

# AP2 Carbon Probe

## User Guide

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## Understanding Safety Messages

The following **Note**, **Warning** and **Caution** messages and symbols may display throughout this guidance to draw your attention to important safety and operational information:

- The electrical hazard symbol  precedes an electric shock hazard contained within a **Danger** or **Warning** safety alert.

### **DANGER**

#### **RISK DETAILED HERE**

**Danger** indicates a hazardous situation which, if not avoided, will result in death or serious injury.

**Failure to follow these instructions will result in death or serious injury**

### **WARNING**

#### **RISK DETAILED HERE**

**Warning** indicates a hazardous situation which, if not avoided, could result in death or serious injury.

**Failure to follow these instructions can result in death, serious injury, or equipment damage**

### **CAUTION**

#### **RISK DETAILED HERE**

**Caution** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**Failure to follow these instructions can result in injury or equipment damage**


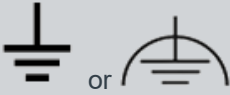








# NOTICE








## RISK DETAILED HERE

**Notice** is used to address practices not related to physical injury. The safety alert symbol shall not be used with this signal word.

**Failure to follow this instruction can result in data loss**

The following symbols may appear throughout this guidance or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure:

Symbol	Description
	Protective earth
	Functional earth
	Unit is protected by double/reinforced insulation for shock hazard prevention.
	This device requires an ac supply only.
	This device requires a dc supply only.
	This device requires an ac or dc supply.
	Electrostatic discharge (ESD) sensitive device; use proper grounding and handling techniques when installing or servicing device.
	Do not touch - Hot surface
	Dispose of using proper recycling techniques or contact manufacturer for proper disposal.
	Contains lithium-ion batteries which should be recycled using proper recycling techniques.

Symbol	Description
	Contains Nickel-cadmium batteries which should be recycled using proper recycling techniques.
	Contains polyethylene terephthalate (PET). Please ensure you recycle using proper recycling techniques.
	Contains high density polyethylene (PE-HD). Please recycle using proper recycling techniques.
	For environmental reasons, this device must be recycled before its age exceeds the number of years shown in the circle.
	Underwriters laboratories listed mark, for Canada and the U.S.
	Unit is compliant with European Union directives. See Declaration of Conformity for further directives and Standards used for compliance.
	Regulatory Compliance Mark (RCM) to Australian Communication and Media Authority.

# Safety Notes, Warnings and Precautions for the AP2 Carbon Probe

Read these instructions carefully, and look at the device to become familiar with it before trying to install, operate, service, or maintain it.

## **DANGER**

### **HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH**

- Electrical equipment must only be installed, operated and maintained by suitably qualified personnel.
- Power down all equipment before starting the installation, removal, wiring, maintenance or inspection of the device.
- The device must be wired and fused in compliance with local and national regulatory requirements for the rated current and voltage of the particular device, for example in the UK, the latest IEE wiring regulations (BS7671) and in the USA, NEC Class 1 wiring methods.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See applicable national standards, for example, NFPA70E, CSA Z462, BS 7671, NFC 18-510.
- Do not exceed the device ratings.
- Do not install or use if any part of the device is damaged. Contact your supplier.
- Do not disassemble, repair or modify equipment outside of the instructions within this guidance. Contact your supplier for repair.
- Ensure all cables and wiring harness are secured using an appropriate strain relief mechanism.

**Failure to follow these instructions will result in death or serious injury**

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**Note** - Qualified personnel are those with the skills and knowledge related to the construction and operation of electrical equipment and its installation and have received safety training to recognize and avoid the hazards involved.

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## Reasonable Use and Responsibility

The safety of any system incorporating this device is the responsibility of the assembler/installer of the system.

The information contained in this manual is subject to change without notice. While every effort has been made to improve the accuracy of the information, your supplier shall not be held liable for errors contained herein.

This probe is intended for industrial applications.

Use in other applications, or failure to observe the installation instructions of this manual may compromise safety or EMC. The installer must ensure the safety and EMC of any particular installation.

Failure to use approved software/hardware with our hardware products may result in injury, harm, or improper operating results.

## Intended Use

The device described or affected by this document, together with software and options, is the AP2 Carbon Probe (referred to herein as “carbon probe”, or “probe”), intended for industrial use according to the instructions, directions, examples, and safety information contained in the present document and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements, and the technical data.

Prior to using the product, a risk assessment must be performed in respect of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the product is used as a component within a machine or process, you must ensure the safety of this overall system.

Operate the product only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted is prohibited and can result in unanticipated hazards.

## **WARNING**

### **UNINTENDED EQUIPMENT OPERATION**

During commissioning, ensure all operating states and potential fault conditions are carefully tested.

**Failure to follow these instructions can result in death, serious injury or equipment damage**

## **CAUTION**


### **UNINTENDED EQUIPMENT BEHAVIOR**

- Introduce (or remove) the probe into (or out of) a hot furnace in stages of 25 mm (1 in) per minute.
- Do not place a hot probe on a cold surface.
- Check and adjust air cleaning at least once per day.
- Use the gland nut on the carbon probe sheath when screwing the probe in or out of the pipe fitting.
- Do not use the sensor head for tightening or loosening the probe.

**Failure to follow these instructions can result in injury or equipment damage**

## **Hazardous Substances**

Californian law requires the following notice:

 **Proposition 65** - These devices contain lead known to the State of California to cause cancer, birth defects or other reproductive harm.

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See <https://www.p65warnings.ca.gov/> for further details.

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## Expected Operating Life

At elevated temperatures, the operating life of the carbon probe is reduced to the following:

- Up to 1000 °C (1832 °F) 12 months
- 1000 °C to 1050 °C (1832 °F to 1922 °F) 6 months
- Over 1050 °C (1922 °F) Severely restricted

## Introduction

The AP2 Carbon Probe (referred to in this guidance as the 'probe') is a consumable item, like a thermocouple, which is mounted with its tip in contact with the furnace atmosphere, ideally close to the working zone.

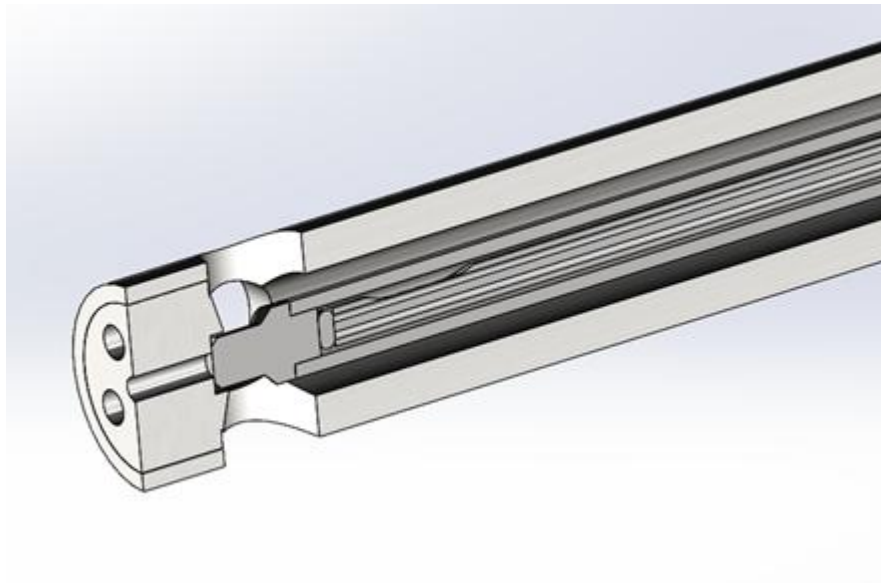
The probe produces an output voltage which, in conjunction with the process temperature and atmosphere, can be interpreted in terms of the atmosphere carbon potential of the furnace.

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See [% Carbon vs. mV Reference Tables](#) on page **19** for details.

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The probe is designed to be used with controllers with a high impedance input:



Carbon Probe Cross Sectional View

## Unpacking

The probe must be unpacked and handled with care. Each probe is despatched in robust packaging.

This packaging should be carefully retained. If it is required to return the probe to the supplier, this packaging is to be used. Returning a probe in anything other than this packaging may invalidate the product warranty.

The packaging consists of an outer box and inner protective foam.

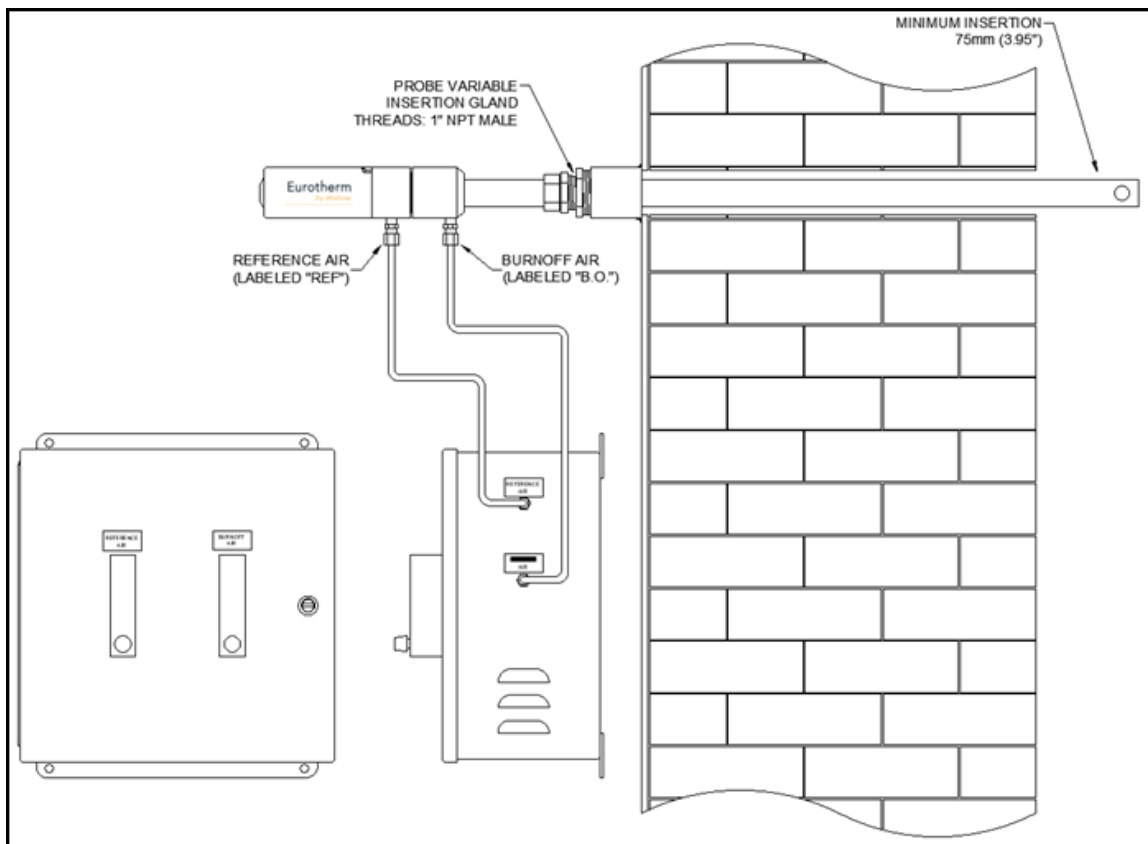
Included with each probe are an Operating Manual, Test Results Certificate and a bag of fittings.

# Installation

**Note** - Before installing this device, read and understand the **Safety Notes, Warnings and Precautions for the AP2 Carbon Probe** on page 6.

Never connect conduit directly to the probe head because a fractured probe tube could pass furnace gases through the conduit to critical instrumentation, equipment or personnel.

The following figure shows typical probe installation:



Probe Installation (Shown with Reference Air / Burnoff Box Part Number 13739 or 1373922)

## Mechanical

Generally, locate the probe in an area where the furnace gases are known to be thoroughly mixed. Locate in a wall area reasonably free from other pipes and valves to simplify installation and replacement.

To mount the probe, proceed as follows:

1. Probes can be mounted vertically or horizontally, vertical mounting is the preferred method. Ensure that, when mounting a probe longer than 1000 mm (39 in) horizontally, that it is sufficiently supported.
2. Avoid subjecting the probe to excessive vibration.
3. Locate the probe away from localized heat sources to avoid unnecessary close contact (i.e. radiant tubes, heating elements).
4. Locate the probe away from atmosphere inlets.
5. Locate the probe so that it operates in the upper area of the work zone if possible.
6. The probe access hole through the furnace lining must be 35 mm (1.38 in) diameter minimum.
7. Ensure center lines of the access hole and pipe couplings are concentric for correct alignment.
8. Ensure that the fixing to the furnace casing is gas-tight.

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**Note** - The probe is supplied as standard with a 'burn-off' port. If the port is not to be used ensure that it is plugged with the included fitting, and the plug is fully tightened using thread sealant to obtain a gas-tight seal.

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9. Install the probe so that the minimum insertion depth into the hot zone is 75 mm (2.95 in).

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**Note** - If the insertion length needs to be reduced, use a suitable reduction collar or gland to decrease effective length.

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10. Connect reference air tubing to the reference air inlet fitting located on the probe head external surface and ensure that the probe is fed with a constant supply of reference air at 200 ml per minute (0.42 SCFH) minimum.

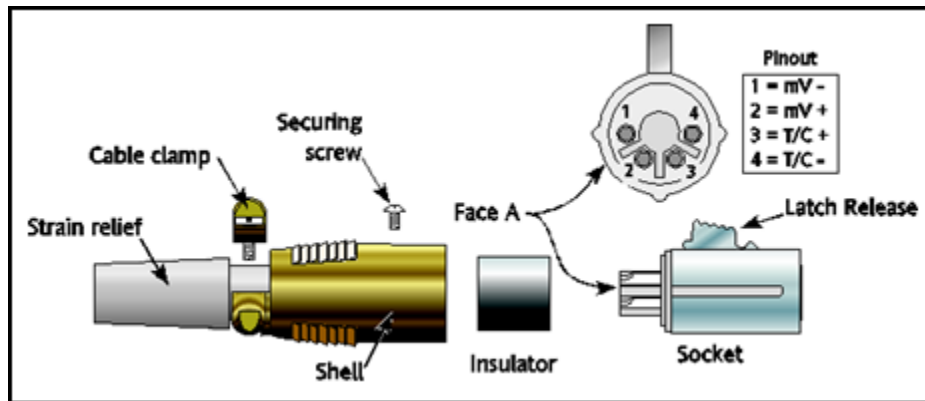
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**Tip** - It is recommended that the probe is provided with an intermittent supply of cleaning air.

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## Electrical Connections

Use 16/0.2 mm (19/32 AWG) twisted twin cable between the probe and the controller, up to a maximum length of 30 m (98.4 ft). If a thermocouple is included in the probe assembly, use the appropriate compensating cable. High temperature-rated (e.g. silicone rubber insulated) cable is essential for connections to the probe and over any part of the cable run which is subject to high temperatures. For the remainder of the run, shielded cable should be used. Shields should be connected to ground at the instrument end only:



DIN Plug Wiring

## Measuring Systems

The probe is designed to be used with a Eurotherm controller capable of carbon potential control. However, the probe may be used with any high impedance measuring system. At operating temperatures, the sensor impedance is typically 5 kΩ to 50 kΩ. Measuring systems with input impedances of 10 MΩ or higher are recommended. If an instrument with a low impedance 'front end' is used the effect will be to depress/lower the probe millivolt signal, resulting in inaccurate readings.

## Probe Care and Maintenance

The integrity of any atmosphere control system depends on the sensor/measurement device.

### **WARNING**

#### **RISK OF BURN**

Always use suitable Personal Protective Equipment (PPE)

**Failure to follow these instructions can result in death, serious injury or equipment damage**

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**Note** - Take care when removing a probe from a hot furnace as the probe may be extremely hot.

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### Reference Air

A constant flow of Reference Air (200 to 700 ml/min) (0.42 to 1.48 SCFH) is used to maintain the accuracy of the probe. Reference air should be clean and free from airborne contamination. Compressed air should not be used. If combustion air is used this should be filtered.

### **NOTICE**

#### **MEASUREMENT INACCURACIES**

Check and adjust, at least once per day

**Failure to follow this instruction can result in incorrect readings**

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**Note** - Inadequate or incorrect probe air cleaning can lead to incorrect readings.

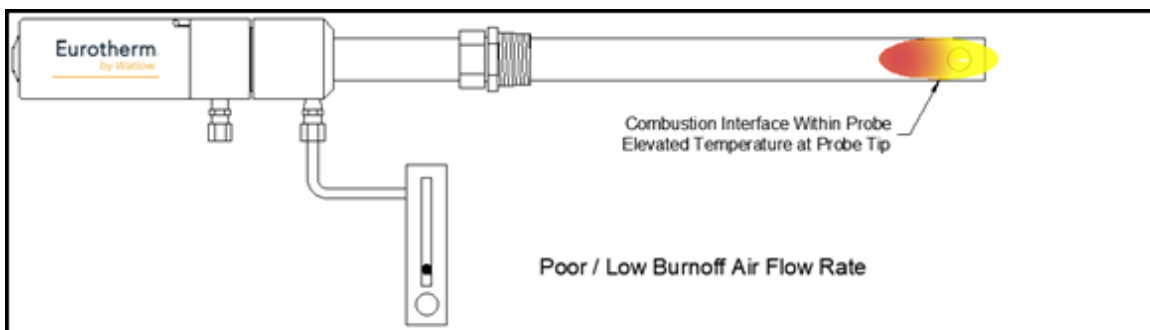
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## Probe Cleaning

Over 80% of probe issues are due to excessive carbon build up on the probe, this is more commonly described as 'sooting'. This can be reduced by regular probe cleaning, or 'burn off', using air. The important factors affecting efficient probe burn off are:

- Furnace atmosphere pressure/velocity around the probe.
- The flow of burn off air.
- Temperature increase at the probe tip.

When air is forced down the probe sheath a combustion reaction takes place with the furnace atmosphere, this is an exothermic reaction causing a local rise in temperature. The reaction interface settles at a point down the length of the probe:

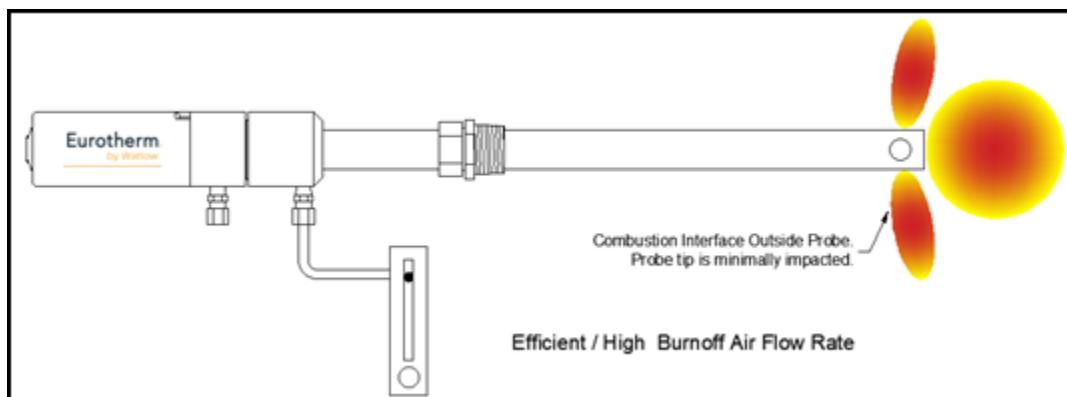


Inadequate Burn Off

As the flow of burn off air is increased the interface will naturally move down the probe. Carbon will only be removed from the probe if free oxygen is present to react with it and hence burn the carbon away. At the combustion interface oxygen will be used up quickly and there will be very little free oxygen available to react with the carbon.

The interface must therefore pass the tip of the probe in order to ensure effective cleaning at the probe tip.

If sufficient flow is present, then this combustion interface will actually move off the end of the probe entirely, leaving the probe tip in free oxygen:



Efficient Burn Off

The conditions are correct when there is a significant drop in the output of the probe.

Care should be taken to avoid the combustion interface centering on the probe tip, if this is the case the probe temperature may rise by as much as 120 °C (248 °F). It is important to note that the probe tip must be kept below 1050 °C (1922 °F) to avoid permanently damaging the sensor. Therefore, it is important that the burn off flow is sufficient when probe cleaning takes place above 900 °C (1652 °F).

The condition of the furnace atmosphere near the probe is of great importance when establishing the correct flow rate. For example, in one installation a flow of 4000 ml/min (8.48 SCFH) was required to overcome the atmosphere but only 1000 ml/min (2.12 SCFH) was required when the furnace fan was switched off.

Probe cleaning normally takes between 3 and 6 minutes. It is best carried out at the start of a cycle to ensure correct operation during the process and may be repeated during long cycles (or periodically in a continuous furnace) to maintain the level of atmosphere control.

Most carbon controllers have inbuilt facilities to activate the probe cleaning air automatically during the cycle. Alternatively, a timer can be built into the probe air supply enclosure.

## Diagnostic Test

The only way to establish that a probe is reading accurately is to compare the reading with a reference probe, carbon foil, or another gas parameter, for example, CO<sub>2</sub> or DEWPOINT.

The following tests can be performed to give an indication of the probe health:

### Electrical Impedance Test

The output impedance of a probe is a function of the electrode contact area, materials of construction, and temperature. The lower the impedance, the more surface area is in contact with the electrode assembly. A value below 25 kΩ at temperature above 800 °C (1472 °F) is acceptable, once the value rises above 50 kΩ it is necessary to change the probe.

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**Tip** - Check and record the probe impedance on a weekly basis.

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### Electrode Response Time

The ability of a probe to recover to its original millivolt reading, after being short circuited, is an important parameter.

To run a test, it is necessary to short circuit the probe electrodes for 15 seconds, remove the short, and measure the time for the millivolt reading to recover to 99% of its original value. If this time is more than 60 seconds, the probe is behaving sluggishly and its health or performance may be compromised.

# Troubleshooting

## Instrument and Voltmeter tests

Check/perform the following:

- Probe thermocouple display on measurement instrument is within  $\pm 10$  °C (18 °F) of furnace control thermocouple.
- Process Factor, 'CO Factor', or, oxygen probe mV offset is set to the appropriate value.
- Oxygen mV reading on the instrument matches a simultaneous reading from digital voltmeter within  $\pm 6$  mV.

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**Note** - Digital voltmeter to be 0.5% basic DC accuracy with 10 M $\Omega$  minimum input impedance, or higher in both cases.

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- After the probe is shorted for 15 seconds, it returns to its original reading,  $\pm 10$  mV, within 60 seconds (as measured with the voltmeter).

## Reference Air Tests

Perform the following:

- Reference air consists of clean room air, free of airborne contaminants (not compressed air). Try alternative sources of reference air if in doubt.
- Reference air flow is between 200 and 700 ml/min (0.42 to 1.48 SCFH) on the flowmeter. The reference air tube can be disconnected at the probe and should bubble when placed in a cup of water, for example reference air is getting to the probe.
- With instrument in manual control mode, shutting off the reference air for 30 seconds should not result in the loss of more than 5 mV on the O<sub>2</sub> mV display.

## Impedance Test

With the probe at 800 °C (1472 °F) minimum, the probe impedance test yields values in the range of 0.1 $\Omega$  to 50 k $\Omega$ . Typical readings for the carbon probe will be 5  $\Omega$  to 10 k $\Omega$ .

## Visual Observation

### **WARNING**

#### **RISK OF BURN**

Always use suitable Personal Protective Equipment (PPE)

**Failure to follow these instructions can result in death, serious injury or equipment damage**

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**Note** - Take care when removing a probe from a hot furnace as the probe may be extremely hot.

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### **CAUTION**

#### **UNINTENDED EQUIPMENT BEHAVIOR**

- Introduce (or remove) the probe into (or out of) a hot furnace in stages of 25mm (1in) per minute.
- Do not place a hot probe on a cold surface.

**Failure to follow these instructions can result in injury or equipment damage**

Observe and verify the following:

- Probe/Sheath shows no accumulation of soot or other deposits, any accumulation may mean that the burn off procedure is ineffective.
- Probe sensor tip, as viewed through the sheath holes, shows no obvious fracture and the sensor appears physically intact.
- Probe sheath/head assembly shows no signs of mechanical damage.

## % Carbon vs. mV Reference Tables

The following tables give %CP vs. probe millivolts at different furnace temperatures for a natural gas (20% CO) and propane (23% CO) reacted endothermic carrier gas. These tables are based on theoretical calculations and are for equilibrium conditions only.

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**Note** - For most heat treatment operations, equilibrium conditions rarely exist.

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Relationship Between %CP and Probe mV at Various Temperatures for Endothermic Atmospheres Generated from Methane (20% CO):

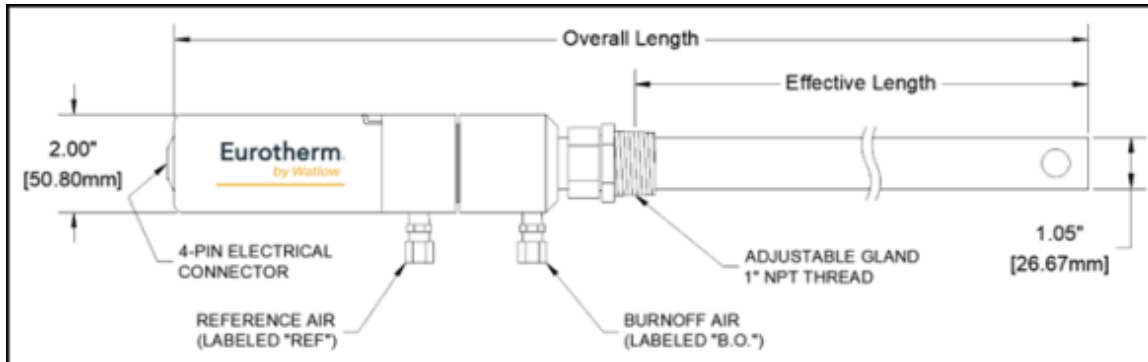
% CP	Temperature °F/°C								
	1472 °F	1517 °F	1562 °F	1607 °F	1652 °F	1697 °F	1742 °F	1787 °F	1832 °F
	800 °C	825 °C	850 °C	875 °C	900 °C	925 °C	950 °C	975 °C	1000 °C
0.20	1034	1039	1043	1048	1053	1058	1062	1067	1072
0.25	1043	1048	1053	1058	1063	1068	1073	1078	1083
0.30	1051	1056	1061	1066	1072	1077	1082	1087	1092
0.35	1058	1063	1069	1074	1079	1085	1090	1095	1101
0.40	1065	1070	1076	1081	1087	1092	1098	1103	1109
0.45	1071	1076	1082	1088	1093	1099	1105	1110	1116
0.50	1076	1082	1088	1094	1100	1105	1111	1117	1123
0.55	1082	1088	1094	1099	1105	1111	1117	1123	1129
0.60	1087	1193	1099	1105	1111	1117	1123	1129	1135
0.65	1091	1097	1103	1110	1116	1122	1128	1134	1140
0.70	1096	1102	1108	1114	1120	1127	1133	1139	1145
0.75	1100	1106	1112	1119	1125	1131	1138	1144	1150
0.80	1104	1110	1116	1123	1129	1136	1142	1148	1155
0.85	1107	1114	1120	1127	1133	1140	1146	1153	1159
0.90	1111	1117	1124	1131	1137	1144	1150	1157	1163
0.95	1114	1121	1128	1134	1141	1148	1154	1161	1167
1.00	1118	1124	1131	1138	1144	1151	1158	1165	1171
1.05	1121	1127	1134	1141	1148	1155	1161	1168	1175
1.10	1124	1131	1137	1144	1151	1158	1165	1172	1179
1.15	1127	1133	1140	1147	1154	1161	1168	1175	1182
1.20	1129	1136	1143	1150	1157	1164	1171	1178	1185

Relationship Between %CP and Probe mV at Various Temperatures for Endothermic Atmospheres Generated from Propane (23% CO):

Temperature °F/°C									
% CP	1472 °F	1517 °F	1562 °F	1607 °F	1652 °F	1697 °F	1742 °F	1787 °F	1832 °F
	800 °C	825 °C	850 °C	875 °C	900 °C	925 °C	950 °C	975 °C	1000 °C
0.20	1027	1031	1036	1041	1046	1051	1055	1060	1065
0.25	1036	1041	1046	1051	1056	1061	1066	1071	1075
0.30	1044	1049	1054	1059	1064	1070	1075	1080	1085
0.35	1051	1056	1062	1067	1072	1078	1083	1088	1094
0.40	1058	1063	1069	1074	1080	1085	1091	1096	1101
0.45	1064	1069	1075	1081	1086	1092	1097	1103	1109
0.50	1069	1075	1081	1087	1092	1098	1104	1110	1115
0.55	1075	1081	1086	1092	1098	1104	1110	1116	1122
0.60	1080	1086	1092	1098	1104	1110	1116	1122	1127
0.65	1084	1090	1096	1102	1109	1115	1121	1127	1133
0.70	1089	1095	1101	1107	1113	1120	1126	1132	1138
0.75	1093	1099	1105	1112	1118	1124	1130	1137	1143
0.80	1097	1103	1109	1116	1122	1128	1135	1141	1148
0.85	1100	1107	1113	1120	1126	1133	1139	1146	1152
0.90	1104	1110	1117	1123	1130	1137	1143	1150	1156
0.95	1107	1114	1120	1127	1134	1140	1147	1154	1160
1.00	1110	1117	1124	1131	1137	1144	1151	1157	1164
1.05	1114	1120	1127	1134	1141	1147	1154	1161	1168
1.10	1117	1123	1130	1137	1144	1151	1158	1165	1171
1.15	1119	1126	1133	1140	1147	1154	1161	1168	1175
1.20	1122	1129	1136	1143	1150	1157	1164	1171	1178

# Specification

## Dimensions



## Technical Specifications

Probe Length	Effective Length (±10mm)	Overall Length (±10mm)
	mm (inches)	mm (inches)
AP2x-xx121	502 (19.8)	754 (29.7)
AP2x-xx128	683 (26.9)	935 (36.8)
AP2x-xx132	815 (32.1)	1067 (42.0)
AP2x-xx136	913 (35.9)	1165 (45.9)
AP2x-xx144	1041 (41.0)	1293 (50.9)

Parameter	Value
Output	0.00 V to 1.40 Vdc over operating range
Temperature range	760 °C to 1050 °C (1400 °F to 1922 °F)
10-90% Response time	Less than 2s at temperatures > 760 °C (1400 °F)
Range of operation	Partial pressure of oxygen down to 10 <sup>-24</sup>
Thermocouple	Types K, R, S, N and No T/C
Probe sheath	Special alloy – resistant to corrosion and oxidization up to 1050 °C (1922 °F)
Diameter of sheath	26.67 mm (1.05 in) O.D. nominal
Aperture required	35 mm (1.38 in) minimum

Parameter	Value
Fitting detail	Screwed fitting 1 inch NPT Male Adjustable Gland
Minimum Furnace insertion	75 mm (2.95 in)
Reference Air Flow	200 ml/min (0.42 SCFH) to 700 ml/min (1.48 SCFH) air (20.9% O <sub>2</sub> )
DC Measuring System	%Oxygen sensors should be used with a controlling, recording, or indicating instrument having an input impedance of 10 MΩ or higher.

## Part Numbers

The following Part Numbers apply to the AP2 Carbon Probe:

Part Number	Description
AP20-00121	Carbon Probe, No Thermocouple, 21 Inch
AP20-00128	Carbon Probe, No Thermocouple, 28 Inch
AP20-00136	Carbon Probe, No Thermocouple, 36 Inch
AP21-00121	Carbon Probe, Type K Thermocouple, 21 Inch
AP21-00128	Carbon Probe, Type K Thermocouple, 28 Inch
AP21-00132	Carbon Probe, Type K Thermocouple, 32 Inch
AP21-00136	Carbon Probe, Type K Thermocouple, 36 Inch
AP22-00121	Carbon Probe, Type R Thermocouple, 21 Inch
AP22-00132	Carbon Probe, Type R Thermocouple, 32 Inch
AP23-00121	Carbon Probe, Type S Thermocouple, 21 Inch
AP23-00128	Carbon Probe, Type S Thermocouple, 28 Inch
AP23-00132	Carbon Probe, Type S Thermocouple, 32 Inch

Part Number	Description
AP23-00136	Carbon Probe, Type S Thermocouple, 36 Inch
AP23-00144	Carbon Probe, Type S Thermocouple, 44 Inch
AP25-00128	Carbon Probe, Type N Thermocouple, 28 Inch

Other related parts:

Part Number	Description
LA031108	LENGTH REDUCTION COLLAR CARBON PROBE
E24-540	SOCKET CONNECTOR
A10727-200-06	K TYPE 4 COND W/ARMOR 6' PROBE CABLE
A10727-200-12	K TYPE 4 COND W/ARMOUR 12' PROBE CABLE
A10727-200-18	K TYPE 4 COND W/ARMOUR 18' PROBE CABLE
A10727-300-06	R & S TYPE 4 COND W/ARMOR 6' PROBE CABLE
A10727-300-12	R & S TYPE 4 COND W/ARMOUR 12' PROBE CAB
A10727-300-18	R & S TYPE 4 COND W/ARMOUR 18' PROBE CAB
A10727-500-06	N TYPE 4 COND W/ARMOR 6' PROBE CABLE
A10727-500-12	N TYPE 4 COND W/ARMOUR 12' PROBE CABLE
A10727-500-18	N TYPE 4 COND W/ARMOUR 18' PROBE CABLE
A12337-200-06	K TYPE 4 CONDUCTOR 6' PROBE CABLE
A12337-200-12	K TYPE 4 CONDUCTOR 12' PROBE CABLE

Part Number	Description
A12337-200-18	K TYPE 4 CONDUCTOR 18' PROBE CABLE
A12337-300-06	R & S TYPE 4 CONDUCTOR 6 PROBE CABLE
A12337-300-12	R & S TYPE 4 CONDUCTOR 12' PROBE CABLE
A12337-300-18	R & S TYPE 4 CONDUCTOR 18' PROBE CABLE
A12337-500-06	N TYPE 4 CONDUCTOR 6' PROBE CABLE
A12337-500-12	N TYPE 4 CONDUCTOR 12' PROBE CABLE
A12337-500-18	N TYPE 4 CONDUCTOR 18' PROBE CABLE

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**Note** - As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this publication.

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