters, the **DIAGNOSTIC ALARMS** LED will indicate an alarm. See Section 7, Troubleshooting, for alarm codes. If the calibration was invalid, the SBX 1000 will return to normal operation, as it was before a calibration was initiated, and the parameters will not be updated.
9. Place control loop in automatic.

Section 6 Maintenance/Service

Overview	page 6-1
SBX 1000 Repair Procedures	page 6-1

OVERVIEW

This section contains the procedures to maintain and service the SBX 1000.

WARNING

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

WARNING

It is recommended that the SBX 1000 be removed from the stack or duct for all service activities. The unit should be allowed to cool and be taken to a clean work area. Failure to comply may cause severe burns.

WARNING

Disconnect and lock out power before working on any electrical components. There may be voltage up to 264 VAC. Failure to comply may result in serious injury or death.

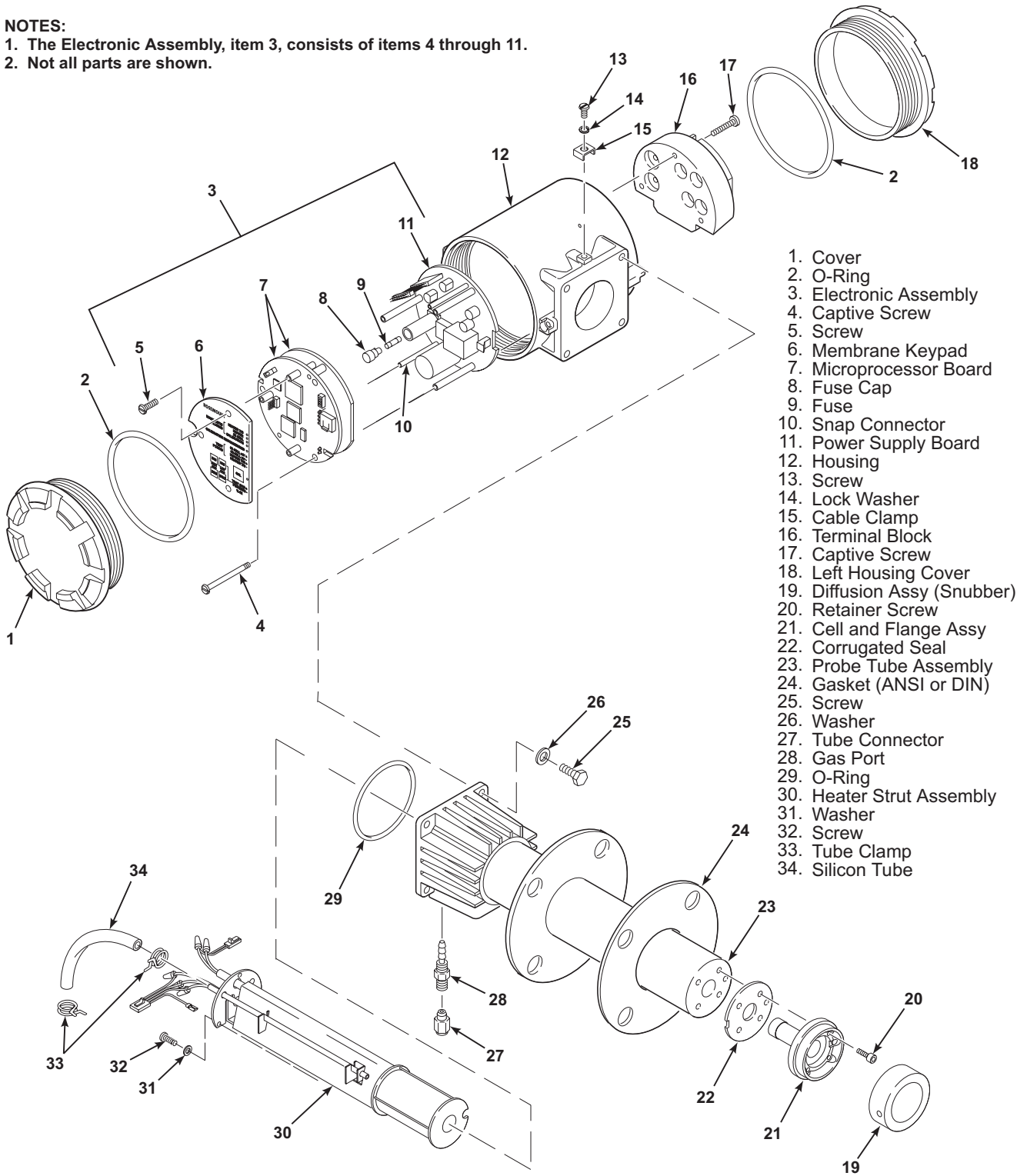
SBX 1000 REPAIR PROCEDURES

Use the following procedures to remove or install the SBX 1000. Unless otherwise noted, item numbers in the following procedures refer to the item numbers in the exploded view diagram, Figure 6-1.

Figure 6-1. SBX 1000 Exploded View

NOTES:

1. The Electronic Assembly, item 3, consists of items 4 through 11.
2. Not all parts are shown.



1. Cover
2. O-Ring
3. Electronic Assembly
4. Captive Screw
5. Screw
6. Membrane Keypad
7. Microprocessor Board
8. Fuse Cap
9. Fuse
10. Snap Connector
11. Power Supply Board
12. Housing
13. Screw
14. Lock Washer
15. Cable Clamp
16. Terminal Block
17. Captive Screw
18. Left Housing Cover
19. Diffusion Assy (Snubber)
20. Retainer Screw
21. Cell and Flange Assy
22. Corrugated Seal
23. Probe Tube Assembly
24. Gasket (ANSI or DIN)
25. Screw
26. Washer
27. Tube Connector
28. Gas Port
29. O-Ring
30. Heater Strut Assembly
31. Washer
32. Screw
33. Tube Clamp
34. Silicon Tube

Removal and Replacement

1. Remove the SBX 1000 from the stack or duct.
 - a. Turn off power to the system.
 - b. Shut off the calibration gases at the cylinders and the instrument air.
 - c. Disconnect the calibration gas and instrument air lines from the probe.
 - d. Remove the cover to expose the terminal block.
 - e. Tag and remove all signal and power wiring to the probe.
 - f. Remove insulation to access the mounting bolts. Unbolt the SBX 1000 from the stack and take it to a clean work area.
 - g. Allow the unit to cool to a comfortable working temperature.
2. Replace the SBX 1000 on the stack or duct.
 - a. Install new gasket (24) on the SBX 1000 probe.
 - b. Bolt the SBX 1000 probe to the stack and install insulation.
 - c. Connect all signal and power leads at the probe. Refer to Section 2, Installation for detailed wiring instructions.
 - d. Install left housing cover (18) and ensure it is tight.
 - e. Connect the calibration gas and instrument air lines to the probe.
 - f. Turn on calibration gases at the cylinders and turn on instrument air.
 - g. Restore power to the system.

Remove Probe from Housing

NOTE

Recalibration is required whenever electronics cards or sensing cell is replaced.

1. Follow the instructions in Removal and Replacement to remove the SBX 1000 from the stack or duct.
2. Remove right housing cover (1) uncovering the electronic assembly (3).
3. Press and remove the J1 connector from the J1 socket on the microprocessor board (7).
4. Loosen three captive mounting screws (4) securing the electronics stack in housing (12).
5. Move the J1 connector leads out of the slot on the microprocessor board. Slide the electronics stack partially out of the housing to access the J8 connector on power supply board (11). Squeeze the J8 connector on the sides and carefully remove the connector from the J8 socket. The electronic assembly can now be completely removed from the housing.

CAUTION

Do not force the probe when removing the probe from the electronics housing. Damage to the aluminum housing can occur.

6. Remove four screws (25) and washers (26) from the probe finned housing.

Install Probe on Housing

NOTE

Recalibration is required whenever electronics cards or sensing cell is replaced.

1. Make sure that O-ring (29) is in good condition and installed in the O-ring groove on the probe.
2. Place the J1 and J8 connectors from the probe in the hole on the flat side of the electronic housing.
3. Line up the conduit ports on the electronics housing (12) with the CAL and REF gas ports on probe tube assembly (23). Attach the probe tube assembly to the housing using four screws (25) and washers (26).
4. Hold the J1 and J8 connectors out and to the probe side of the electronic housing.
5. Reconnect the J8 connector to power supply board (11). Make sure the connector is secure.
6. Holding the J1 connector leads, slide electronic assembly (3) into the housing. Align the electronic assembly so that it fits flush on the pins in the back of the housing. To ensure that it is flush, gently try to rotate the electronics. If the electronics rotate, repeat the alignment.
7. Connect the J1 connector leads to the J1 socket on microprocessor board (7). Ensure the connector is secure.
8. Tighten three captive screws (4) that secure the electronics assembly into the housing.
9. Replace the housing cover and ensure it is tight.
10. Follow the instructions in Removal and Replacement to install the SBX 1000 into the stack or duct.

Electronics Assembly Replacement

1. Remove right housing cover (1) uncovering electronic assembly (3).
2. Press and remove the J1 connector from the J1 socket on the microprocessor board (7).
3. Loosen three captive mounting screws (4) securing the electronics stack in housing (12).
4. Move the J1 connector leads out of the slot on the microprocessor board. Slide the electronics stack partially out of the housing to access the J8 connector on power supply board (11). Squeeze the J8 connector on the sides and carefully remove the connector from the J8 socket. The electronic assembly can now be completely removed from the housing.
5. To install the electronics assembly, hold the J1 and J8 connectors out and to the probe side of the electronic housing.
6. Reconnect the J8 connector to power supply board (11). Make sure the connector is secure.
7. Holding the J1 connector leads, slide electronic assembly (3) into the housing. Align the electronic assembly so that it fits flush on the pins in the back of the housing. To ensure that it is flush, gently try to rotate the electronics. If the electronics rotate, repeat the alignment.
8. Connect the J1 connector leads to the J1 socket on microprocessor board (7). Ensure the connector is secure.

9. Tighten three captive screws (4) that secure the electronics assembly into the housing.
10. Replace the housing cover and ensure it is tight.
11. If you have installed a new electronics assembly in the SBX 1000, the SBX 1000 must be recalibrated.

Terminal Block Replacement

1. Unscrew left housing cover (18).
2. Loosen captive screws (17) on terminal block (16) and carefully lift the terminal block out of the housing.
3. Carefully align the new terminal block on the pins so that it sits flat in the housing. The round end of the terminal block should be on the opposite side of the housing conduit ports and should not be able to rotate.
4. Tighten the three mounting screws and ensure the terminal block is secure in the housing.
5. Replace the housing cover and ensure it is tight.

Fuse Replacement

1. Remove the electronics assembly from the housing per steps 1 through 4 of Electronics Assembly Replacement.
2. Turn electronic assembly (3) over so that you are looking at the bottom of the power supply printed circuit board. Gently depress the two snap connector posts (10) one at a time. Carefully separate power supply board (11) from the rest of the electronics assembly.
3. Remove fuse caps (8) and fuses (9). Replace the fuses with new fuses.
4. Align snap connector posts (10) with the post holes on power supply board (11) and the pin connector on the power supply board with the connector port on the electronics stack. Gently push the boards together until the white posts snap in place. Ensure the electronics assembly is secure by gently trying to separate the boards.
5. Install the electronics assembly in housing per steps 5 through 11 of Electronics Assembly Replacement.

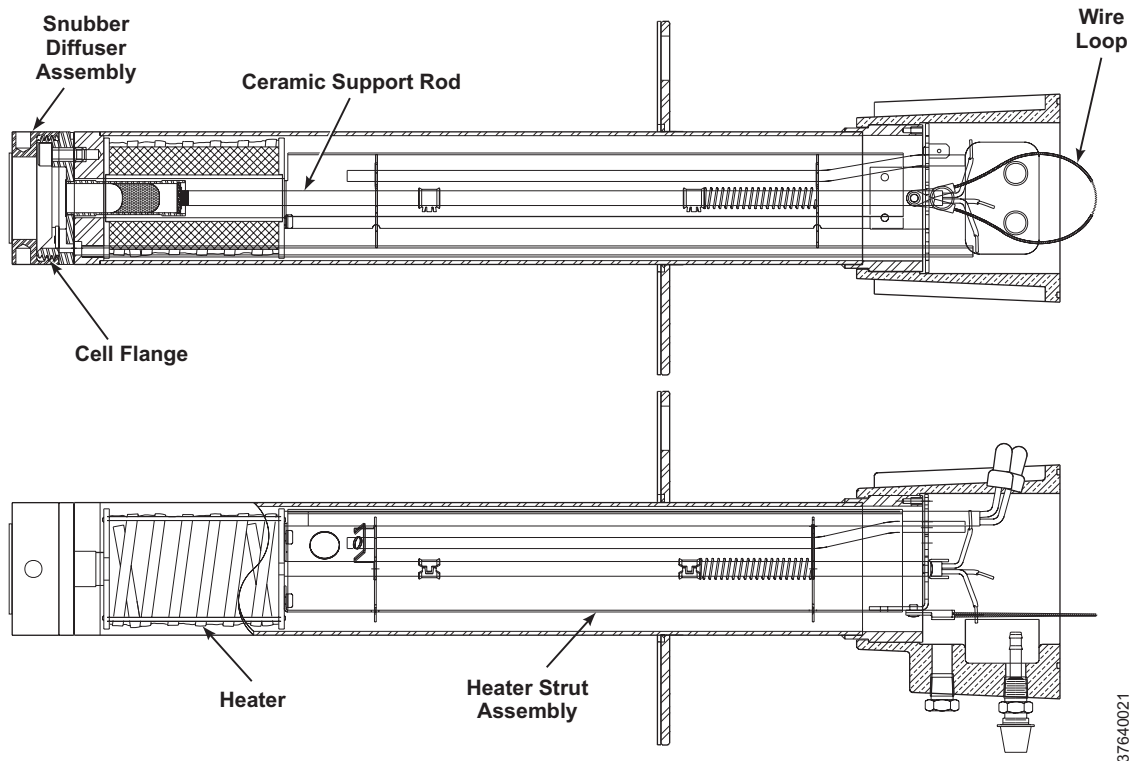
Heater Strut Replacement

This procedure covers heater strut replacement. Do not attempt to replace the heater strut until all other possibilities for poor performance have been considered.

1. Follow the instructions in Removal and Replacement to remove the SBX 1000 from the stack or duct.
2. Remove the probe from the housing per Remove Probe from Housing.
3. Remove tube clamps (33) and silicon tubes (34) from the CAL and REF gas ports and the CAL and REF gas lines.
4. Loosen, but do not remove, three screws (32). The spring tension will release and the heater strut assembly should move up.

5. When the spring tension is released, remove three screws (32). Grasp the wire loop and carefully slide the heater strut assembly (Figure 6-2) out of the probe tube.
6. When replacing the strut, orient the probe so the small calibration gas tube is at the 6 o'clock position of the probe tube. Align the slot on the heater plate with the calibration gas line in the probe tube. Slide the strut into the probe tube. It will turn to align the hole on the back plate of the strut with the calibration gas line. When the hole and the calibration gas line are aligned correctly, the strut will slide in the rest of the way.
7. As the strut installation nears completion, use the tube guide rod from the cell replacement kit to assist in guiding the calibration gas tube through the hole in the end of the strut.
8. Push down on the back plate of the strut to make sure you have spring tension and then tighten the three screws on the back plate.
9. Replace the CAL and REF gas silicon tubes.
10. Install the housing on the probe per Install Probe on Housing.
11. Follow the instructions in Removal and Replacement to install the SBX 1000 into the stack or duct.

Figure 6-2. Heater Strut Replacement



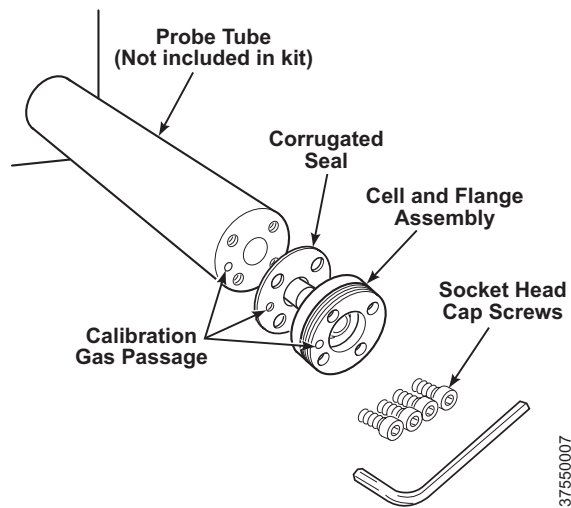
37640021

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 the cell replacement kit (Figure 9-2).

The cell replacement kit (Figure 6-3) contains a cell and flange assembly, corrugated seal, setscrews, socket head cap screws, and anti-seize compound. The items are carefully packaged to preserve precise surface finishes. Do not remove items from the 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 (Figure 9-1 and Figure 9-2).

Figure 6-3. Cell Replacement Kit



⚠ WARNING

Use heat-resistant gloves and clothing when removing the probe. 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 of up to 115 VAC.

⚠ CAUTION

Do not remove the cell unless certain it needs to be replaced. Removal may damage the cell and platinum pad. Go through the complete troubleshooting procedure to make sure the cell needs to be replaced before removing it.

1. Follow the instructions in Removal and Replacement to remove the SBX 1000 from the stack or duct.

NOTE

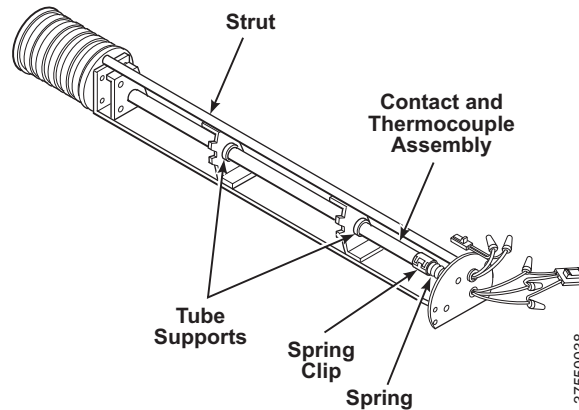
To determine if the diffusion element needs to be replaced, refer to the calibration instructions in Section 4, Calibration.

2. Use spanner wrenches from the probe disassembly kit (Figure 9-1) to remove diffusion assembly (19, Figure 6-1). Inspect the diffusion assembly; if damaged, replace.
3. Loosen four retainer screws (20) from cell and flange assembly (21) and remove the assembly and corrugated seal (22). The cell flange has a notch that may be used to gently pry the flange away from the probe. Note that the contact pad inside of 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 crimp connections and withdraw the cell with the wires still attached.
4. If the contact assembly is damaged replace the strut or the contact pad. Instructions for replacing the contact pad are in the cell replacement kit.
5. Discard the corrugated seal. Clean the mating faces of the probe tube and retainer. Remove burrs and raised surfaces with a block of wood and crocus cloth. Clean the threads on the retainer and hub.
6. Rub a small amount of anti-seize compound on both sides of the new corrugated seal (22).
7. Assemble cell and flange assembly (21), corrugated seal (22) on probe tube (23). Make sure the calibration tube lines up with the calibration gas passage in each component. Apply a small amount of anti-seize compound to retainer screw (20) threads and use the screws to secure assembly. Torque to 35 in-lbs (4 N·m).
8. Apply anti-seize compound to the threads of cell assembly (21), diffusion assembly (19), and setscrews (for optional ceramic diffusion assembly only). Install the diffusion assembly on the cell assembly. Using pin spanner wrenches, torque to 10 ft-lbs (14 N·m). If applicable, reinstall the vee deflector, orienting apex toward gas flow. Secure with the setscrews and anti-seize compound. Torque to 25 in-lbs (2.8 N·m).
9. On systems equipped with an abrasive shield, install the dust seal gaskets, with joints 180° apart.
10. Follow the instructions in Removal and Replacement to install the SBX 1000 into the stack or duct.
11. Turn on power 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 the SBX 1000 stabilizes, calibrate the unit. If new components have been installed, repeat calibration after 24 hours of operation.

Contact and Thermocouple Replacement

1. Remove the cell per Cell Replacement, steps 1 through 6.
2. Remove the heater strut assembly per Heater Strut Replacement, steps 1 through 5.
3. Use a pencil to mark locations of the spring clips, Figure 6-4, on the ceramic rod of the contact and thermocouple assembly.
4. Squeeze the tabs on the spring clips and pull the contact and thermocouple assembly out of the heater strut. Retain the spring clips and spring; replace if damaged.
5. While very carefully handling the new contact and thermocouple assembly, lay the old assembly next to the new one. Transfer the pencil marks to the new rod. Throw away the old contact and thermocouple assembly.
6. Carefully guide the new contact and thermocouple assembly through the spring, spring clips (held open by squeezing the tabs), tube supports, and heater support of the heater strut assembly until the spring clip reaches the pencil mark.
7. Install the cell per Cell Replacement, steps 7 through 12.
8. Slide the heater strut assembly into the probe per Heater Strut Replacement, steps 6 through 10.
9. Follow instructions in Removal and Replacement to install the SBX 1000 into the stack or duct.

Figure 6-4. Contact and Thermocouple Assembly Replacement



Section 7 Troubleshooting

Overview	page 7-1
Alarm Indications	page 7-3
Identifying and Correcting Alarms	page 7-4
Incorrect Oxygen Readings	page 7-20

⚠ WARNING

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

OVERVIEW

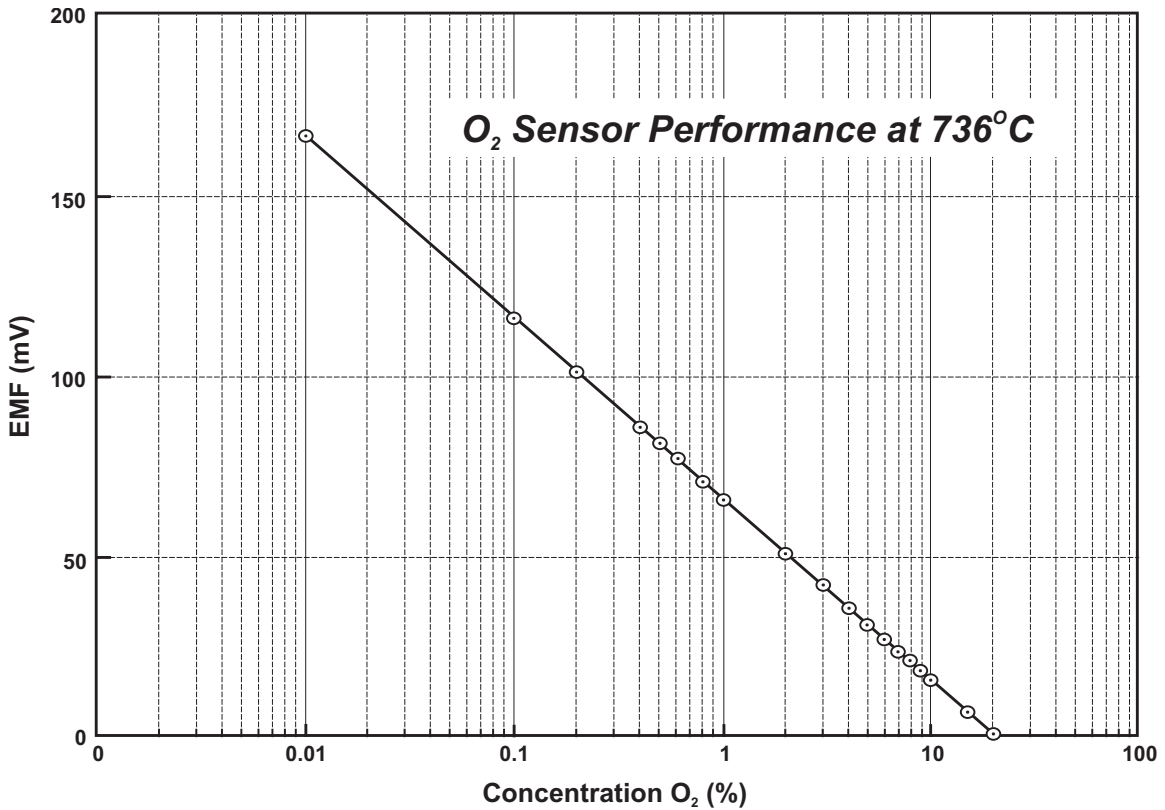
While the SBX 1000 electronics provide a significant number of diagnostic alarms to assist in troubleshooting potential problems, it is good to place these alarms in perspective with respect to the instrument's operating principles:

1. When the zirconium oxide sensing cell is heated to its setpoint [1357°F (736°C)], the cell will generate a voltage that represents the difference between the process oxygen% and the reference oxygen% inside the probe (20.95% oxygen ambient air).
2. Test points are provided to read the raw millivolt value generated by the thermocouple that controls both the cell temperature and the raw cell signal.
3. The cell temperature at test points 3 and 4 should always be stable at approximately 29 to 30 millivolts, which represents the 1357°F (736°C) setpoint temperature.
4. When flowing calibration gasses, the raw cell millivolt value at test points 1 and 2 should represent the levels on the chart in Figure 7-1. Note that the raw cell millivolt value increases logarithmically as the oxygen concentration decreases.

Grounding

It is essential that adequate grounding (earthing) precautions are taken when installing the system. Thoroughly check both the probe and electronics to ensure the grounding quality has not degraded during fault finding. The system provides facilities for 100% effective grounding and the total elimination of ground loops.

Figure 7-1. O₂ Sensor Millivolt Readings



O2%	100	20	15	10	9	8	7	6	5	4
EMF (mV)	-34	1.0	7.25	16.1	18.4	21.1	23.8	27.2	31.2	36.0
O2%	3	2	1	0.8	-0.6	0.5	0.4	0.2	0.1	0.01
EMF (mV)	42.3	51.1	66.1	71.0	77.5	81.5	86.3	101.4	116.6	166.8

37550050

Electrical Noise

The SBX 1000 has been designed to operate in the type of environment normally found in a boiler room or control room. Noise suppression circuits are employed on all field terminations and main inputs. When fault finding, evaluate the electrical noise being generated in the immediate circuitry of a faulty system. Also, ensure all cable shields are connected to earth.

Loose Integrated Circuits

The SBX 1000 uses a microprocessor and supporting integrated circuits (IC). If the electronics are handled roughly during installation or located where subjected to severe vibration, the ICs could work loose. Before troubleshooting the system, ensure all ICs are fully seated.

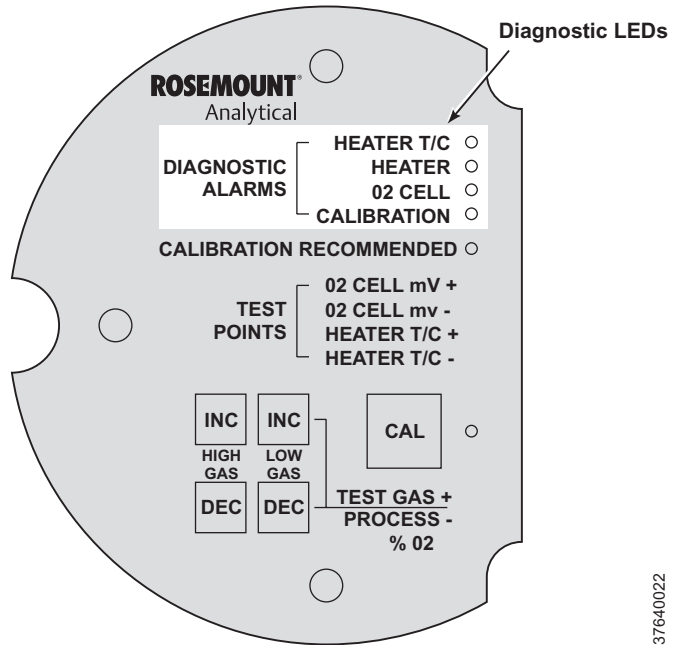
Electrostatic Discharge

Electrostatic discharge can damage the ICs used in the electronics. Before removing or handling the processor board or the ICs, ensure you are at ground potential.

ALARM INDICATIONS

The majority of the fault conditions for the SBX 1000 with a membrane keypad will be indicated by one of the four LEDs referred to as diagnostic, or unit, alarms on the operator's keypad, Figure 7-2. An LED will flash a code that will correspond to an error message. Only one LED will blink at a time. An alarm code guide is provided inside the screw on cover for the electronics.

Figure 7-2. Diagnostic LEDs



The Logic I/O contact will also activate when any alarm condition listed in Table 7-1 is present, or when the call impedance is high. The Logic I/O contact is a self-powered, +5 VDC, 340 Ohm series resistance. An interposing relay will be required if this contact is to be utilized to annunciate a higher voltage device, such as a light or horn, and may also be required for certain DCS input cards. A Potter & Brumfield R10S-E1Y1-J1.0K 3.2 mA DC or equivalent interposing relay will be mounted where the contact wires terminate in the control/relay room.

SBX 1000

IDENTIFYING AND CORRECTING ALARMS

Faults in the SBX 1000 are indicated using the four diagnostic, or unit, alarm LEDs, shown in Figure 7-2. The pattern of repeating blinks will define the problem. A condensed table of the errors and the corresponding blink codes can be found on the inside right cover of the electronics housing. Table 7-1 identifies the blink code and fault status of each LED as well as the output of the 4-20 mA signal line and a fault number that corresponds to the troubleshooting instructions provided in this section.

Table 7-1. Diagnostic/Unit Alarm Definitions - Membrane Keypad

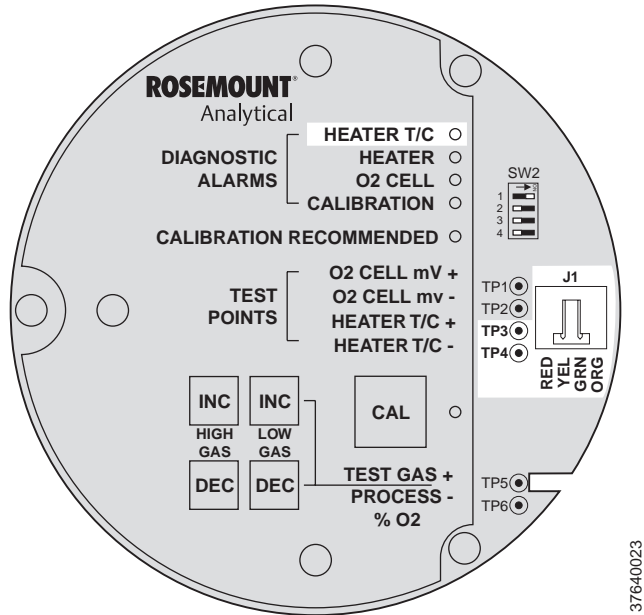
LED	Flashes	Status	4-20 mA Line	Fault	Self-Clearing
HEATER T/C	1	OPEN	Dependent on position 3 of SW2*	1	NO
	2	SHORTED	Dependent on position 3 of SW2*	2	NO
	3	REVERSED	Dependent on position 3 of SW2*	3	NO
	4	A/D COMM ERROR	Dependent on position 3 of SW2*	4	NO
HEATER	1	OPEN	Dependent on position 3 of SW2*	5	NO
	2	HIGH HIGH TEMP	Dependent on position 3 of SW2*	6	NO
	3	HIGH CASE TEMP	Dependent on position 3 of SW2*	7	YES
	4	LOW TEMP	Dependent on position 3 of SW2*	8	YES
	5	HIGH TEMP	Dependent on position 3 of SW2*	9	YES
O2 CELL	1	HIGH mV	Dependent on position 3 of SW2*	10	YES
	3	BAD	Track O ₂	11	YES
	4	EEPROM CORRUPT	Dependent on position 3 of SW2*	12	NO
CALIBRATION	1	INVALID SLOPE	Track O ₂	13	YES
	2	INVALID CONSTANT	Track O ₂	14	YES
	3	LAST CALIBRATION FAILED	Track O ₂	15	YES
CALIBRATION RECOMMENDED	**	CALIBRATION RECOMMENDED	Track O ₂		YES

* Critical alarm conditions will render the O₂ measurement as unusable, and any of these events will cause the 4-20 mA signal to go to a user-selectable limit of 3.5 mA or 21.6 mA (position 3 of SW2). Factory default value is 3.5 mA. Alarms which are not self-clearing (Self-Clearing = NO) will require a recycling of power to the electronics.

** The CALIBRATION RECOMMENDED alarm flashes the **Calibration Recommended** LED on the operator's keypad.

Alarm Descriptions and Corrective Actions

Figure 7-3. Fault 1, Open Thermocouple



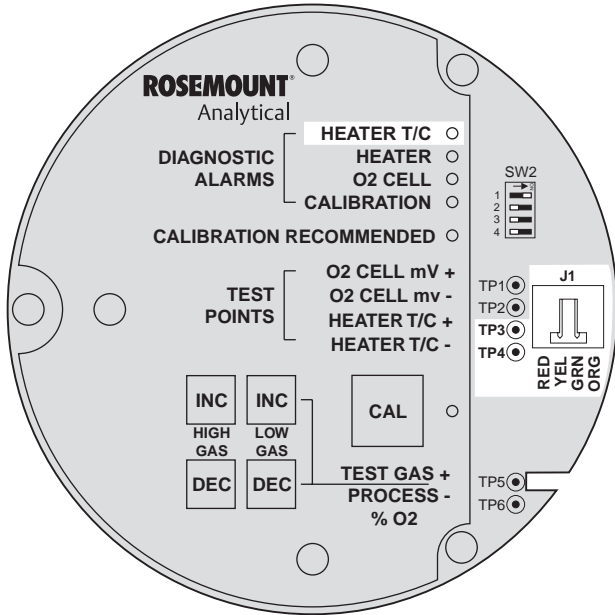
Fault 1, Open Thermocouple

Figure 7-3 shows the electronic assembly for an SBX 1000. J1 and test points TP1 through TP8 are located on the microprocessor board, below the membrane keypad.

When Fault 1 is detected, the **HEATER T/C** LED flashes once, pauses for three seconds, and repeats.

1. Remove power from the SBX 1000. Ensure the J1 connector is properly seated. Restore power.
2. Using a multimeter, measure TP3+ to TP4-. If the reading is 1.2 VDC \pm 0.1 VDC, the thermocouple is open.
3. Remove power from the SBX 1000. Disconnect J1. Measure continuity across the red and yellow thermocouple leads. The measurement should read approximately 1 ohm. Restore power.
4. If the thermocouple is open, see Section 6, Maintenance/Service.

Figure 7-4. Fault 2, Shorted Thermocouple



376-0023

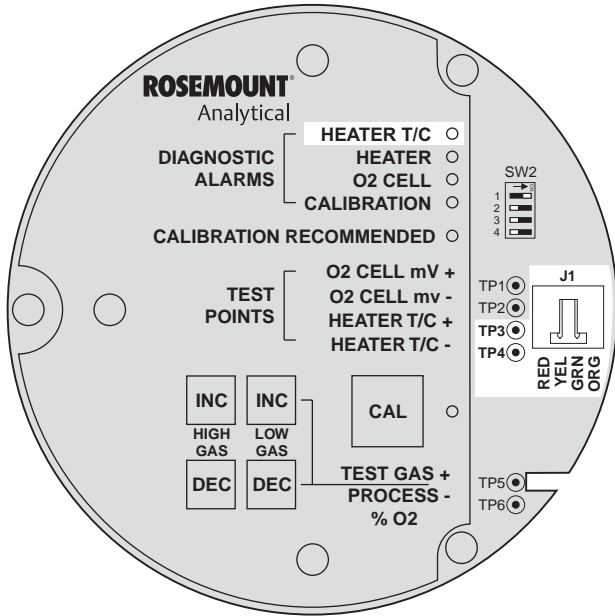
Fault 2, Shorted Thermocouple

When Fault 2 is detected (Figure 7-4), the **HEATER T/C** LED flashes twice, pauses for three seconds, and repeats.

1. Using a multimeter, measure the voltage across TP3+ and TP4-.
2. If the voltage reading is 0 ± 0.5 mV then a shorted thermocouple is likely.
3. Remove power and disconnect J1.
4. Measure the resistance from TP3+ to TP4-. The reading should be approximately 20K ohms. If so, the short is not on the PC board. The thermocouple wiring or the thermocouple is shorted.

Fault 3, Reversed Thermocouple Wiring or Faulty PC Board

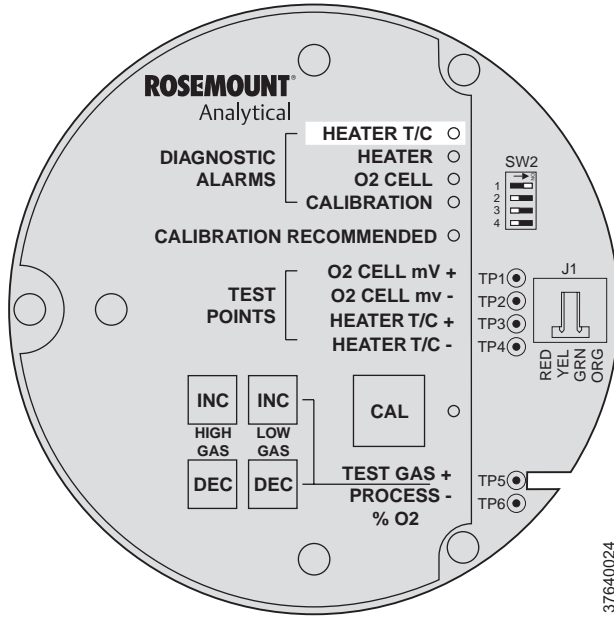
Figure 7-5. Fault 3, Reversed Thermocouple Wiring or Faulty PC Board



376-40023

1. When Fault 3 is detected (Figure 7-5), the **HEATER T/C** LED flashes three times, pauses for three seconds and repeats.
2. Using a multimeter, measure the voltage from TP3+ to TP4-.
3. If the voltage reading is negative, the thermocouple wiring is reversed.
4. Check red and yellow wires in the J1 connector for the proper placement.
5. If the wiring is correct, the fault is in the PC board. Replace the electronic assembly.

Figure 7-6. Fault 4, A/D Comm Error



Fault 4, A/D Comm Error

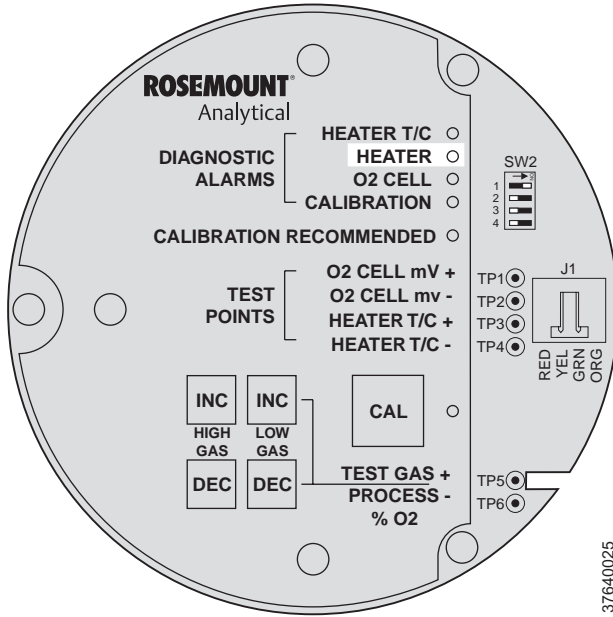
When Fault 4 is detected (Figure 7-6), the **HEATER T/C** LED flashes four times, pauses for three seconds and repeats.

Call the factory for assistance.

37640024

Fault 5, Open Heater

Figure 7-7. Fault 5, Open Heater



When Fault 5 is detected (Figure 7-7), the **HEATER** LED flashes once, pauses for three seconds and repeats.

1. Remove power.
2. Remove the electronic assembly.
3. Using a multimeter, measure the resistance across the terminals of the heater connector plug that connects to the J8 connector on the power supply board (Figure 7-8).
4. The resistance reading should be approximately 62.5 ohms. If the heater is open, replace it. Refer to Section 6, Maintenance/Service.

Figure 7-8. J8 Connector

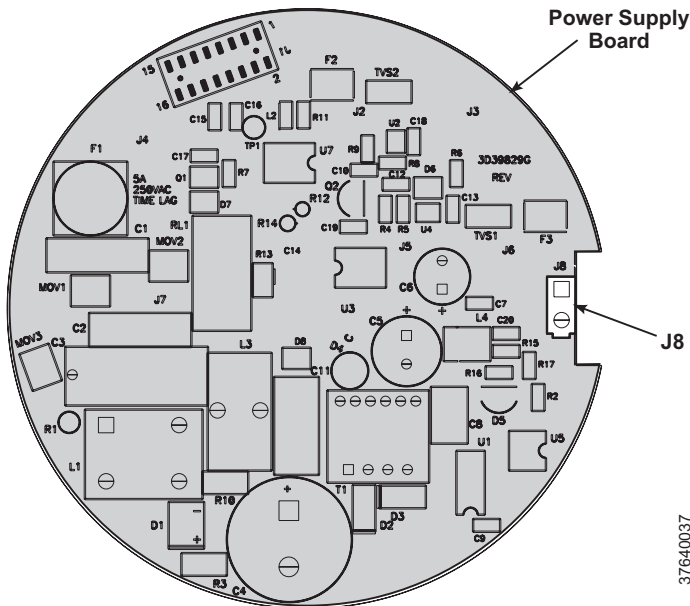
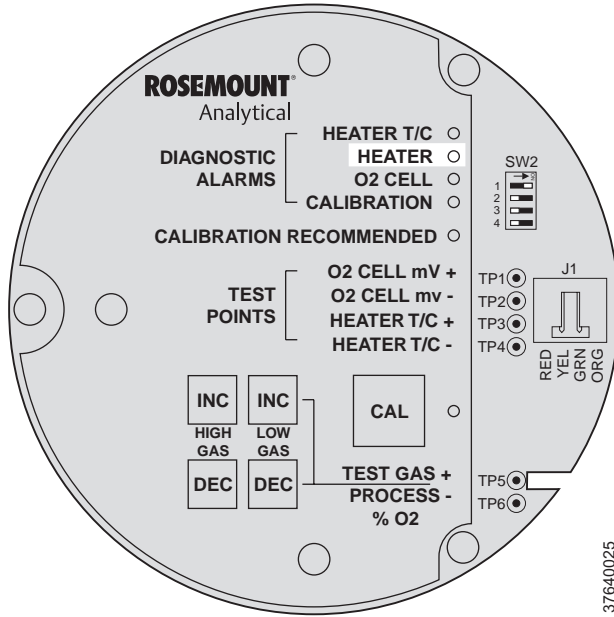


Figure 7-9. Fault 6, High High Heater Temperature

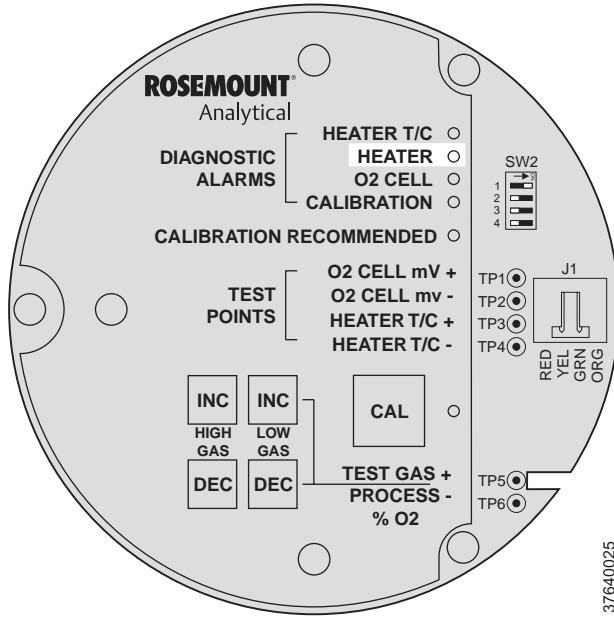


Fault 6, High High Heater Temperature

When Fault 6 is detected (Figure 7-9), the **HEATER** LED flashes twice, pauses for three seconds and repeats.

1. The high high heater temperature alarm will activate when the thermocouple produces a voltage of 37.1 mV [1652°F (900°C)].
2. The triac and the temperature control may be at fault.
3. Remove power. Allow the SBX 1000 to cool for five minutes, then restore power.
4. If the condition repeats, replace the electronic assembly.

Figure 7-10. Fault 7, High Case Temperature



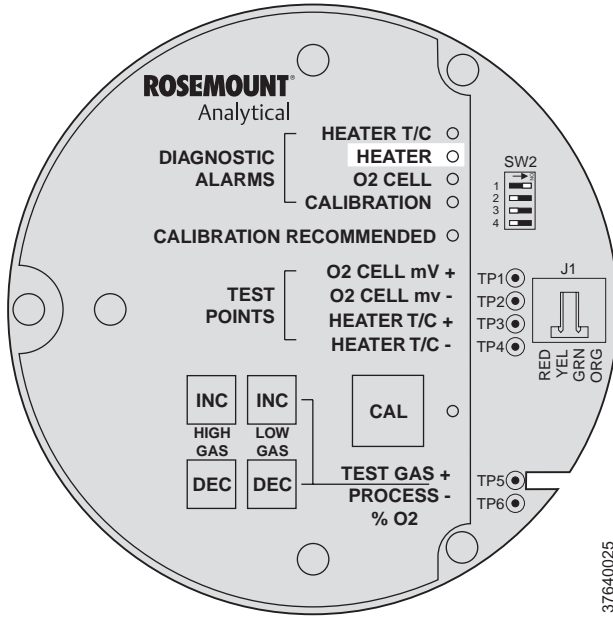
Fault 7, High Case Temperature

When Fault 7 is detected (Figure 7-10), The **HEATER** LED flashes three times, pauses for three seconds and repeats.

1. If the case temperature exceeds 185°F (85°C), the temperature control will shut off and the 4-20 mA signal output will go to the default value.
2. This signifies that the environment where the SBX 1000 is installed exceeds the ambient temperature requirements or that heat, due to convection, is causing the case temperature to rise above the limit.
3. Placing a spool piece between the stack flange and the SBX 1000 flange may eliminate this problem.
4. If a spool piece does not solve the problem, probe relocation is the only solution.

Fault 8, Low Heater Temperature

Figure 7-11. Fault 8, Low Heater Temperature



When Fault 8 is detected (Figure 7-11), the **HEATER** LED flashes four times, pauses for three seconds and repeats.

1. The low heater temperature alarm is active when the cell thermocouple reading has dropped below 28.6 mV.
2. If the thermocouple reading continues to ramp downward for one minute and does not return to the temperature set point of approximately 29.3 mV, an Open Heater fault will be displayed.
3. Power down the electronics. Remove the electronic assembly. Using a multimeter, measure the resistance across the terminals of the plug that connect to the heater connector, J8, on the power supply board (Figure 7-12).
4. If the heater is good, the reading will be approximately 62.5 ohms. If the heater is open, replace it. Refer to Section 6, Maintenance/Service.

Figure 7-12. J8 Connector

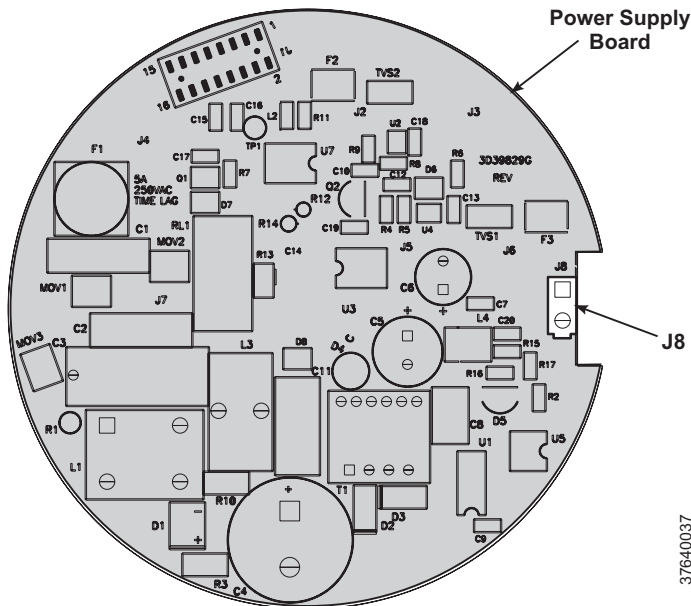
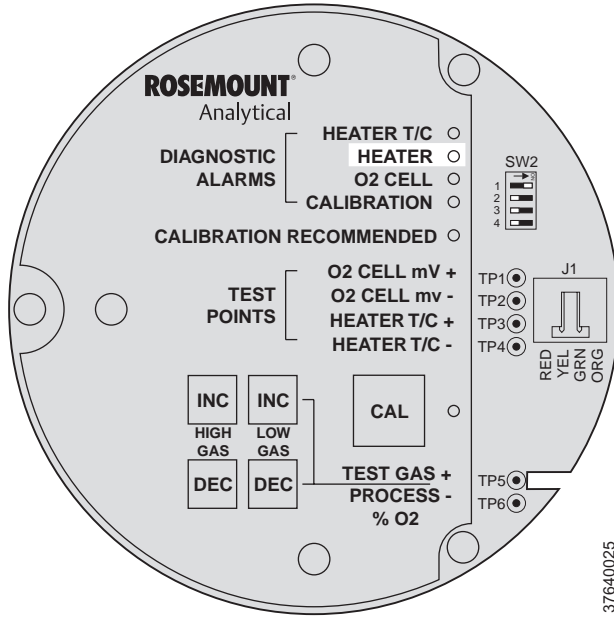


Figure 7-13. Fault 9, High Heater Temperature

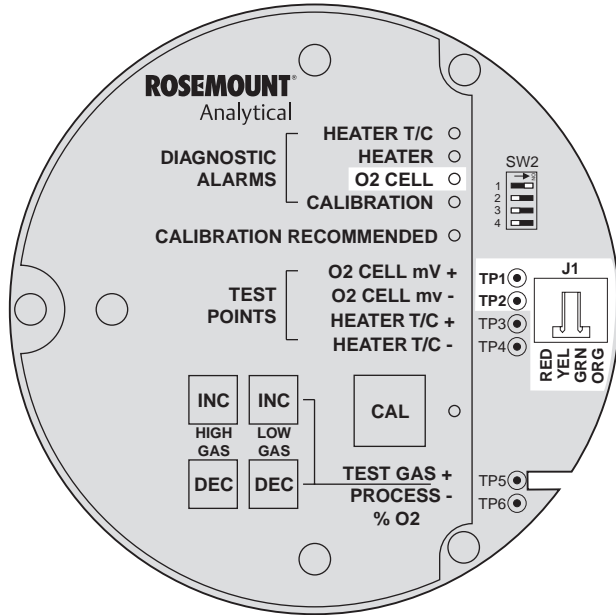


Fault 9, High Heater Temperature

When Fault 9 is detected (Figure 7-13), the **HEATER** LED flashes five times, pauses for three seconds and repeats.

1. If the cell thermocouple produces a voltage in excess of approximately 30.7 mV, the high heater temperature alarm activates.
2. The 4-20 mA signal returns to the default value (4 or 20 mA).
3. This alarm is self-clearing. When cell heater control is restored, and the thermocouple voltage returns to the normal range, the alarm clears.
4. If the cell heater temperature continues to rise, the next alarm will be the high high heater temperature alarm.

Figure 7-14. Fault 10, High Cell mV

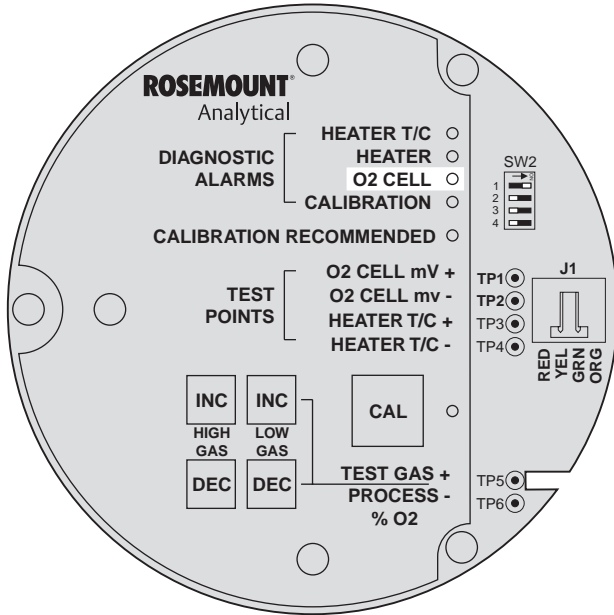


Fault 10, High Cell mV

When Fault 10 is detected (Figure 7-14), the **O2 CELL** LED flashes once, pauses for three seconds and repeats.

1. Using a multimeter, measure the voltage from TP1+ to TP2-. If you measure 1.2 Vdc, a cell wire (orange or green) is open or detached from the input.
2. One possible cause is the connector J1. Remove power to the SBX 1000. Check the orange or green wires connected to connector J1. The wires may have come loose from the crimped connection.
3. The platinum pad could also be at fault. The pad could have broken free from the back of the cell.
4. Replace the heater strut. If necessary, replace the cell and flange assembly.

Figure 7-15. Fault 11, Bad Cell

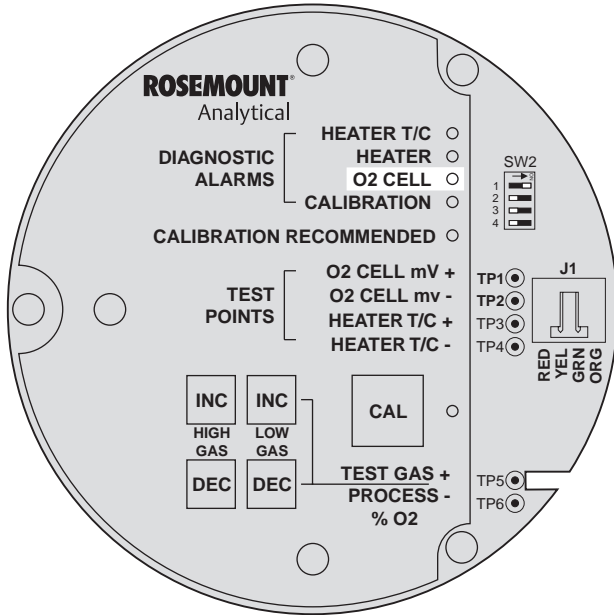


Fault 11, Bad Cell

When Fault 11 is detected (Figure 7-15), the **O2 CELL** LED flashes three times, pauses for three seconds and repeats.

The bad cell alarm activates when the cell exceeds the maximum resistance value. The cell should be replaced.

Figure 7-16. Fault 12, EEPROM Corrupt

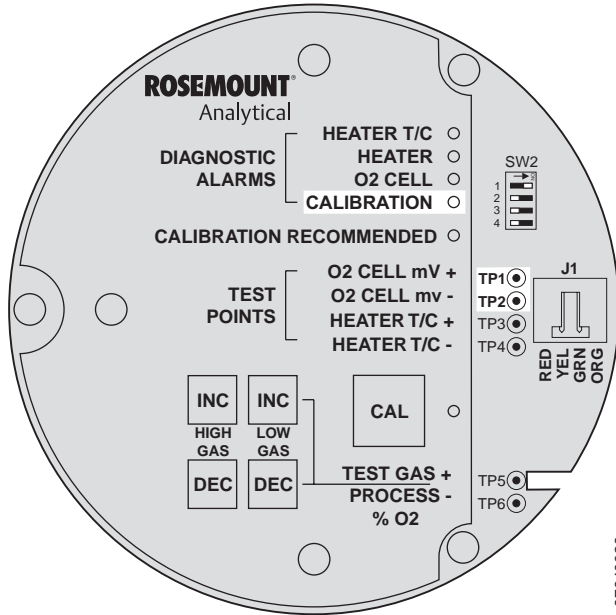


Fault 12, EEPROM Corrupt

When Fault 12 is detected (Figure 7-16), the **O2 CELL** LED flashes four times, pauses for three seconds and repeats.

1. This alarm can occur if the EEprom is changed for a later version. At power up, the EEprom is not updated.
2. To correct this problem, power down and then restore power. The alarm should clear.
3. If the alarm occurs while the unit is running, there is a hardware problem on the microprocessor board.
4. If cycling the power does not clear the alarm, replace the electronic assembly.

Figure 7-17. Fault 13, Invalid Slope

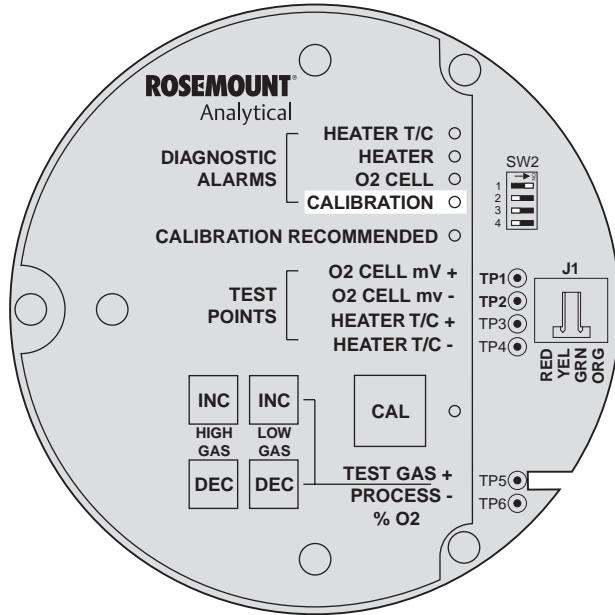


Fault 13, Invalid Slope

When Fault 13 is detected (Figure 7-17), the **CALIBRATION** LED flashes once, pauses for three seconds and repeats.

1. During a calibration, the electronics calculates a slope value. If the value of the slope is less than 35 mV/decade or more than 52 mV/decade, the slope alarm will be active until the end of the purge cycle.
2. Verify the SBX 1000 calibration by carefully repeating the calibration procedure.
3. Ensure the calibration gases match the calibration gas parameters. If you attach a multimeter to TP1+ and TP2-, the approximate sample gas measurements should be:
 - 8% O₂ = 23 mV
 - 0.4% O₂ = 85 mV
4. If the oxygen readings are bad, power down and remove the SBX 1000 from the stack. Replace the cell and flange assembly.

Figure 7-18. Fault 14, Invalid Constant



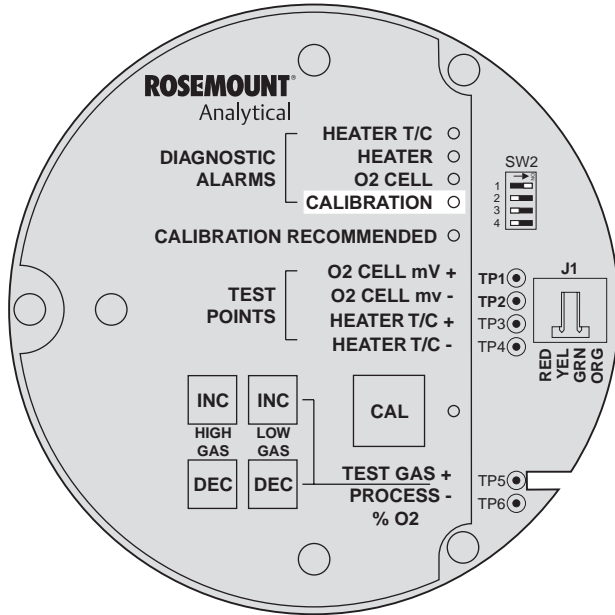
37640029

Fault 14, Invalid Constant

When Fault 14 is detected (Figure 7-18), the **CALIBRATION** LED flashes twice, pauses for three seconds and repeats.

1. After a calibration has been performed, the electronics calculates a cell constant value.
2. If the cell constant value is outside of the range, -4 mV to 10 mV, the invalid constant alarm will activate.
3. Repeat the calibration procedure and verify that the last calibration is performed correctly.
4. If the invalid constant fault occurs again, power down and remove the SBX 1000 from the stack. Replace the cell and flange assembly.

Figure 7-19. Fault 15, Last Calibration Failed



Fault 15, Last Calibration Failed

When Fault 15 is detected (Figure 7-19), the **CALIBRATION** LED flashes three times, pauses for three seconds and repeats.

1. The last calibration failed alarm activates when the slope and constant values calculated are out of range and the unit reverts to using the previous calibration values.
2. Repeat the calibration procedure and verify that the last calibration is performed correctly.
3. If the last calibration failed fault occurs again, power down and remove the SBX 1000 from the stack. Replace the cell and flange assembly.

**INCORRECT OXYGEN
READINGS**

There are a few fault conditions where no alarm indication is present and the probe passes calibration, but the oxygen reading may still be incorrect:

Probe passes calibration, but still appears to read high

1. There may be a leak that is permitting ambient air to mix with the process gases. Since many combustion processes are slightly negative in pressure, ambient air can be sucked into the cell area, biasing the oxygen reading upward.

Make sure that the calibration gas line is capped tightly between calibrations. If autocal is used, make sure the check valve is seating properly.

2. There may be a leak inside the probe itself, permitting the reference air (20.95% oxygen) to mix with the process gases at the cell. To confirm this condition, instrument air will need to be connected for reference. Pressurize the inside (reference side) of the probe by plugging the reference air exhaust port with your finger for 1 minute. The oxygen reading should decrease slightly. If the oxygen reading increases during this test, there is a leak inside the probe.
 - a. Acid condensation inside the probe can degrade the red silicon tube that carries the calibration gas to the cell. Remove the blue electronics housing or probe head to inspect this hose.
 - b. The sensing cell is bolted to the end of the probe, and uses a corrugated metallic seal to separate the process gases from the ambient reference air. This seal can be used only one time; always replace this seal when a cell is replaced. Always apply anti-seize compound on both sides of the corrugations.

Probe passes calibration, but still appears to read low

The diffusion element at the end of the probe is a passive filter. It plugs very slowly, since there is no active flow being drawn across it. This diffusion element will eventually plug in applications that have a heavy particulate loading (coal or wood fired boilers, cement and lime kilns, catalyst regeneration, recovery boilers, etc.) It is important not to pressurize the sensing cell during calibrations by flowing excessive cal gas against a plugged diffusor. Calibration flow rates should be set only when a new diffusor is installed. As the diffusor plugs, do not adjust the flow rates upward.

How do I detect a plugged diffuser?

The oxygen signal's speed of response will degrade. The oxygen trend in the control room will become smoother.

When calibrating, the calibration gas flow rate will be noted to be lower. Never readjust this flow upwards. Adjust this flow only when a new diffuser is installed.

Always note the time it takes for the cell to recover to the normal process value after the cal gas is removed. As the diffuser plugs, this recovery time will get longer and longer. Use the Calibration Record form provided in this manual.

Can I calibrate a badly plugged diffuser?

It may not be possible to immediately replace a plugged diffuser while the process is on line.

One can calibrate the probe without pressurizing the cell by adjusting the calibration gas flow rate downward before calibration. For instance, say the process is at 3%, and the first calibration gas is 8%. Adjust the flow of cal gas downward until the reading begins to migrate from 8% to lower values, indicating that process gases are now mixing in with the calibration gases.

Adjust the flow rate back up until this mixing is just eliminated. Calibrate at this flow rate. Replace the diffuser at the first opportunity.

 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.

Section 8 Return of Materials

Returning Material page 8-1

RETURNING MATERIAL

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

1. Secure a return authorization number from an Emerson Process Management sales office or representative before returning the equipment. Equipment must be returned with complete identification in accordance with Emerson Process Management instructions or it will not be accepted. In no event will Emerson Process Management be responsible for equipment returned without proper authorization and identification.
2. Carefully pack defective unit in a sturdy box with sufficient shock absorbing material to ensure that no additional damage will occur during shipping.
3. In a cover letter, describe completely:
 - a. The symptoms from which it was determined that the equipment is faulty.
 - b. The environment in which the equipment has been operating (housing, weather, vibration, dust, etc.).
 - c. Site from which equipment was removed.
 - d. Whether warranty or nonwarranty service is requested.
 - e. Complete shipping instructions for return of equipment.
 - f. Reference the return authorization number.
4. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in Rosemount Analytical Return Authorization, prepaid, to:

Emerson Process Management
Rosemount Analytical
Daniel Headquarters
11100 Britmore Park Drive
Houston, TX 77041

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 Analytical warranty, the defective unit will be repaired or replaced at Emerson Process Management's option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

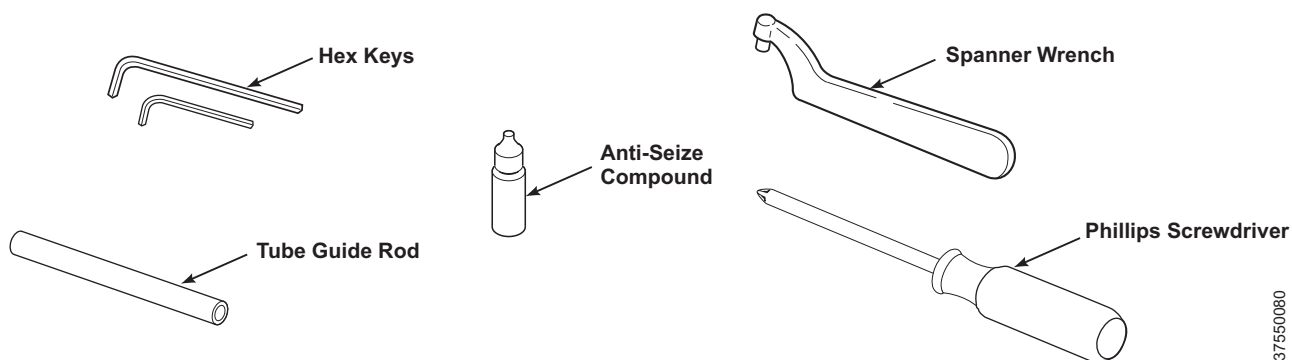
For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

Section 9 Replacement Parts

Common Parts	page 9-1
SBX 1000 Electronics	page 9-3
SBX 1000 Probe	page 9-4

COMMON PARTS

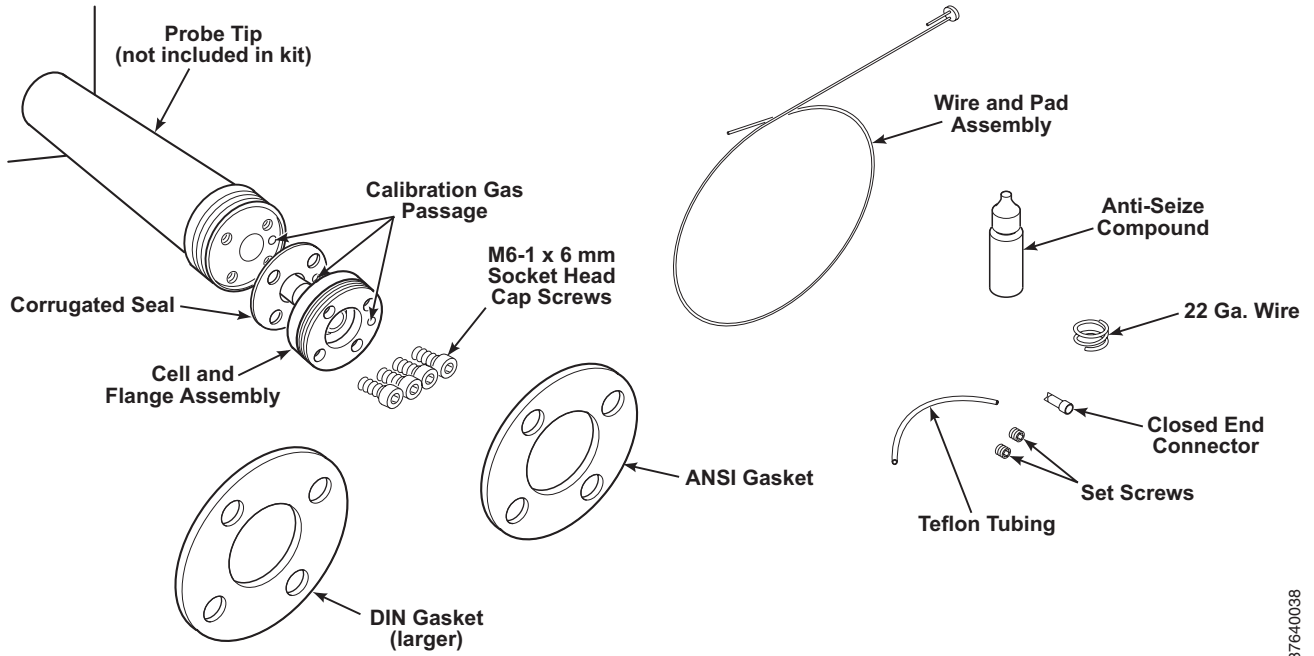
Figure 9-1. Probe Disassembly Kit



37550080

Part Number	Description
3535B42G02	Probe Disassembly Kit (See Figure 9-1)

Figure 9-2. Cell Replacement Kit

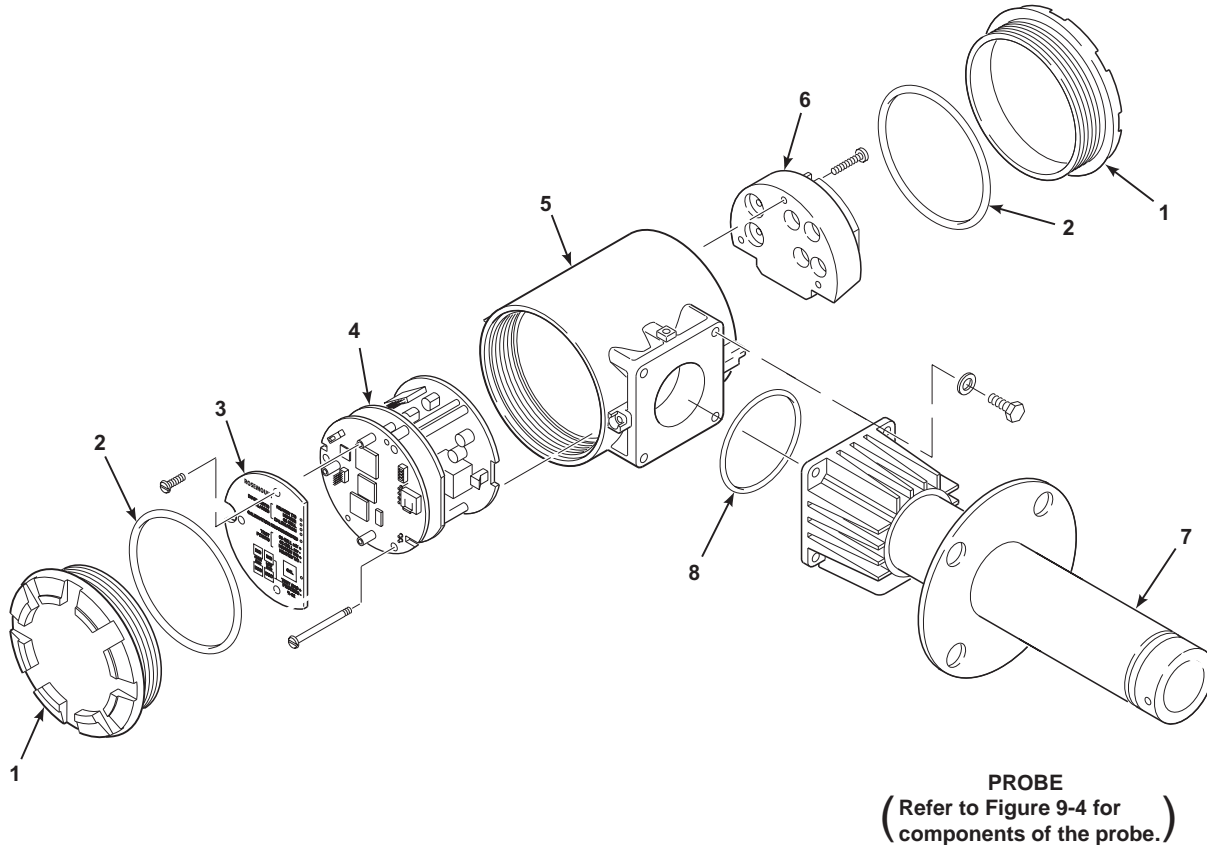


37640038

Part Number	Description
4847B61G33	Cell Replacement Kit

SBX 1000 ELECTRONICS

Figure 9-3. Electronic Components - Replacement Parts



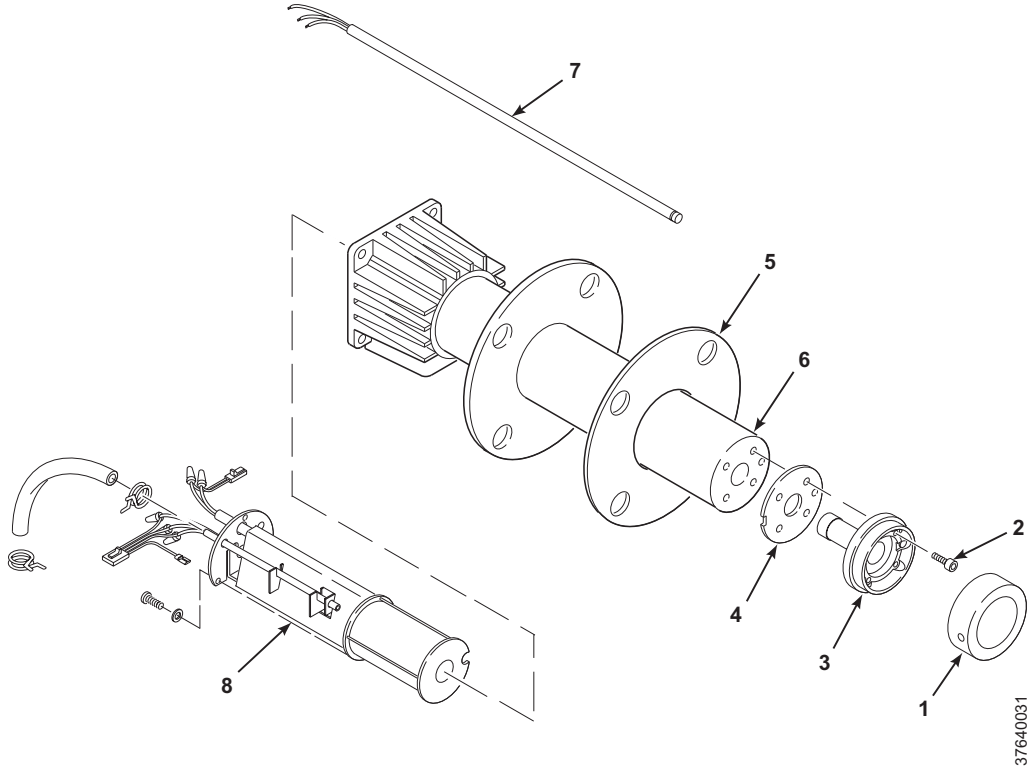
PROBE
 (Refer to Figure 9-4 for
 components of the probe.)

37640030

Index No.	Part Number	Description
1	5R10145G02	Cover
2	120039078	O-Ring, Cover
3	4849B72H01	Membrane Keypad, English
4	6A00174G01	Electronics Assembly
5	5R10146G05	Housing
6	08732-0002-0002	Termination Block, Transient Protected
7	Ref	Probe and Diffusor (See Figure 9-4 for parts and entire assembly)
8	120039076	O-Ring

SBX 1000 PROBE

Figure 9-4. Probe Components - Replacement Parts



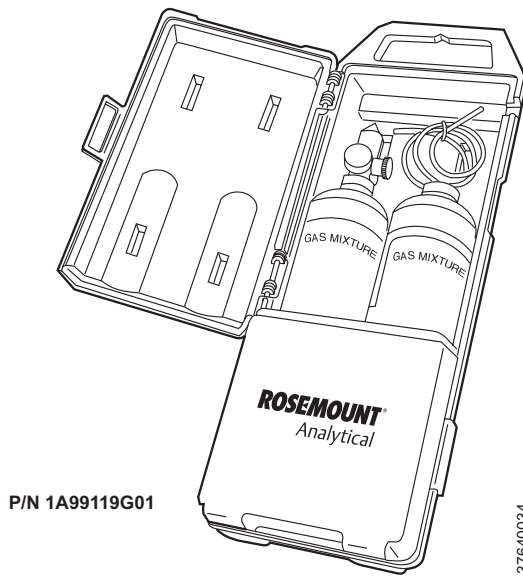
Index No.	Part Number	Description
1	4843B37G01	Snubber Diffuser
2	Ref	Screw (Part of Cell Replacement Kit, Figure 9-2)
3	Ref	Cell (Part of Cell Replacement Kit, Figure 9-2)
4	Ref	Corrugated Seal (Part of Cell Replacement Kit, Figure 9-2)
5	Ref	Flange Gasket (Part of Cell Replacement Kit, Figure 9-2)
6	3D39644G23	12" ANSI/DIN Probe Tube Assembly
7	4513C61G15	12" Contact and Thermocouple Replacement Assembly
8	3D39645G09	12" Heater Strut Assembly
	3D39648G49	12" ANSI/DIN Probe with Snubber Diffuser (Includes items 1 through 8)

Section 10 Optional Accessories

O2 Calibration Gas	page 10-1
Reference Air Set	page 10-2
Mounting Adaptor	page 10-2

O₂ CALIBRATION GAS

Figure 10-1. Calibration Gas Bottles

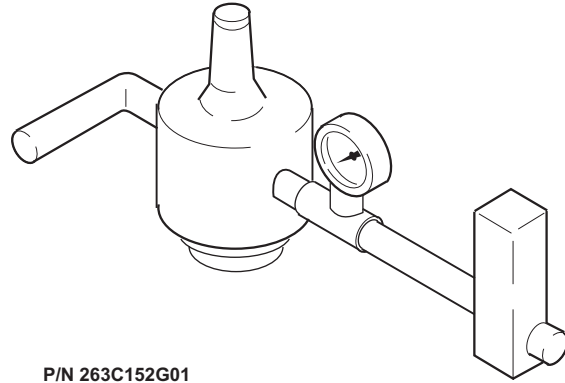


Rosemount Analytical O₂ Calibration Gas and Service Kits have been carefully designed to provide a more convenient and fully portable means of testing, calibrating, and servicing Rosemount Analytical oxygen analyzers. These lightweight, disposable gas cylinders eliminate the need to rent gas bottles.

For more information, call Emerson Process Management at 1-800-433-6076.

REFERENCE AIR SET

Figure 10-2. Reference Air Set

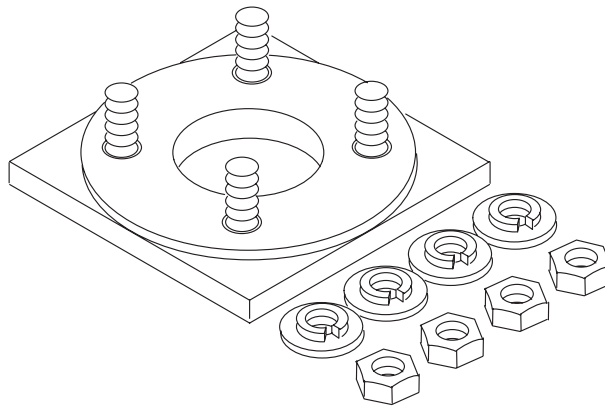


37640035

The reference air set includes a filter/regulator, pressure gage and flowmeter assembled into a single package. The reference air set components are selected for optimal control for the specified pressure and flow requirements.

MOUNTING ADAPTOR

Figure 10-3. Mounting Adaptor and Hardware



37640036

The mounting adaptor and hardware kit is custom made for a good fit with the SBX 1000. To order the kit, call Emerson Process Management at 1-800-433-6076.

Appendix A Safety Data




Safety Instructions	page A-2
Ceramic Fiber Products Material Safety Data Sheet	page A-15
High Pressure Gas Cylinders	page A-21

SAFETY INSTRUCTIONS

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.

BELANGRIJK

Veiligheidsvoorschriften voor de aansluiting en installatie van dit toestel.




De hierna volgende veiligheidsvoorschriften zijn vooral bedoeld voor de EU lidstaten. Hier moet aan gehouden worden om de onderworpenheid aan de Laag Spannings Richtlijn (Low Voltage Directive) te verzekeren. Niet EU staten zouden deze richtlijnen moeten volgen tenzij zij reeds achterhaald zouden zijn door plaatselijke of nationale voorschriften.

1. Degelijke aardingsaansluitingen moeten gemaakt worden naar alle voorziene aardpunten, intern en extern.
2. Na installatie of controle moeten alle veiligheidsdeksels en -aarding terug geplaatst worden. Ten alle tijde moet de betrouwbaarheid van de aarding behouden blijven.
3. Voedingskabels moeten onderworpen zijn aan de IEC227 of de IEC245 voorschriften.
4. Alle bekabeling moet geschikt zijn voor het gebruik in omgevingstemperaturen, hoger dan 75°C.
5. Alle wartels moeten zo gedimensioneerd zijn dat een degelijke kabel bevestiging verzekerd is.
6. Om de veilige werking van dit toestel te verzekeren, moet de voeding door een stroomonderbreker gevoerd worden (min 10A) welke alle draden van de voeding moet onderbreken. De stroomonderbreker mag een mechanische schakelaar bevatten. Zoniet moet een andere mogelijkheid bestaan om de voedingsspanning van het toestel te halen en ook duidelijk zo zijn aangegeven. Stroomonderbrekers of schakelaars moeten onderworpen zijn aan een erkende standaard zoals IEC947.
7. Waar toestellen of deksels aangegeven staan met het symbool is er meestal hoogspanning aanwezig. Deze deksels mogen enkel verwijderd worden nadat de voedingsspanning werd afgelegd en enkel door getraind onderhoudspersoneel. 
8. Waar toestellen of deksels aangegeven staan met het symbool is er gevaar voor hete oppervlakken. Deze deksels mogen enkel verwijderd worden door getraind onderhoudspersoneel nadat de voedingsspanning verwijderd werd. Sommige oppervlakken kunnen 45 minuten later nog steeds heet aanvoelen. 
9. Waar toestellen of deksels aangegeven staan met het symbool gelieve het handboek te raadplegen. 
10. Alle grafische symbolen gebruikt in dit produkt, zijn afkomstig uit een of meer van devolgende standards: EN61010-1, IEC417 en ISO3864.

VIGTIGT

Sikkerhedsinstruktion for tilslutning og installation af dette udstyr.

Følgende sikkerhedsinstruktioner gælder specifikt i alle EU-medlemslande. Instruktionerne skal nøje følges for overholdelse af Lavspændingsdirektivet og bør også følges i ikke EU-lande medmindre andet er specificeret af lokale eller nationale standarder.

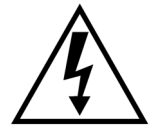
1. Passende jordforbindelser skal tilsluttes alle jordklemmer, interne og eksterne, hvor disse forefindes.
2. Efter installation eller fejlfinding skal alle sikkerhedsdæksler og jordforbindelser reetableres.
3. Forsyningskabler skal opfylde krav specificeret i IEC227 eller IEC245.
4. Alle ledningstilslutninger skal være konstrueret til omgivelsestemperatur højere end 75°C.
5. Alle benyttede kabelforskrutninger skal have en intern dimension, så passende kabelafastning kan etableres.
6. For opnåelse af sikker drift og betjening skal der skabes beskyttelse mod indirekte berøring gennem afbryder (min. 10A), som vil afbryde alle kredsløb med elektriske ledere i fejlsituation. Afbryderen skal indholde en mekanisk betjent kontakt. Hvis ikke skal anden form for afbryder mellem forsyning og udstyr benyttes og mærkes som sådan. Afbrydere eller kontakter skal overholde en kendt standard som IEC947.
7. Hvor udstyr eller dæksler er mærket med dette symbol, er farlige spændinger normalt forekommende bagved. Disse dæksler bør kun afmonteres, når forsyningsspændingen er frakoblet - og da kun af instrueret servicepersonale. 
8. Hvor udstyr eller dæksler er mærket med dette symbol, forefindes meget varme overflader bagved. Disse dæksler bør kun afmonteres af instrueret servicepersonale, når forsyningsspænding er frakoblet. Visse overflader vil stadig være for varme at berøre i op til 45 minutter efter frakobling. 
9. Hvor udstyr eller dæksler er mærket med dette symbol, se da i betjeningsmanual for instruktion. 
10. Alle benyttede grafiske symboler i dette udstyr findes i én eller flere af følgende standarder:- EN61010-1, IEC417 & ISO3864.

BELANGRIJK

Veiligheidsinstructies voor de bedrading en installatie van dit apparaat.

Voor alle EU lidstaten zijn de volgende veiligheidsinstructies van toepassing. Om aan de geldende richtlijnen voor laagspanning te voldoen dient men zich hieraan strikt te houden. Ook niet EU lidstaten dienen zich aan het volgende te houden, tenzij de lokale wetgeving anders voorschrijft.




1. Alle voorziene interne- en externe aardaansluitingen dienen op adequate wijze aangesloten te worden.
2. Na installatie, onderhouds- of reparatie werkzaamheden dienen alle beschermdeksels /kappen en aarding en om reden van veiligheid weer aangebracht te worden.
3. Voedingskabels dienen te voldoen aan de vereisten van de normen IEC 227 of IEC 245.
4. Alle bedrading dient geschikt te zijn voor gebruik bij een omgevings temperatuur boven 75°C.
5. Alle gebruikte kabelwartels dienen dusdanige inwendige afmetingen te hebben dat een adequate verankering van de kabel wordt verkregen.
6. Om een veilige werking van de apparatuur te waarborgen dient de voeding uitsluitend plaats te vinden via een meerpoleige automatische zekering (min.10A) die alle spanningvoerende geleiders verbreekt indien een foutconditie optreedt. Deze automatische zekering mag ook voorzien zijn van een mechanisch bediende schakelaar. Bij het ontbreken van deze voorziening dient een andere als zodanig duidelijk aangegeven mogelijkheid aanwezig te zijn om de spanning van de apparatuur af te schakelen. Zekeringen en schakelaars dienen te voldoen aan een erkende standaard zoals IEC 947.
7. Waar de apparatuur of de beschermdeksels/kappen gemarkeerd zijn met het volgende symbool, kunnen zich hieronder spanning voerende delen bevinden die gevaar op kunnen leveren. Deze beschermdeksels/ kappen mogen uitsluitend verwijderd worden door getraind personeel als de spanning is afgeschakeld.
8. Waar de apparatuur of de beschermdeksels/kappen gemarkeerd zijn met het volgende symbool, kunnen zich hieronder hete oppervlakken of onderdelen bevinden. Bepaalde delen kunnen mogelijk na 45 min. nog te heet zijn om aan te raken.
9. Waar de apparatuur of de beschermdeksels/kappen gemarkeerd zijn met het volgende symbool, dient men de bedieningshandleiding te raadplegen.
10. Alle grafische symbolen gebruikt bij dit produkt zijn volgens een of meer van de volgende standaarden: EN 61010-1, IEC 417 & ISO 3864.



TÄRKEÄÄ

Turvallisuusohje, jota on noudatettava tämän laitteen asentamisessa ja kaapeloinnissa.

Seuraavat ohjeet pätevät erityisesti EU:n jäsenvaltioissa. Niitä täytyy ehdottomasti noudattaa jotta täytettäisiin EU:n matalajännitedirektiivin (Low Voltage Directive) yhteensopivuus. Myös EU:hun kuulumattomien valtioiden tulee nou-dattaa tätä ohjetta, elleivät kansalliset standardit estä sitä.

1. Riittävät maadoituskytkennät on tehtävä kaikkiin maadoituspisteisiin, sisäisiin ja ulkoisiin.
2. Asennuksen ja vianetsinnän jälkeen on kaikki suojat ja suojamaat asennettava takaisin pai-koilleen. Maadoitusliittimen kunnollinen toiminta täytyy aina ylläpitää.
3. Jännitesyöttöjohtimien täytyy täyttää IEC227 ja IEC245 vaatimukset.
4. Kaikkien johdotuksien tulee toimia >75°C lämpötiloissa.
5. Kaikkien läpivientiholkkien sisähalkaisijan täytyy olla sellainen että kaapeli lukkiutuu kun-nolla kiinni.
6. Turvallisen toiminnan varmistamiseksi täytyy jännitesyöttö varustaa turvakytkimellä (min 10A), joka kytkee irti kaikki jännitesyöttöjohtimet vikatilanteessa. Suojaan täytyy myös sisältyä mekaaninen erotuskytkin. Jos ei, niin jännitesyöttö on pystyttävä katkaisemaan muilla keinoilla ja merkittävä siten että se tunnistetaan sellaiseksi. Turvakytkimien tai kat-kaisimien täytyy täyttää IEC947 standardin vaatimukset näkyvyydestä.
7. Mikäli laite tai kosketussuoja on merkitty tällä merkillä on merkinnän takana tai alla hengenvaarallisen suuruinen jännite. Suojaa ei saa poistaa jänniteen ollessa kytkettynä laitteeseen ja poistamisen saa suorittaa vain alan asian-tuntija. 
8. Mikäli laite tai kosketussuoja on merkitty tällä merkillä on merkinnän takana tai alla kuuma pinta. Suojan saa poistaa vain alan asiantuntija kun jännite-syöttö on katkaistu. Tällainen pinta voi säilyä kosketuskuumana jopa 45 mi-nuuttia. 
9. Mikäli laite tai kosketussuoja on merkitty tällä merkillä katso lisäohjeita käyt-töohjekirjasta. 
10. Kaikki tässä tuotteessa käytetyt graafiset symbolit ovat yhdestä tai useammasta seuraavis-ta standardeista: EN61010-1, IEC417 & ISO3864.

IMPORTANT

Consignes de sécurité concernant le raccordement et l'installation de cet appareil.

Les consignes de sécurité ci-dessous s'adressent particulièrement à tous les états membres de la communauté européenne. Elles doivent être strictement appliquées afin de satisfaire aux directives concernant la basse tension. Les états non membres de la communauté européenne doivent également appliquer ces consignes sauf si elles sont en contradiction avec les standards locaux ou nationaux.

1. Un raccordement adéquat à la terre doit être effectuée à chaque borne de mise à la terre, interne et externe.
2. Après installation ou dépannage, tous les capots de protection et toutes les prises de terre doivent être remis en place, toutes les prises de terre doivent être respectées en permanence.
3. Les câbles d'alimentation électrique doivent être conformes aux normes IEC227 ou IEC245.
4. Tous les raccordements doivent pouvoir supporter une température ambiante supérieure à 75°C.
5. Tous les presse-étoupes utilisés doivent avoir un diamètre interne en rapport avec les câbles afin d'assurer un serrage correct sur ces derniers.
6. Afin de garantir la sécurité du fonctionnement de cet appareil, le raccordement à l'alimentation électrique doit être réalisé exclusivement au travers d'un disjoncteur (minimum 10A.) isolant tous les conducteurs en cas d'anomalie. Ce disjoncteur doit également pouvoir être actionné manuellement, de façon mécanique. Dans le cas contraire, un autre système doit être mis en place afin de pouvoir isoler l'appareil et doit être signalisé comme tel. Disjoncteurs et interrupteurs doivent être conformes à une norme reconnue telle IEC947.
7. Lorsque les équipements ou les capots affichent le symbole suivant, cela signifie que des tensions dangereuses sont présentes. Ces capots ne doivent être démontés que lorsque l'alimentation est coupée, et uniquement par un personnel compétent.
8. Lorsque les équipements ou les capots affichent le symbole suivant, cela signifie que des surfaces dangereusement chaudes sont présentes. Ces capots ne doivent être démontés que lorsque l'alimentation est coupée, et uniquement par un personnel compétent. Certaines surfaces peuvent rester chaudes jusqu'à 45 mn.
9. Lorsque les équipements ou les capots affichent le symbole suivant, se reporter au manuel d'instructions.
10. Tous les symboles graphiques utilisés dans ce produit sont conformes à un ou plusieurs des standards suivants: EN61010-1, IEC417 & ISO3864.



WICHTIG

Sicherheitshinweise für den Anschluß und die Installation dieser Geräte.

Die folgenden Sicherheitshinweise sind in allen Mitgliederstaaten der europäischen Gemeinschaft gültig. Sie müssen strikt eingehalten werden, um der Niederspannungsrichtlinie zu genügen.

Nichtmitgliedstaaten der europäischen Gemeinschaft sollten die national gültigen Normen und Richtlinien einhalten.

1. Alle intern und extern vorgesehenen Erdungen der Geräte müssen ausgeführt werden.
2. Nach Installation, Reparatur oder sonstigen Eingriffen in das Gerät müssen alle Sicherheitsabdeckungen und Erdungen wieder installiert werden. Die Funktion aller Erdverbindungen darf zu keinem Zeitpunkt gestört sein.
3. Die Netzspannungsversorgung muß den Anforderungen der IEC227 oder IEC245 genügen.
4. Alle Verdrahtungen sollten mindestens bis 75°C ihre Funktion dauerhaft erfüllen.
5. Alle Kabeldurchführungen und Kabelverschraubungen sollten in Ihrer Dimensionierung so gewählt werden, daß diese eine sichere Verkabelung des Gerätes ermöglichen.
6. Um eine sichere Funktion des Gerätes zu gewährleisten, muß die Spannungsversorgung über mindestens 10 A abgesichert sein. Im Fehlerfall muß dadurch gewährleistet sein, daß die Spannungsversorgung zum Gerät bzw. zu den Geräten unterbrochen wird. Ein mechanischer Schutzschalter kann in dieses System integriert werden. Falls eine derartige Vorrichtung nicht vorhanden ist, muß eine andere Möglichkeit zur Unterbrechung der Spannungszufuhr gewährleistet werden mit Hinweisen deutlich gekennzeichnet werden. Ein solcher Mechanismus zur Spannungsunterbrechung muß mit den Normen und Richtlinien für die allgemeine Installation von Elektrogeräten, wie zum Beispiel der IEC947, übereinstimmen.



7. Mit dem Symbol sind Geräte oder Abdeckungen gekennzeichnet, die eine gefährliche (Netzspannung) Spannung führen. Die Abdeckungen dürfen nur entfernt werden, wenn die Versorgungsspannung unterbrochen wurde. Nur geschultes Personal darf an diesen Geräten Arbeiten ausführen.



8. Mit dem Symbol sind Geräte oder Abdeckungen gekennzeichnet, in bzw. unter denen heiße Teile vorhanden sind. Die Abdeckungen dürfen nur entfernt werden, wenn die Versorgungsspannung unterbrochen wurde. Nur geschultes Personal darf an diesen Geräten Arbeiten ausführen. Bis 45 Minuten nach dem Unterbrechen der Netzzufuhr können derartige Teile noch über eine erhöhte Temperatur verfügen.



9. Mit dem Symbol sind Geräte oder Abdeckungen gekennzeichnet, bei denen vor dem Eingriff die entsprechenden Kapitel im Handbuch sorgfältig durchgelesen werden müssen.
10. Alle in diesem Gerät verwendeten graphischen Symbole entspringen einem oder mehreren der nachfolgend aufgeführten Standards: EN61010-1, IEC417 & ISO3864.

IMPORTANTE

Norme di sicurezza per il cablaggio e l'installazione dello strumento.

Le seguenti norme di sicurezza si applicano specificatamente agli stati membri dell'Unione Europea, la cui stretta osservanza è richiesta per garantire conformità alla Direttiva del Basso Voltaggio. Esse si applicano anche agli stati non appartenenti all'Unione Europea, salvo quanto disposto dalle vigenti normative locali o nazionali.




1. Collegamenti di terra idonei devono essere eseguiti per tutti i punti di messa a terra interni ed esterni, dove previsti.
2. Dopo l'installazione o la localizzazione dei guasti, assicurarsi che tutti i coperchi di protezione siano stati collocati e le messa a terra siano collegate. L'integrità di ciascun morsetto di terra deve essere costantemente garantita.
3. I cavi di alimentazione della rete devono essere secondo disposizioni IEC227 o IEC245.
4. L'intero impianto elettrico deve essere adatto per uso in ambiente con temperature superiore a 75°C.
5. Le dimensioni di tutti i connettori dei cavi utilizzati devono essere tali da consentire un adeguato ancoraggio al cavo.
6. Per garantire un sicuro funzionamento dello strumento il collegamento alla rete di alimentazione principale dovrà essere eseguita tramite interruttore automatico (min.10A), in grado di disattivare tutti i conduttori di circuito in caso di guasto. Tale interruttore dovrà inoltre prevedere un sezionatore manuale o altro dispositivo di interruzione dell'alimentazione, chiaramente identificabile. Gli interruttori dovranno essere conformi agli standard riconosciuti, quali IEC947.
7. Il simbolo riportato sullo strumento o sui coperchi di protezione indica probabile presenza di elevati voltaggi. Tali coperchi di protezione devono essere rimossi esclusivamente da personale qualificato, dopo aver tolto alimentazione allo strumento.
8. Il simbolo riportato sullo strumento o sui coperchi di protezione indica rischio di contatto con superfici ad alta temperatura. Tali coperchi di protezione devono essere rimossi esclusivamente da personale qualificato, dopo aver tolto alimentazione allo strumento. Alcune superfici possono mantenere temperature elevate per oltre 45 minuti.
9. Se lo strumento o il coperchio di protezione riportano il simbolo, fare riferimento alle istruzioni del manuale Operatore.
10. Tutti i simboli grafici utilizzati in questo prodotto sono previsti da uno o più dei seguenti standard: EN61010-1, IEC417 e ISO3864.



VIKTIG

Sikkerhetsinstruks for tilkobling og installasjon av dette utstyret.

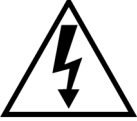


Følgende sikkerhetsinstruksjoner gjelder spesifikt alle EU medlemsland og land med i EØS-avtalen. Instruksjonene skal følges nøye slik at installasjonen blir i henhold til lavspenningsdirektivet. Den bør også følges i andre land, med mindre annet er spesifisert av lokale- eller nasjonale standarder.

1. Passende jordforbindelser må tilkobles alle jordingspunkter, interne og eksterne hvor disse forefinnes.
2. Etter installasjon eller feilsøking skal alle sikkerhetsdeksler og jordforbindelser reetableres. Jordingsforbindelsene må alltid holdes i god stand.
3. Kabler fra spenningsforsyning skal oppfylle kravene spesifisert i IEC227 eller IEC245.
4. Alle ledningsforbindelser skal være konstruert for en omgivelsestemperatur høyere en 750°C.
5. Alle kabelforskrivninger som benyttes skal ha en indre dimensjon slik at tilstrekkelig avlastning oppnåes.
6. For å oppnå sikker drift og betjening skal forbindelsen til spenningsforsyningen bare skje gjennom en strømbryter (minimum 10A) som vil bryte spenningsforsyningen til alle elektriske kretser ved en feilsituasjon. Strømbryteren kan også inneholde en mekanisk operert bryter for å isolere instrumentet fra spenningsforsyningen. Dersom det ikke er en mekanisk operert bryter installert, må det være en annen måte å isolere utstyret fra spenningsforsyningen, og denne måten må være tydelig merket. Kretsbrytere eller kontakter skal oppfylle kravene i en annerkjent standard av typen IEC947 eller tilsvarende.
7. Der hvor utstyr eller deksler er merket med symbol for farlig spenning, er det sannsynlig at disse er tilstede bak dekslet. Disse dekslene må bare fjernes når spenningsforsyning er frakoblet utstyret, og da bare av trent servicepersonell. 
8. Der hvor utstyr eller deksler er merket med symbol for meget varm overflate, er det sannsynlig at disse er tilstede bak dekslet. Disse dekslene må bare fjernes når spenningsforsyning er frakoblet utstyret, og da bare av trent servicepersonell. Noen overflater kan være for varme til å berøres i opp til 45 minutter etter spenningsforsyning frakoblet. 
9. Der hvor utstyret eller deksler er merket med symbol, vennligst referer til instruksjonsmanualen for instruksjer.
10. Alle grafiske symboler brukt i dette produktet er fra en eller flere av følgende standarder: EN61010-1, IEC417 & ISO3864. 

IMPORTANTE

Instruções de segurança para ligação e instalação deste aparelho.

As seguintes instruções de segurança aplicam-se especificamente a todos os estados membros da UE. Devem ser observadas rigidamente por forma a garantir o cumprimento da Directiva sobre Baixa Tensão. Relativamente aos estados que não pertençam à UE, deverão cumprir igualmente a referida directiva, exceptuando os casos em que a legislação local a tiver substituído.

1. Devem ser feitas ligações de terra apropriadas a todos os pontos de terra, internos ou externos.
2. Após a instalação ou eventual reparação, devem ser recolocadas todas as tampas de segurança e terras de protecção. Deve manter-se sempre a integridade de todos os terminais de terra.
3. Os cabos de alimentação eléctrica devem obedecer às exigências das normas IEC227 ou IEC245.
4. Os cabos e fios utilizados nas ligações eléctricas devem ser adequados para utilização a uma temperatura ambiente até 75°C.
5. As dimensões internas dos buçins dos cabos devem ser adequadas a uma boa fixação dos cabos.
6. Para assegurar um funcionamento seguro deste equipamento, a ligação ao cabo de alimentação eléctrica deve ser feita através de um disjuntor (min. 10A) que desligará todos os condutores de circuitos durante uma avaria. O disjuntor poderá também conter um interruptor de isolamento accionado manualmente. Caso contrário, deverá ser instalado qualquer outro meio para desligar o equipamento da energia eléctrica, devendo ser assinalado convenientemente. Os disjuntores ou interruptores devem obedecer a uma norma reconhecida, tipo IEC947.
7. Sempre que o equipamento ou as tampas contiverem o símbolo, é provável a existência de tensões perigosas. Estas tampas só devem ser retiradas quando a energia eléctrica tiver sido desligada e por Pessoal da Assistência devidamente treinado. 
8. Sempre que o equipamento ou as tampas contiverem o símbolo, há perigo de existência de superfícies quentes. Estas tampas só devem ser retiradas por Pessoal da Assistência devidamente treinado e depois de a energia eléctrica ter sido desligada. Algumas superfícies permanecem quentes até 45 minutos depois. 
9. Sempre que o equipamento ou as tampas contiverem o símbolo, o Manual de Funcionamento deve ser consultado para obtenção das necessárias instruções. 
10. Todos os símbolos gráficos utilizados neste produto baseiam-se em uma ou mais das seguintes normas: EN61010-1, IEC417 e ISO3864.

IMPORTANTE

Instrucciones de seguridad para el montaje y cableado de este aparato.

Las siguientes instrucciones de seguridad, son de aplicacion especifica a todos los miembros de la UE y se adjuntaran para cumplir la normativa europea de baja tension.




1. Se deben preveer conexiones a tierra del equipo, tanto externa como internamente, en aquellos terminales previstos al efecto.
2. Una vez finalizada las operaciones de mantenimiento del equipo, se deben volver a colocar las cubiertas de seguridad aasi como los terminales de tierra. Se debe comprobar la integridad de cada terminal.
3. Los cables de alimentacion electrica cumplan con las normas IEC 227 o IEC 245.
4. Todo el cableado sera adecuado para una temperatura ambiental de 75°C.
5. Todos los prensaestopas seran adecuados para una fijacion adecuada de los cables.
6. Para un manejo seguro del equipo, la alimentacion electrica se realizara a traves de un interruptor magnetotermico (min 10 A), el cual desconectara la alimentacion electrica al equipo en todas sus fases durante un fallo. Los interruptores estaran de acuerdo a la norma IEC 947 u otra de reconocido prestigio.
7. Cuando las tapas o el equipo lleve impreso el simbolo de tension electrica peligrosa, dicho alojamiento solamente se abra una vez que se haya interrumpido la alimentacion electrica al equipo asimismo la intervencion sera llevada a cabo por personal entrenado para estas labores.
8. Cuando las tapas o el equipo lleve impreso el simbolo, hay superficies con alta temperatura, por tanto se abra una vez que se haya interrumpido la alimentacion electrica al equipo por personal entrenado para estas labores, y al menos se esperara unos 45 minutos para enfriar las superficies calientes.
9. Cuando el equipo o la tapa lleve impreso el simbolo, se consultara el manual de instrucciones.
10. Todos los simbolos graficos usados en esta hoja, estan de acuerdo a las siguientes normas EN61010-1, IEC417 & ISO 3864.



VIKTIGT




Säkerhetsföreskrifter för kablage och installation av denna apparat.

Följande säkerhetsföreskrifter är tillämpliga för samtliga EU-medlemsländer. De skall följas i varje avseende för att överensstämja med Lågspännings direktivet. Icke EU medlemsländer skall också följa nedanstående punkter, såvida de inte övergrips av lokala eller nationella föreskrifter.

1. Tillämplig jordkontakt skall utföras till alla jordade punkter, såväl internt som externt där så erfordras.
2. Efter installation eller felsökning skall samtliga säkerhetshöljen och säkerhetsjord återplaceras. Samtliga jordterminaler måste hållas obrutna hela tiden.
3. Matningsspänningens kabel måste överensstämja med föreskrifterna i IEC227 eller IEC245.
4. Allt kablage skall vara lämpligt för användning i en omgivningstemperatur högre än 75°C.
5. Alla kabelförskruvningar som används skall ha inre dimensioner som motsvarar adekvat kabelförankring.
6. För att säkerställa säker drift av denna utrustning skall anslutning till huvudströmmen endast göras genom en säkring (min 10A) som skall fränkoppla alla strömförande kretsar när något fel uppstår. Säkringen kan även ha en mekanisk fränskiljare. Om så inte är fallet, måste ett annat förfarande för att fränskilja utrustningen från strömförsörjning tillhandahållas och klart framgå genom markering. Säkring eller omkopplare måste överensstämja med en gällande standard såsom t ex IEC947.
7. Där utrustning eller hölje är markerad med vidstående symbol föreligger risk för livsfarlig spänning i närheten. Dessa höljen får endast avlägsnas när strömmen ej är ansluten till utrustningen - och då endast av utbildad servicepersonal. 
8. När utrustning eller hölje är markerad med vidstående symbol föreligger risk för brännskada vid kontakt med uppvärmd yta. Dessa höljen får endast avlägsnas av utbildad servicepersonal, när strömmen kopplats från utrustningen. Vissa ytor kan vara mycket varma att vidröra även upp till 45 minuter efter avstängning av strömmen. 
9. När utrustning eller hölje markerats med vidstående symbol bör instruktionsmanualen studeras för information. 
10. Samtliga grafiska symboler som förekommer i denna produkt finns angivna i en eller flera av följande föreskrifter:- EN61010-1, IEC417 & ISO3864.

ΠΡΟΣΟΧΗ**Οδηγίες ασφαλείας για την καλωδίωση και εγκατάσταση της συσκευής.**

Οι ακόλουθες οδηγίες ασφαλείας εφαρμόζονται ειδικά σε όλες τις χώρες μέλη της Ευρωπαϊκής Κοινότητας. Θα πρέπει να ακολουθούνται αυστηρά ώστε να εξασφαλιστεί η συμβατότητα με τις οδηγίες για τη Χαμηλή Τάση. Χώρες που δεν είναι μέλη της Ευρωπαϊκής Κοινότητας θα πρέπει επίσης να ακολουθούν τις οδηγίες εκτός εάν αντικαθίστανται από τα Τοπικά ή Εθνικά Πρότυπα.

1. Επαρκείς συνδέσεις γείωσης θα πρέπει να γίνονται σε όλα τα σημεία γείωσης, εσωτερικά και εξωτερικά όπου υπάρχουν.
2. Μετά την εγκατάσταση ή την εκοφαλάτωση όλα τα καλύματα ασφαλείας και οι γειώσεις ασφαλείας πρέπει να επανεγκαθίστανται. Η καλή κατάσταση όλων των ακροδεκτών γείωσης πρέπει να ελέγχεται και να συντηρείται διαρκώς.
3. Τα καλώδια τροφοδοσίας πρέπει να πληρούν τις απαιτήσεις των IEC227 ή IEC245.
4. Όλες οι καλωδιώσεις θα πρέπει να είναι κατάλληλες για χρήση σε ατμοσφαιρική θερμοκρασία χώρου υψηλότερη από 75°C.
5. Όλοι οι στυπιοθλίπτες θα πρέπει να είναι τέτοιων εσωτερικών διαστάσεων ώστε να παρέχουν επαρκή στερέωση των καλωδίων.
6. Για τη διασφάλιση ασφαλούς λειτουργίας της σύνδεσης τροφοδοσίας αυτής της συσκευής θα πρέπει να γίνεται μόνο μέσω ασφαλειοδιακόπτη (ελάχιστο 10A) ο οποίος θα αποσυνδέει όλους του ηλεκτροφόρους αγωγούς στη διάρκεια κατάστασης σφάλματος.
Ο ασφαλειοδιακόπτης μπορεί επίσης να περιλαμβάνει μηχανικό διακόπτη απομόνωσης. Εάν δεν περιλαμβάνει, τότε άλλα μέσα αποσύνδεσης της συσκευής από την τροφοδοσία πρέπει να παροχρηθούν και σαφώς να σημειθούν σαν τέτοια. Οι ασφαλειοδιακόπτες ή διακόπτες πρέπει να συμφωνούν με αναγνωρισμένα πρότυπα όπως το IEC947.
7. Όπου συσκευές ή καλύματα είναι σημασμένα με το σύμβολο επικίνδυνες τάσεις ενυπάρχουν κάτω από αυτά. Αυτά τα καλύματα θα πρέπει να αφαιρούνται μόνο όταν έχει αφαιρεθεί η τροφοδοσία από τη συσκευή και τότε μόνο από ειδικευμένο τεχνικό προσωπικό. 
8. Όπου συσκευές ή καλύματα είναι σημασμένα με το σύμβολο υπάρχει κίνδυνος από καυτές επιφάνειες κάτω από αυτά. Αυτά τα καλύματα θα πρέπει να αφαιρούνται μόνο από ειδικευμένο τεχνικό προσωπικό, όταν η τροφοδοσία έχει αφαιρεθεί από τη συσκευή. Τέτοιες επιφάνειες μπορούν να παραμείνουν ζεστές στην αφή έως και 45 λεπτά αργότερα. 
9. Όπου συσκευές ή καλύματα είναι σημασμένα με το σύμβολο αναφερθείται στις οδηγίες χρήσης της συσκευής. 
10. Όλα τα γραφικά σύμβολα που χρησιμοποιούνται σε αυτό το προϊόν είναι από ένα ή περισσότερα από τα έξης πρότυπα: EN61010-1, IEC417 και ISO3864.

**CERAMIC FIBER
PRODUCTS MATERIAL
SAFETY DATA SHEET**

JULY 1, 1996

SECTION I. IDENTIFICATION

PRODUCT NAME

Ceramic Fiber Heaters, Molded Insulation Modules and Ceramic Fiber Radiant Heater Panels.

CHEMICAL FAMILY

Vitreous Aluminosilicate Fibers with Silicon Dioxide.

CHEMICAL NAME

N.A.

CHEMICAL FORMULA

N.A.

MANUFACTURER'S NAME AND ADDRESS

Watlow Columbia
2101 Pennsylvania Drive
Columbia, MO 65202
573-814-1300, ext. 5170
573-474-9402

HEALTH HAZARD SUMMARY WARNING

- Possible cancer hazard based on tests with laboratory animals.
- May be irritating to skin, eyes and respiratory tract.
- May be harmful if inhaled.
- Cristobalite (crystalline silica) formed at high temperatures (above 1800°F) can cause severe respiratory disease.

SECTION II. PHYSICAL DATA

APPEARANCE AND ODOR

Cream to white colored fiber shapes. With or without optional white to gray granular surface coating and/or optional black surface coating.

SPECIFIC WEIGHT: 12-25 LB./CUBIC FOOT

BOILING POINT: N.A.

VOLATILES (% BY WT.): N.A.

WATER SOLUBILITY: N.A.

SECTION III. HAZARDOUS INGREDIENTS

MATERIAL, QUANTITY, AND THRESHOLD/EXPOSURE LIMIT VALUES

Aluminosilicate (vitreous) 99+ %	1 fiber/cc TWA
CAS. No. 142844-00-06	10 fibers/cc CL
Zirconium Silicate	0-10% 5 mg/cubic meter (TLV)
Black Surface Coating**	0 - 1% 5 mg/cubic meter (TLV)
Amorphous Silica/Silicon Dioxide	0-10% 20 mppcf (6 mg/cubic meter) PEL (OSHA 1978) 3 gm/cubic meter (Respirable dust): 10 mg/cubic meter, Intended TLV (ACGIH 1984-85)

**Composition is a trade secret.

SECTION IV. FIRE AND EXPLOSION DATA**FLASH POINT: NONE****FLAMMABILITY LIMITS: N.A.****EXTINGUISHING MEDIA**

Use extinguishing agent suitable for type of surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS / SPECIAL FIRE FIGHTING PROCEDURES

N.A.

SECTION V. HEALTH HAZARD DATA**THRESHOLD LIMIT VALUE**

(See Section III)

EFFECTS OF OVER EXPOSURE

- EYE - Avoid contact with eyes. Slightly to moderately irritating. Abrasive action may cause damage to outer surface of eye.
- INHALATION - May cause respiratory tract irritation. Repeated or prolonged breathing of particles of respirable size may cause inflammation of the lung leading to chest pain, difficult breathing, coughing and possible fibrotic change in the lung (Pneumoconiosis). Pre-existing medical conditions may be aggravated by exposure: specifically, bronchial hyper-reactivity and chronic bronchial or lung disease.
- INGESTION - May cause gastrointestinal disturbances. Symptoms may include irritation and nausea, vomiting and diarrhea.
- SKIN - Slightly to moderate irritating. May cause irritation and inflammation due to mechanical reaction to sharp, broken ends of fibers.

EXPOSURE TO USED CERAMIC FIBER PRODUCT

Product which has been in service at elevated temperatures (greater than 1800°F/982°C) may undergo partial conversion to cristobalite, a form of crystalline silica which can cause severe respiratory disease (Pneumoconiosis). The amount of cristobalite present will depend on the temperature and length of time in service. (See Section IX for permissible exposure levels).

SPECIAL TOXIC EFFECTS

The existing toxicology and epidemiology data bases for RCF's are still preliminary. Information will be updated as studies are completed and reviewed. The following is a review of the results to date:

EPIDEMIOLOGY

At this time there are no known published reports demonstrating negative health outcomes of workers exposed to refractory ceramic fiber (RCF). Epidemiologic investigations of RCF production workers are ongoing.

- 1) There is no evidence of any fibrotic lung disease (interstitial fibrosis) whatsoever on x-ray.
- 2) There is no evidence of any lung disease among those employees exposed to RCF that had never smoked.

- 3) A statistical "trend" was observed in the exposed population between the duration of exposure to RCF and a decrease in some measures of pulmonary function. These observations are clinically insignificant. In other words, if these observations were made on an individual employee, the results would be interpreted as being within the normal range.
- 4) Pleural plaques (thickening along the chest wall) have been observed in a small number of employees who had a long duration of employment. There are several occupational and non-occupational causes for pleural plaque. It should be noted that plaques are not "pre-cancer" nor are they associated with any measurable effect on lung function.

TOXICOLOGY

A number of studies on the health effects of inhalation exposure of rats and hamsters are available. Rats were exposed to RCF in a series of life-time nose-only inhalation studies. The animals were exposed to 30, 16, 9, and 3 mg/m³, which corresponds with approximately 200, 150, 75, and 25 fibers/cc.

Animals exposed to 30 and 16 mg/m³ were observed to have developed a pleural and parenchymal fibroses; animals exposed to 9 mg/m³ had developed a mild parenchymal fibrosis; animals exposed to the lowest dose were found to have the response typically observed any time a material is inhaled into the deep lung. While a statistically significant increase in lung tumors was observed following exposure to the highest dose, there was no excess lung cancers at the other doses. Two rats exposed to 30 mg/m³ and one rat exposed to 9 mg/m³ developed mesotheliomas.

The International Agency for Research on Cancer (IARC) reviewed the carcinogenicity data on man-made vitreous fibers (including ceramic fiber, glasswool, rockwool, and slagwool) in 1987. IARC classified ceramic fiber, fibrous glasswool and mineral wool (rockwool and slagwool) as possible human carcinogens (Group 2B).

EMERGENCY FIRST AID PROCEDURES

- **EYE CONTACT** - Flush eyes immediately with large amounts of water for approximately 15 minutes. Eye lids should be held away from the eyeball to insure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.
- **INHALATION** - Remove person from source of exposure and move to fresh air. Some people may be sensitive to fiber induced irritation of the respiratory tract. If symptoms such as shortness of breath, coughing, wheezing or chest pain develop, seek medical attention. If person experiences continued breathing difficulties, administer oxygen until medical assistance can be rendered.
- **INGESTION** - Do not induce vomiting. Get medical attention if irritation persists.
- **SKIN CONTACT** - Do not rub or scratch exposed skin. Wash area of contact thoroughly with soap and water. Using a skin cream or lotion after washing may be helpful. Get medical attention if irritation persists.

SECTION VI. REACTIVITY DATA**STABILITY/CONDITIONS TO AVOID**

Stable under normal conditions of use.

HAZARDOUS POLYMERIZATION/CONDITIONS TO AVOID

N.A.

INCOMPATIBILITY/MATERIALS TO AVOID

Incompatible with hydrofluoric acid and concentrated alkali.

HAZARDOUS DECOMPOSITION PRODUCTS

N.A.

SECTION VII. SPILL OR LEAK PROCEDURES**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED**

Where possible, use vacuum suction with HEPA filters to clean up spilled material. Use dust suppressant where sweeping if necessary. Avoid clean up procedure which may result in water pollution. (Observe Special Protection Information Section VIII.)

WASTE DISPOSAL METHODS

The transportation, treatment, and disposal of this waste material must be conducted in compliance with all applicable Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION**RESPIRATORY PROTECTION**

Use NIOSH or MSHA approved equipment when airborne exposure limits may be exceeded. NIOSH/MSHA approved breathing equipment may be required for non-routine and emergency use. (See Section IX for suitable equipment).

Pending the results of long term health effects studies, engineering control of airborne fibers to the lowest levels attainable is advised.

VENTILATION

Ventilation should be used whenever possible to control or reduce airborne concentrations of fiber and dust. Carbon monoxide, carbon dioxide, oxides of nitrogen, reactive hydrocarbons and a small amount of formaldehyde may accompany binder burn-off during first heat. Use adequate ventilation or other precautions to eliminate vapors resulting from binder burn-off. Exposure to burn-off fumes may cause respiratory tract irritation, bronchial hyper-reactivity and asthmatic response.

SKIN PROTECTION

Wear gloves, hats and full body clothing to prevent skin contact. Use separate lockers for work clothes to prevent fiber transfer to street clothes. Wash work clothes separately from other clothing and rinse washing machine thoroughly after use.

EYE PROTECTION

Wear safety glasses or chemical worker's goggles to prevent eye contact. Do not wear contact lenses when working with this substance. Have eye baths readily available where eye contact can occur.

SECTION IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

General cleanliness should be followed.

The Toxicology data indicate that ceramic fiber should be handled with caution. The handling practices described in this MSDS must be strictly followed. In particular, when handling refractory ceramic fiber in any application, special caution should be taken to avoid unnecessary cutting and tearing of the material to minimize generation of airborne dust.

It is recommended that full body clothing be worn to reduce the potential for skin irritation. Washable or disposable clothing may be used. Do not take unwashed work clothing home. Work clothes should be washed separately from other clothing. Rinse washing machine thoroughly after use. If clothing is to be laundered by someone else, inform launderer of proper procedure. Work clothes and street clothes should be kept separate to prevent contamination.

Product which has been in service at elevated temperatures (greater than 1800°F/982°C) may undergo partial conversion to cristobalite, a form of crystalline silica. This reaction occurs at the furnace lining hot face. As a consequence, this material becomes more friable; special caution must be taken to minimize generation of airborne dust. The amount of cristobalite present will depend on the temperature and length in service.

IARC has recently reviewed the animal, human, and other relevant experimental data on silica in order to critically evaluate and classify the cancer causing potential. Based on its review, IARC classified crystalline silica as a group 2A carcinogen (probable human carcinogen).

The OSHA permissible exposure limit (PEL for cristobalite is 0.05 mg/m³ (respirable dust). The ACGIH threshold limit value (TLV) for cristobalite is 0.05 mg/m³ (respirable dust) (ACGIH 1991-92). Use NIOSH or MSHA approved equipment when airborne exposure limits may be exceeded. The minimum respiratory protection recommended for given airborne fiber or cristobalite concentrations are:

CONCENTRATION

Concentration	Personal Protective Equipment
0-1 fiber/cc or 0-0.05 mg/m ³ cristobalite (the OSHA PEL)	Optional disposable dust respirator (e.g. 3M 9970 or equivalent).
Up to 5 fibers/cc or up to 10 times the OSHA PEL for cristobalite	Half face, air-purifying respirator equipped with high efficiency particulate air (HEPA) filter cartridges (e.g. 3M 6000 series with 2040 filter or equivalent).
Up to 25 fibers/cc or 50 times the OSHA PEL for cristobalite (2.5 mg/m ³)	Full face, air-purifying respirator with high efficiency particulate air (HEPA) filter cartridges (e.g. 3M 7800S with 7255 filters or equivalent) or powered air-purifying respirator (PARR) equipped with HEPA filter cartridges (e.g. 3M W3265S with W3267 filters or equivalent).
Greater than 25 fibers/cc or 50 times the OSHA PEL for cristobalite (2.5 mg/m ³)	Full face, positive pressure supplied air respirator (e.g. 3M 7800S with W9435 hose & W3196 low pressure regulator kit connected to clean air supply or equivalent).

If airborne fiber or cristobalite concentrations are not known, as minimum protection, use NIOSH/MSHA approved half face, air-purifying respirator with HEPA filter cartridges.

Insulation surface should be lightly sprayed with water before removal to suppress airborne dust. As water evaporates during removal, additional water should be sprayed on surfaces as needed. Only enough water should be sprayed to suppress dust so that water does not run onto the floor of the work area. To aid the wetting process, a surfactant can be used.

After RCF removal is completed, dust-suppressing cleaning methods, such as wet sweeping or vacuuming, should be used to clean the work area. If dry vacuuming is used, the vacuum must be equipped with HEPA filter. Air blowing or dry sweeping should not be used. Dust-suppressing components can be used to clean up light dust.

Product packaging may contain product residue. Do not reuse except to reship or return Ceramic Fiber products to the factory.

**HIGH PRESSURE GAS
CYLINDERS**

**GENERAL PRECAUTIONS FOR HANDLING AND STORING
HIGH PRESSURE GAS CYLINDERS**

**Edited from selected paragraphs of the
Compressed Gas Association's
"Handbook of Compressed Gases"
published in 1981**

**Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, Virginia 22202
Used by Permission**

1. Never drop cylinders or permit them to strike each other violently.
2. Cylinders may be stored in the open, but in such cases, should be protected against extremes of weather and, to prevent rusting, from the dampness of the ground. Cylinders should be stored in the shade when located in areas where extreme temperatures are prevalent.
3. The valve protection cap should be left on each cylinder until it has been secured against a wall or bench, or placed in a cylinder stand, and is ready to be used.
4. Avoid dragging, rolling, or sliding cylinders, even for a short distance; they should be moved by using a suitable hand-truck.
5. Never tamper with safety devices in valves or cylinders.
6. Do not store full and empty cylinders together. Serious suckback can occur when an empty cylinder is attached to a pressurized system.
7. No part of cylinder should be subjected to a temperature higher than 52°C (125°F). A flame should never be permitted to come in contact with any part of a compressed gas cylinder.
8. Do not place cylinders where they may become part of an electric circuit. When electric arc welding, precautions must be taken to prevent striking an arc against the cylinder.

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WARRANTY

Rosemount Analytical warrants that the equipment manufactured and sold by it will, upon shipment, be free of defects in workmanship or material. Should any failure to conform to this warranty become apparent during a period of one year after the date of shipment, Rosemount Analytical shall, upon prompt written notice from the purchaser, correct such nonconformity by repair or replacement, F.O.B. factory of the defective part or parts. Correction in the manner provided above shall constitute a fulfillment of all liabilities of Rosemount Analytical with respect to the quality of the equipment.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL, OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OF FITNESS FOR PURPOSE).

The remedy(ies) provided above shall be purchaser's sole remedy(ies) for any failure of Rosemount Analytical to comply with the warranty provisions, whether claims by the purchaser are based in contract or in tort (including negligence).

Rosemount Analytical does not warrant equipment against normal deterioration due to environment. Factors such as corrosive gases and solid particulates can be detrimental and can create the need for repair or replacement as part of normal wear and tear during the warranty period.

Equipment supplied by Rosemount Analytical Analytical Inc. but not manufactured by it will be subject to the same warranty as is extended to Rosemount Analytical by the original manufacturer.

At the time of installation it is important that the required services are supplied to the system and that the electronic controller is set up at least to the point where it is controlling the sensor heater. This will ensure, that should there be a delay between installation and full commissioning that the sensor being supplied with ac power and reference air will not be subjected to component deterioration.

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