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TABLE OF CONTENTS

Millivolt: One Thousands of a volt.

Ohms: Unit of Resistance.

Peak: the demonstrated absolute positive value relative to sampled temperature range. The point at which the needle on a meter begins to fall while leaning mixture.

PMA: Part Manufacturing Approval

POH: Pilot Operating Handbook

Polarity: Correct connections in regards to positive + and negative –.

Potentiometer: A variable electrical resistor used to regulate current.

Probe: A thermocouple composed of two wires of dissimilar metals joined together at one end. When this junction is heated, a millivolt signal is generated. The word probe is used interchangeably throughout this manual. It can also be a thermistor/RTD device that does not output electricity but changes the grounding potential or current/voltage to an amplified meter with temperature.

Relative Scale: Does not depict true temperature but merely the relative mark on the dial that peak temperature was detected when leaning before needle began to fall.

Resistance: The opposition to the flow of current that converts electrical energy into heat. Unit of measurement is the Ohm.

RTD, Resistance Type Device: Any sensing device that varies resistance /current/voltage with temperature.

Set Point: The temperature selected with the heater control knob of the **ALCAL® 2000** and verified by the LCD display.

TBO: Time Before Overhaul

T/C: Thermocouple

Thermistor: See Resistance Type Device

Thermocouple: See Probe

TIT: Turbine Inlet Temperature

TOT: Turbine Outlet Temperature

Turbine Inlet Temperature: Temperature measured at the exhaust intake of a turbocharger. The purpose being to provide an operational limit value which is not to be exceeded (in most cases 1650°F).

Type-E: Thermocouple/Lead comprised of Chromel/Constantan wire. The color-coding and polarity is +Brown/-Red. Industry Standard is +Purple/-Red.

Type-J: Thermocouple/Lead comprised of Iron/Constantan. The color coding and polarity is +Black/-Yellow. Industry Standard is +White/-Red.

Type-K: Thermocouple/lead comprised of Chromel and Alumel wire. The color-coding and polarity is +Yellow/-Red.

UCS: Universal Cylinder Selector switch.

Un-Amplified: Relies totally on electricity produced by thermocouple to operate. No aircraft bus voltage is required.

Ungrounded: Unconnected to or shielded from ground source.

- I. INTRODUCTION2**
 - General Description2
 - Basic Thermocouple/Meter Theory2
 - Component Items and Function7
 - ALCOR®** Meter and Probe Accessories12
 - Technical Specifications13
- II. TESTING AND CALIBRATING METERS14**
 - Method 1: Simulating Thermocouple Output14
 - Method 2: Using Thermocouple Output16
 - Bench Testing EGT/TIT/CHT Meters18
 - Miscellaneous, Non-**ALCOR®** Meters19
- III. TESTING THERMOCOUPLES20**
 - Method 1: Resistance Test, EGT/TIT/CHT20
 - Method 2: Simple Functional Tests Using Heat20
 - Method 3: Accuracy Test, EGT/TIT/CHT Thermocouples22
 - Method 4: Optional Method23
- IV. TROUBLESHOOTING25**
 - Meters and Thermocouples25
 - Frequently Asked Questions, FAQ's27
 - Engine Problems in Flight using EGT30
- V. GENERAL INFORMATION31**
 - Maintenance31
 - Safety Precautions32
 - Calibration & Repair of your **Alcal® 2000**32
 - ALCAL® 2000** Troubleshooting33
 - Warranty33
 - Contact **ALCOR®**33
- VI. TABLES34**
 - Competitor Info & Compatibility34
 - Temperature Vs Millivolt35
 - ALCOR Product Cross Reference36
 - Glossary47

FIGURES

- 1. 2 1/4" Single Front Adjust4
- 2. 2 1/4" Single Rear Adjust, screw .4
- 3. 2 1/4" Single Rear Adjust, plug....4
- 4. 3 1/8" Dual Front Adjustment.....4
- 5. 3 1/8" Dual Rear Adjust, screw....4
- 6. 2 1/4" Dual Front Adjust.....4
- 7. Multi Cyl Comb Analyzer4
- 8. Panel Components6
- 9. Compartment Cover8
- 10. Fuse.....9
- 11. Field Operating Instr.....11
- 12. CHT Heater.....12
- 13. EGT Heater.....13
- 14. EGT Ext Ref Thermocouple14
- 15. CHT Heater Thermocouple.....15
- 16. Test Cable.....16
- 17. Ext Lead17
- 18. Type K Transition Adapter18
- 19. CHT Bayonet Adapter.....19
- 20. CHT Gasket Adapter20
- 21. Calibration Screwdriver.....21
- 22. UCS Switch.....22
- 23. Reverse Stagger Jumper.....23
- 24. Exhaust Hole Adapter.....24
- 25. Fire Sleeve25

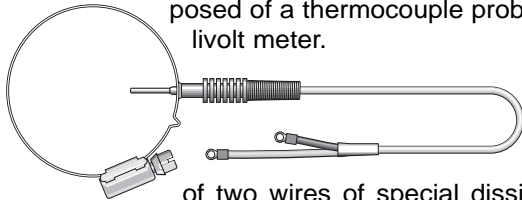
GENERAL DESCRIPTION

Thank you for purchasing the new **ALCAL® 2000** EGT/TIT/CHT Tester/Calibrator! The **ALCAL® 2000** has long been a favorite test method for aviation technicians and mechanics since 1970. This latest generation tester comes complete ready to test and calibrate all **ALCOR®** type K, J, & E meters and thermocouples, as well as other types of temperature sensing equipment.

The rugged integrated circuit will achieve exceptional accuracy through extreme temperature ranges. The large liquid crystal display is well suited for this application because of its low power requirements, large numerals, and readability in the widest range of lighting. An internal battery allows complete portability for meter calibration, free of problems associated with getting power to the aircraft. Your **ALCAL® 2000** comes complete with batteries and all necessary components to perform meter calibrations and probe testing.

BASIC THERMOCOUPLE /METER THEORY

A basic ALCOR EGT (Exhaust Gas Temperature), TIT (Turbine Inlet Temperature) or CHT (Cylinder Head Temperature) system is composed of a thermocouple probe, an extension lead, and a millivolt meter.



THERMOCOUPLE

A thermocouple is composed of two wires of special dissimilar metals joined together at one end. Different combinations of these dissimilar metals can be employed to make a thermocouple, and each combination generates a different voltage at a given temperature. (See Chapter VI. Tables, Temperature vs Millivolt).

Regardless of manufacturer, it is important that the meter used is the same type as the thermocouple and lead wire.

When this junction is heated, a millivolt (thousandths of a volt) is generated. This voltage is proportional to the temperature difference between the hot junction and the point where the voltage was measured (called the Cold/Reference Junction).

$$\text{Volts} = S \times (T_2 - T_1)$$

T₂ equals the temperature at the hot junction, T₁ equals the temperature at the cold junction, and S equals the proportional constant. The proportional constant is referred to as the Sebeck coefficient. For example the Sebeck coefficient is about 22.2 microvolts per degree F for type K ,

GLOSSARY

ALCAL® 2000: ALcor CALibrator

Alumel: A type of special thermocouple metal used on Type-K, Chromel/Alumel thermocouples. It is magnetic.

Amplified: The process of increasing the strength of a signal, current or power.

Analog: data represented by mechanical/physical means (i.e. a needle).

Calibration: Meter or thermocouple is compared to known values (Institute of Standards and Technology)

Chromel: A type of special thermocouple metal used on Type-K, Chromel/Alumel thermocouples. It is non magnetic.

CHT: Cylinder Head Temperature

Constantan: A type of special thermocouple metal used on Type-E, Chromel/Constantan thermocouples. It is non magnetic.

Cylinder Head Temperature: Temperature measured either inside the casting of the cylinder head by means of a hole under the lower spark plug (when provided) or measured by means of a round thermocouple sensor located under the spark plug.

Decade Box: A test apparatus used to simulate the lead/thermocouple resistance when bench checking a meter.

EGT: Exhaust Gas Temperature

Element: Heat sensing portion of EGT/TIT thermocouple made using a special ALCOLOY® process.

Exhaust Gas Temperature: Temperature of exhaust gas inside the exhaust pipe.

Grounded: Mechanically bonded to negative electrical source on aircraft.

Indicators: See Meter

Iron: A component of Type-J thermocouples and wire that are composed of Iron and Constantan. It is sensitive to oxidation, especially at very high temperatures and magnetic.

LED: Light Emitting Diode

LCD, Liquid Crystal Display: A common form of display device that relies on energizing crystals so that a letter or number can be displayed.

LCD: Liquid Crystal Display

Lead (lead): Provides pathway for electricity or resistance variations so that those variables can be read in the form of temperature on an indicator.

MCCA: Multi Cylinder Combustion Analyzer(EGT/ 46353 & 46354, CHT- / 46363, 46364,& 46365 / Piper)

MEL: Minimum Equipment List, all items listed must be in working order or aircraft may not be considered airworthy.

Meter: Any digital or analog display that depicts temperature, pressure, etc. The words meter, indicator, gauge are used interchangeably.

PROBE CROSS REFERENCE

OLD PART NUMBER	NEW ALCOR P/N	TYPE	WIRE COLOR	SIZE	STAGGER	RESISTANCE	APPROX. LENGTH
86142	86240	Screw-In	R/Y	7/16"-20	Normal	.80±.1 ohms	14.20"
86145	86255	Clamp	R/Y	3 1/4" MAX	Normal	.80±.1 ohms	13.81"
86147	86255	Clamp	R/Y	3 1/4" MAX	Normal	.80±.1 ohms	13.81"
86155	86156	Clamp	R/BR	3 1/4" MAX	Normal	.85±.15 ohms	11.56"
86157	86245	Screw-In	R/Y	7/16"-20	Reverse	.70±.10 ohms	12.2"
86165	86275	Clamp	R/Y	3 1/4" MAX	Reverse	.8±.1 ohms	13.8"
86167	86275	Clamp	R/Y	3 1/4" MAX	Reverse	.8±.1 ohms	13.8"
86225	86281	Clamp	R/Y	3 1/4" MAX	Normal	.85±.10 ohms	15.0"
86236	86275	Clamp	R/Y	3 1/4" MAX	Reverse	.8±.1 ohms	13.81"
86258	86255	Clamp	R/Y	3 1/4" MAX	Normal	.80±.1 ohms	13.81"
86271	86307	Screw-In Unground	R/Y	1/4" NPT	Normal	.71±.03 ohms	10.0"
86272	86308	Screw-In Unground	R/Y	7/16"-20	Normal	.71±.03 ohms	10.0"
86291	86309	Screw-In Unground	R/Y	7/16"-20	Normal		31.50"
86293	86310	Clamp Unground	R/Y	2.35" MAX	Normal		30.00"
001-005-3B	86240	Screw-In	R/Y	7/16"-20	Normal	.80±.1 ohms	14.20"
001-005-5B	86240	Screw-In	R/Y	7/16"-20	Normal	.80±.1 ohms	14.20"
001-005-A36	86255	Clamp	R/Y	3 1/4" MAX	Normal	.80±.1 ohms	13.81"
001-005-A44	86255	Clamp	R/Y	3 1/4" MAX	Normal	.80±.1 ohms	13.81"
001-005-N	86143	Screw-In	R/Y	1/4" NPT Female	Normal	.89±.10 ohms	14.75"
001-005-N2	86230	Screw-In	R/Y	1/4" NPT	Normal	.80±.1 ohms	14.20"
MCI-106-A36	86156	Clamp	R/BR	3 1/4" MAX	Normal	.85±.15 ohms	11.56"
MCI-106-A44	86156	Clamp	R/BR	3 1/4" MAX	Normal	.85±.15 ohms	11.56"
MCI-106-B	86149	Screw-In	R/BR	7/16"-20	Normal	.97±.15 ohms	12.20"
MCI-106-H	86153	Screw-In	R/BR	1/4" NPT	Normal	.97±.15 ohms	12.20"
MCI-A106-A36	86275	Clamp	R/Y	3 1/4" MAX	Reverse	.80±.1 ohms	13.8"
MCI-A106-A36P	86275	Clamp	R/Y	3 1/4" MAX	Reverse	.80±.1 ohms	13.8"
MCI-A106-A44	86275	Clamp	R/Y	3 1/4" MAX	Reverse	.80±.1 ohms	13.8"
MCI-A106-A44S	86226	Clamp	R/Y	3 1/4" MAX	Reverse	.70±.10 ohms	11.70"
MCI-A106-A44S	86226	Clamp	R/Y	3 1/4" MAX	Reverse	.70±.10 ohms	11.70"
MCI-A106-B	86245	Screw-In	R/Y	7/16"-20	Reverse	.70±.10 ohms	12.20"
MCI-A106-H	86159	Screw-In	R/Y	1/4" NPT	Reverse	.70±.10 ohms	12.20"
MCI-A106-J1	86160	Screw-In	R/Y	7/16"-20	Reverse	.70±.10 ohms	12.20"
MCI-A106-K	86161	Screw-In	R/Y	1/4" NPT	Reverse	.70±.1 ohms	9.50"
MCI-A106-N	86162	Screw-In	R/Y	1/8-27MPT	Reverse		12.75"
AN5540-2	86202	Spark Plg	Y/BL	18 MM		.13+15-.05 ohms	12.0"
AN5541-1	86251	Bayonet	Y/BL			.24±.05 ohms	15.0"
AN4076-1	28202	Adapter for Bayonet probe					
AN5546-1	86146 (RTD)	Bayonet	Copper				14.5" to 15.5"

Red and Yellow is Chromel Alumel Wires (R/Y)

Red and Brown is Chromel Constantan (R/BR)

Yellow and Black is Iron Constantan (Y/BL)

Reverse Stagger is Short Yellow Wire instead of Short Red Wire

Screw-In: Probe screws into adapter welded on exhaust mostly for measuring TIT.

Clamp: Uses Radiator Clamp to mount Probe on Exhaust



Chromel/Alumel thermocouples. From this equation it can be seen that the voltage varies if the cold junction temperature changes, even if the hot junction temperature does not change. Because of this, the cold junction temperature must be known if the hot junction temperature is to be determined. By knowing the Seabek coefficient for the thermocouple type used, the cold junction temperature, and the measured voltage, then the hot junction temperature can be calculated. Most all thermocouple probes require an extension lead wire to carry the thermocouple voltage to the EGT, TIT, or CHT voltmeters. **This extension wire is made of the same type of wire as the thermocouple wire in the probe.** This locates the cold junction at the back of the meter.

ALCOR[®] EGT/TIT, Type K and E thermocouples may be grounded or ungrounded, depending on the meter being used (**ALCOR**[®] meters can use both types). EGT and TIT probes come in two basic styles. Generally EGT probes are attached to the exhaust pipe using a clamp and TIT probes screw into the exhaust pipe just before the turbocharger.

ALCOR[®] CHT, Type J thermocouples are grounded. CHT bayonet style probes are mounted in a hole below the lower spark plug, using a special adapter which allows for easy installation and removal. If the hole is used for a pre-heater or does not exist, then a gasket type thermocouple must be used and installed below the spark plug, replacing the standard copper washer. It must be noted however that a gasket type can run 50°F to 100°F (usually about 60°F) hotter than the bayonet style because of the localized heat sink characteristics of a spark plug. Bayonet styles that are not spring loaded do not use special adapters to allow metal contact in thermal well bottom and are not as accurate as those that make contact.

Many manufacturers of EGT/CHT indicators, in particular digital instruments, use Type K for both CHT and EGT. (See Chapter VI. Tables)

Resistance Type Devices (RTDs), do not produce millivolts and therefore are not to be confused with thermocouples. They are primarily used in CHT applications and the most common are approximately 1 inch long and look somewhat like a miniature spark plug (Delco AC and Rochester P/Ns 1514340, 1513431, 333A, and 333B). They have a single wire, which provides ground potential to the indicator. Other types are quarter-turn bayonet styles with two wires (AN5546-1). Two wire types rely on resistance changing voltage to the meter. Single and dual wire types can easily be checked by comparing resistance from probe terminal to probe body or between terminal connectors at a given temperature. No information is currently available in Chapter VI, TABLES for resistance values of thermistors.

METERS

Meters/Indicators are either powered by the aircraft electrical system (amplified) or solely by the millivolts produced by the thermocouple (un-amplified) which use a meter movement. **ALCOR**[®] produces both types of

meters. All displays are in 25 degree increments with every fourth one representing 100 degrees for both Centigrade and Fahrenheit dials.

Un-amplified meters use meter movements powered solely by the millivolts generated from the thermocouple probe. Meter movements will draw some current, as much as 0.7mA. Because of this, differences in the resistance due to variations in length of the thermocouple extension lead will have an effect on the indicator calibration. (Ohms Law, $E=IR$, $E=Voltage$, $I=Current$, $R=Resistance$, shows that current flow through a resistance will cause a voltage drop, so variations in resistance will cause variations in voltage drop.) A potentiometer is provided to calibrate the indicator to the combined lead/probe resistance. It is this potentiometer that is adjusted when using the **ALCOR**® 2000 to calibrate an indicator to allow more or less current to reach the meter movement. Potentiometer access will either be from the front or rear of the meter depending upon manufacturer and age. **ALCOR**® meters that were manufactured since 1980 will have a carbon potentiometer accessible from the front through a small hole. All other **ALCOR**® meters will have a rear adjustable rheostat-type potentiometer accessible through either: 1) a hole covered with a plug which is removed and a #2 blade screwdriver is inserted, or 2) a Phillips head plastic screw. **Rear adjustable meters may not be repairable due to unavailability of parts.** **ALCOR**® provides a calibration screwdriver, (Item 33) which should remain in the cockpit after installation for future calibration needs.

When resistance is changed anywhere in an un-amplified system (i.e. lead is shortened or lengthened), the meter will have to be re-calibrated. Amplified,

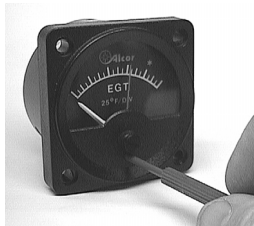


FIGURE 1

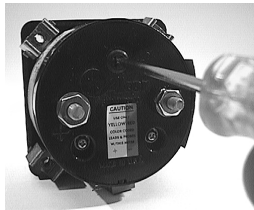


FIGURE 2

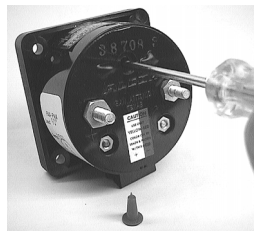


FIGURE 3



FIGURE 4

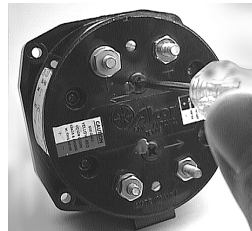


FIGURE 5

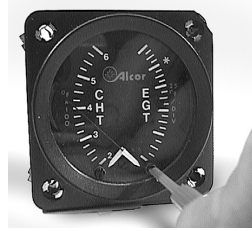


FIGURE 6

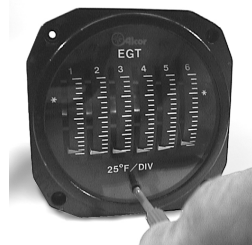


FIGURE 7

PART NO.	NEW ALCOR P/N	DESCRIPTION	NOTES
210-8ALC/12V	46150	2 1/4 SE EGT C/A 90"L12V	TR celsius dial, L12V, re-cal, 3.3 ohms @ 900°C Rd.Ln.
210-8ALC/24V	46150	2 1/4 SE EGT C/A 90"L24V	TR celsius dial, L24V, re-cal, 3.3 ohms @ 900°C Rd.Ln.
210-8B	46150	2 1/4 SE EGT C/A 90"	3.3 ohms 1550°F
210-8BL/12	46150	2 1/4 SE EGT C/A 90"L12V	L12V, 3.3 ohms 1550°F
210-8BL/24	46150	2 1/4 SE EGT C/A 90"L24V	L24V, 3.3 ohms 1550°F
210-8BLC/12V	46150	2 1/4 SE EGT C/A 90"L12V	TR celsius dial, L12V, re-cal, 3.3 ohms @ 900°C Rd.Ln.
210-8BLC/24V	46150	2 1/4 SE EGT C/A 90"L24V	TR celsius dial, L24V, re-cal, 3.3 ohms @ 900°C Rd.Ln.
210-9A	46150	2 1/4 SE EGT C/A 90"	3.3 ohms 1550°F
210-9AL/	46150	2 1/4 SE EGT C/A 90"L	L24V, 3.3 ohms 1550°F
210-9B	46150	2 1/4 SE EGT C/A 90"	3.3 ohms 1550°F
210-9BL/12V	46150	2 1/4 SE EGT C/A 90"L12V	L12V, 3.3 ohms 1600°F
210-10A	46500-12	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms 1600°F
210-10B	46500-12	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms 1600°F
210-10BL/12	46500-12	2 1/4 SE EGT C/A 90"L12V	TR dial, 3.3 ohms @ 1600°F
210-10BL/24	46500-12	2 1/4 SE EGT C/A 90"L24V	TR dial, 3.3 ohms @ 1600°F
210-10BTR	46500-12	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms @ 1600°F
210-13BTR	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1650°F
210-16A	46500-11	2 1/4 SE TIT C/A 90"	TR dial, 3.3 ohms @ 1650°F
210-16B	46500-11	2 1/4 SE TIT C/A 90"	TR dial, 3.3 ohms @ 1650°F
210-16BL/12	46500-5	2 1/4 SE EGT C/A 90"L12V	TR dial, L12V, 3.3 ohms @ 1650°F
210-16BL/24	46500-3	2 1/4 SE TIT C/A 90"L24V	TR dial, L24V, 3.3 ohms @ 1650°F
210-17BTR	46150	2 1/4 SE EGT C/A 90"	TR celsius dial 3.3 ohms @ 900°C
210-17BTR/12	46500-10	2 1/4 SE EGT C/A 90"L12V	TR dial, 3.3 ohms @ 900°C
210-17BTR/24	46500-9	2 1/4 SE EGT C/A 90"L24V	3.3 ohms @ 900°C
210-19B	No Direct Cross	2 1/4 SE EGT C/A	3.3 ohms @ 1650°F
214-2A	No Direct Cross	VERTICAL 90"	3.3 ohms @ 900°C
217-3A PB	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76"90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
217-3ATR	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76"90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
217-3B	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76"90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
217-3BL/12	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A L12V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1500°F
217-3BPB-4	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76"100"	CHT 2.0 ohms @ 500°F / EGT 3.7 ohms @ 1550°F
217-3BPB-6	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76"100"	CHT 2.0 ohms @ 500°F / EGT 3.7 ohms @ 1550°F
217-3BTR	No Direct Cross	3 1/8 CHT/EGT I/C C/A 76"90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
224-1B	No Direct Cross	2 1/4 TE EGT/EGT C/A 240"	7.6 ohms @ 1550°F
224-2B	No Direct Cross	2 1/4 TE EGT/EGT C/A 20"	7.6 ohms @ 1600°F
224-2BLTR/12	No Direct Cross	2 1/4 EGT L12V	4.8 ohms @ 1650°F
224-3B	No Direct Cross	2 1/4 TE EGT/EGT C/A 20"	7.6 ohms @ 1600°F
224-4B	No Direct Cross	2 1/4 TE EGT/EGT C/A 20"	7.6 ohms @ 900°C
224-5B	No Direct Cross	2 1/4 TE EGT/EGT C/A 25"	6.1 ohms @ 1650°F
224-6B	No Direct Cross	2 1/4 TE EGT/EGT C/A 240"	7.6 ohms @ 1650°F
226-1B	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A 76"90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
226-1BL/24	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A L24V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
226-1BL/12	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A L12V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
226-2B	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
226-3B	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A 76"90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
226-3BL/12	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A L12V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
226-3BL/24	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A L12V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F

No Direct Cross: There is no direct Cross

Reference Number, call *Alcor*®

2 1/4: Fits 2 1/4" diameter hole

3 1/8: Fits 3 1/8" diameter hole

SE: Single Engine

TE: Twin Engine

C/A: Chromel/Alumel, Type K

I/C: Iron/Constantan, Type J

C/C: Chromel/Constantan, Type E

L: Lighted Internally

TR: True Temperature Reading Dial

XXX: Meter is calibrated to Lead Length

Re-cal: Re-calibrate

*Option: change system to C/A because new C/C costs more.

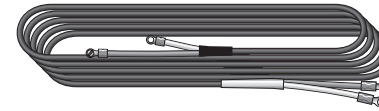
PB: Piggy Back Switch

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PART NO.	NEW ALCOR P/N	DESCRIPTION	NOTES
205-31B	46155	3 1/8 TE EGT/EGT C/A 16'	TR dial, 6.2 ohms @ 1650°F
205-31/BL/24	46155	3 1/8 TE EGT/EGT C/A 16' L24V	TR dial, L24V, 6.2 ohms @ 1650°F
205-33A	46155	3 1/8 TE EGT/EGT C/A 25'	TR dial, re-cal, 6.1 ohms @ 1650°F
205-33B	46155	3 1/8 TE EGT/EGT C/A 25'	TR dial, re-cal, 6.1 ohms @ 1650°F
205-34A	46155	3 1/8 TE EGT/EGT C/A 42'	TR dial, re-cal, 7.7 ohms @ 1650°F
205-34B	46155	3 1/8 TE EGT/EGT C/A 42'	TR dial, re-cal, 9.7 ohms @ 1650°F
205-35A	46155	3 1/8 TE EGT/EGT C/A 25'	TR dial, re-cal, 6.1 ohms @ 1650°F
205-35B	46155	3 1/8 TE EGT/EGT C/A 25'	TR dial, re-cal, 6.1 ohms @ 1650°F
205-37B/20	46000-1	3 1/8 TE EGT/EGT C/A 20'	TR dial, re-cal, 7.6 ohms @ 1650°F
205-37B/28	46000-1	3 1/8 TE EGT/EGT C/A 28'	TR dial, Re-cal, 6.8 ohms @ 1650°F
205-37B/22	46000-1	3 1/8 TE EGT/EGT C/A 22'	TR dial, re-cal, 8.2 ohms @ 1650°F
205-39B	No Direct Cross	3 1/8 TE EGT/EGT C/A 240"	7.6 ohms @ 1725°F
205-40B	46000-7	3 1/8 TE EGT/EGT C/A 240"	7.6 ohms @ 1650°F
206-2A*	46150,42525,85255	2 1/4 SE EGT C/C 100"	4.2 ohms @ 1650°F
206-2AD	Opt.45993 or 46125	3 1/8 TE C/C or 2 1/4 SE C/A	Optn: If 3 1/8 space use 45993 or 2 1/4 space use 46125
206-2B*	46150,42525,85255	2 1/4 SE EGT C/C 100"	4.2 ohms @ 1650°F
206-7A*	46150,42525,85255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
206-7B*	46150,42525,85255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1650°F
206-7BL/24	46164	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1650°F
206-8A*	46150,42525,85255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
206-8AL/24*	46150	2 1/4 SE EGT C/C 90"L24V	3.8 ohms @ 1550°F
206-8B*	46150,42525,85255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
206-8BL/24*	46150	2 1/4 SE EGT C/A 90"L24V	L24V, 3.8 ohms @ 1550°F
206-9A*	46150,42525,85255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
206-9ATR*	46164	2 1/4 SE EGT C/C 90"TR	TR dial, 3.8 ohms @ 1650°F
206-9B*	46150,42525,85255	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1550°F
206-9BL/12*	46150	2 1/4 SE EGT C/C 90"L12V	L24V, 3.8 ohms @ 1550°F
206-9BL/24*	46150	2 1/4 SE EGT C/C 90"L24V	L24V, 3.8 ohms @ 1550°F
206-10A*	46150,42525,85255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
206-10B*	46150	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
206-10BTR*	46164	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1650°F
206-13BTR*	46164	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1650°F
209A-1A	46125	2 1/4 SE EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
209A-1BTR	46125	2 1/4 SE EGT C/A 240"	TR dial, re-cal, 7.6 ohms @ 1600°F
209-1A	46125	2 1/4 SE EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
209-1B	46125	2 1/4 SE EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
209-1BL/12	46125	2 1/4 SE EGT C/A 240"L12V	L12V, re-cal, 7.6 ohms @ 1500°F
209-1BL/24	46125	2 1/4 SE EGT C/A 240"L24V	L12V, re-cal, 7.6 ohms @ 1500°F
209-1BLTR/12	46125	2 1/4 SE EGT C/A 240"L12V	TR dial, L12V, re-cal, 7.6 ohms @ 1600°F
209-1BLTR/24	46125	2 1/4 SE EGT C/A 240"L24V	TR dial, L24V, re-cal, 7.6 ohms @ 1600°F
209-1BTR	46125	2 1/4 SE EGT L/R C/A 240"	TR dial, re-cal, 7.6 ohms @ 1600°F
209-7A1	46125	2 1/4 SE EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
209A-7A2	46125	2 1/4 SE EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
209A-7B3	46125	2 1/4 SE EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
209-7B3	46125	2 1/4 SE EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
209-17BTRC	No Direct Cross	2 1/4 SE EGT C/A 240"	7.6 ohms @ 850°C
209-29A	46199-7	3 1/8 SE EGT C/A 100°F 250R	F: 4.2 ohms, R: 9.2 ohms @ 1550°F
210-4A	No Direct Cross	2 1/4 SE EGT C/A 90"	TR dial (upside down), 3.3 ohms @ 1725°F
210-4B	No Direct Cross	2 1/4 SE EGT C/A 90"	TR dial (upside down), 3.3 ohms @ 1725°F
210-5A	46500-7	2 1/4 SE EGT C/A 90"	TR dial (upside down), 3.3 ohms @ 1600°F
210-5B	46500-7	2 1/4 SE EGT C/A 90"	TR dial (upside down), 3.3 ohms @ 1600°F
210-7A	46150	2 1/4 SE EGT C/A 90"	TR dial, re-cal, 3.3 ohms @ 1650°F
210-7AL/24	46150	2 1/4 SE EGT C/A 90"L24V	TR dial, L24V re-cal, 3.3 ohms @ 1650°F
210-7B	46150	2 1/4 SE EGT C/A 90"	TR dial, re-cal, 3.3 ohms @ 1650°F
210-7BL/24	46150	2 1/4 SE EGT C/A 90"L24V	TR dial, L24V re-cal, 3.3 ohms @ 1650°F
210-8A	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1550°F
210-8AL/24	46150	2 1/4 SE EGT C/A 90"L24V	L24V, 3.3 ohms 1550°F

bus powered meters, are not affected in this manner, due to the fact that they have a solid state circuit that amplifies the millivolt signal. This amplified signal powers the meter movement or digital display. This amplifier draws very little current; therefore, differences in resistance due to variations in length of the thermocouple extension lead have no effect on calibration for resistance changes less than 25 ohms. Usually digital meters do not require calibration in the field but **ALCOR**® indicators should be calibrated to establish peak EGT at 4/5 scale (at the asterisk * mark).

EXTENSION LEADS



Since **ALCOR**® thermocouples or probes are only about 15 inches long, an extension lead wire must be used to extend the thermocouple wire from the probe to the meter.

Extension lead must match meter and thermocouple type.

Most extension leads are 18 gauge for EGT and 20 gauge for CHT, and both are made of two, seven stranded wires. Leads over 25 feet in length require 16-gauge wire to minimize resistance on un-amplified meters. **ALCOR**® lead wires manufactured before the late 1970's will have a woven cloth like cover as an outside insulator. Other manufacturers of amplified or digital-type meters are not concerned with resistance and generally use a much lighter gauge wire. **Beware of inexpensive single strand lead or thermocouple wire since it is prone to premature breakage. Lead and thermocouples manufactured as one complete unit can also pose problems because entire lead/probe must be replaced when probe fails. USE ONLY GENUINE ALCOR REPLACEMENT PARTS**

EGT/TIT Type K extension leads are covered in yellow Teflon and have one each insulated Chromel/Alumel wire bundle. Type E extension leads are covered in brown Teflon and have one each insulated Chromel/Constantan wire bundle. Type E is no longer used in new EGT/TIT products and have been replaced by Type K.

Note: **ALCOR® continues to manufacture replacement Type E leads and thermocouples, but at a greater cost than conventional Type K. If a Type E probe in a single engine system fails consider replacing meter, lead, and probe with new Type K components! Contact **ALCOR**® for details.**

CHT Type J extension leads are covered in black Teflon and have one each insulated Iron/Constantan wire bundle. In order to maintain accuracy CHT systems are required to have the same lead and probe loop resistance regardless of length. Systems dating before about 1978 were 2 ohms and later changed to 8 ohms for both lead and probe. This is accomplished by placing a small resistor into the lead itself thereby maintaining loop resistance regardless of lead length. In this way the indicator will be accurate regardless of the application and or lead length.



FIGURE 8

PART NO.	NEW ALCOR P/N	DESCRIPTION	NOTES
204-10BL/24/20	46199	3 1/8 TE EGT/EGT C/C 20' L24V	L24V, re-cal, 8.9 ohms @ 1550°F
204-11A	45993	3 1/8 TE EGT/EGT C/C 250"	F: 4.2 ohms @ 1650°F, R: 9.2 ohm @ 1550°F
204-15A	46199-8	3 1/8 TE EGT/EGT C/C 100°F250R	F: 4.2 ohms, R: 9.2 ohms @ 843°C
204-15B	46199-8	3 1/8 TE EGT/EGT C/C 100°F250R	F: 4.2 ohms, R: 9.2 ohms @ 843°C
204-16A	46199-9	3 1/8 TE TIT/TIT C/C 16'	TR dial, 7.3 ohms @ 900°C
204-16B	46199-9	3 1/8 TE TIT/TIT C/C 16'	TR dial, 7.3 ohms @ 900°C
204-16BL/24	46199-2	3 1/8 TE TIT/TIT C/C 16' L24V	TR dial, 7.3 ohms @ 900°C
204-17A	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @1550°F
204-17B	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @1550°F
204-18A	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @1550°F
204-18B/20	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @1550°F
204-19A	46199-5	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @ 1600°F
204-19B	46199-5	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @ 1600°F
204-19BL/12	46199-5	3 1/8 TE EGT/EGT C/C 20' L12V	8.9 @ 1600°F, L12V
204-19BL/24	46199-4	3 1/8 TE EGT/EGT C/C 20' L24V	TR dial, 8.9 @ 1600°F, L24V
204-21A	45993	3 1/8 TE EGT/EGT C/C 18'	Re-cal, 8.1 ohms @ 1550°F
204-21B/18	45993	3 1/8 TE EGT/EGT C/C 18'	Re-cal, 8.1 ohms @ 1550°F
204-21B/250	46199-6	3 1/8 TE EGT/EGT C/C 250"	9.2 ohms @ 1700°F
204-29B	46199-7	3 1/8 TE EGT/EGT C/C 100°F250R	F 4.2 ohms, R 9.2 ohms @ 1550°F
205-9A	46000-6	3 1/8 TIT/TIT C/A 16'	TR dial, 6.2 ohms @ 1650°F
205-9AL/24	46000-4	3 1/8 TE TIT/TIT C/A 16' L24V	TR dial, 6.2 ohms @ 1650°F
205-9B	46000-6	3 1/8 TE TIT/TIT C/A 16'	TR dial, 6.2 ohms @ 1650°F
205-9BL/24	46000-4	3 1/8 TE TIT/TIT C/A 16' L24V	TR dial, 6.2 ohms @ 1650°F
205-10A/16	46155	3 1/8 TE EGT/EGT C/A 16'	Re-cal, 6.2 ohms @ 1550°F
205-10A/20	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
205-10AL/24/16	46000-5	3 1/8 TE EGT/EGT C/A 16' L24V	6.2 ohms @ 1550°F
205-10AL/24/20	46000-5	3 1/8 TE EGT/EGT C/A 20' L24V	Re-cal, 7.6 ohms @ 1550°F
205-10B/16	46155	3 1/8 TE EGT/EGT C/A 16'	Re-cal, 6.2 ohms @ 1550°F
205-10B/20	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
205-10BL/24/16	46000-5	3 1/8 TE EGT/EGT C/A 16' L24V	6.2 ohms @ 1550°F
205-10BL/24/20	46000-5	3 1/8 TE EGT/EGT C/A 20' L24V	Re-cal, 7.6 ohms @ 1550°F
205-16A	46000-2	3 1/8 TE TIT/TIT C/A 16'	TR dial, 6.2 ohms @ 900°C
205-16AL/24	46000-13	3 1/8 TE TIT/TIT C/A 16' L24V	TR dial, 6.2 ohms @ 900°C
205-16B	46000-2	3 1/8 TE TIT/TIT C/A 16'	TR dial, 6.2 ohms @ 900°C
205-16BL/24	46260	3 1/8 TE TIT/TIT C/A 16' L24V	TR dial, 6.2 ohms @ 900°C
205-17A	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
205-17B	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
205-18A	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
205-18AL	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, L24V, 7.6 ohms @ 1550°F
205-18B/18	46155	3 1/8 TE EGT/EGT C/A 18'	Re-cal, 6.9 ohms @ 1550°F
205-18B/20	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
205-18BL/24/20	46155	3 1/8 TE EGT/EGT C/A 20' L24V	Re-cal, L24V, 7.6 ohms @ 1550°F
205-18BL/12/18	46155	3 1/8 TE EGT/EGT C/A 18' L12V	Re-cal, L12V, 6.9 ohms @ 1550°F
205-19A	46002	3 1/8 TE EGT/EGT C/A 20' TR	TR dial, 7.6 ohms @ 1600°F
205-19B	46002	3 1/8 TE EGT/EGT C/A 20' TR	TR dial, 7.6 ohms @ 1600°F
205-19BL/24	46002	3 1/8 TE EGT/EGT C/A 20' L24V	TR dial, 7.6 ohms @ 1600°F
205-19BL/12	46002	3 1/8 TE EGT/EGT C/A 20' TR L12	TR dial, 7.6 ohms @ 1600°F
205-21A	46155	3 1/8 TE EGT/EGT C/A 18'	Re-cal, 6.9 ohms @ 1550°F
205-21B	46155	3 1/8 TE EGT/EGT C/A 18'	Re-cal, 6.9 ohms @ 1550°F
205-21BY/225	46000-8	3 1/8 TE EGT/EGT C/A 225"	Re-cal, 7.2 ohms @ 1700°F
205-21BY/250	46000-8	3 1/8 TE EGT/EGT C/A 250"	Re-cal, 7.8 ohms @ 1700°F
205-23A	46155	3 1/8 TE TIT/TIT C/A 16'	TR dial, re-cal, 6.2 ohms @ 1650°F
205-23B	46155	3 1/8 TE TIT/TIT C/A 16'	TR dial, re-cal, 6.2 ohms @ 1650°F
205-24B	46000-2	3 1/8 TE TIT/TIT C/A 16'	TR dial, 6.2 ohms @ 900°C
205-29B	46000-3	3 1/8 TE EGT/EGT C/A100°F250R	F: 3.6, R: 7.8 ohms @ 1550°F
205-29BY	46000-3	3 1/8 TE EGT/EGT C/A100°F250R	F: 3.6, R: 7.8 ohms @ 1550°F
205-31A	46155	3 1/8 TE EGT/EGT C/A 16'	TIT dial, 6.2 ohms @ 1650°F

ALCOR PRODUCT CROSS REFERENCE
METER CROSS-REFERENCE P/N 202-BTR TO 226-3BL/24

PART NO.	NEW ALCOR P/N	DESCRIPTION	NOTES
202-BTRYPB/90	46500-4 w/UCS 80825	2 1/4 SE EGT CS7 C/A 90"	TR dial, 3.3 ohms @ 1500°F
202A-1A	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202A-1AL/12	46500-1	2 1/4 SE EGT C/A 90" L12V	L12V, 3.3 ohms @ 1500°F
202A-1ATR	46164	2 1/4 SE EGT C/A 90" TR	TR dial, 3.3 ohms @ 1650°F
202A-1B	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202A-1BL/12	46500-1	2 1/4 SE EGT C/A 90" L12V	L12V, 3.3 ohms @ 1500°F
202A-1BL/24	46500-1	2 1/4 SE EGT C/A 90" L24V	L24V, 3.3 ohms @ 1500°F
202A-1BTR	46164	2 1/4 SE EGT C/A 90" TR	TR dial, 3.3 ohms @ 1650°F
202-1B	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202-1BL/12	46500-1	2 1/4 SE EGT C/A 90" L12V	L12V, 3.3 ohms @ 1500°F
202-1BL/24/90	46500-1	2 1/4 SE EGT C/A 90" L24V	L24V, 3.3 ohms @ 1500°F
202-1BL/24/144	46500-1	2 1/4 SE EGT C/A 144" L24V	Re-cal, 4.9 ohms @ 1500°F
202-1BLTR/24	46164	2 1/4 SE EGT C/A 96" L24V	TR dial, L24V, 3.3 ohms @ 1650°F
202-1BTR	46164	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms @ 1650°F
202A-2AY	46500-2	2 1/4 SE EGT C/A 100"	3.7 ohms @ 1650°F
202A-4A	46150	2 1/4 SE EGT C/A 78"	Re-cal, 3.0 ohms @ 1450°F
202A-4B	46150	2 1/4 SE EGT C/A 78"	Re-cal, 3.0 ohms @ 1450°F
202-4B	46150	2 1/4 SE EGT C/A 78"	Re-cal, 3.0 ohms @ 1450°F
202A-5A	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202A-5AL/12	46150-w/L	2 1/4 SE EGT C/A 90" L12V	L12V, 3.3 ohms @ 1500°F
202-5B	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202-5BL/12	46150-w/L	2 1/4 SE EGT C/A 90" L12V	L12V, 3.3 ohms @ 1500°F
202A-7A	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202A-7AY	46500-2	2 1/4 SE EGT C/A 100"	3.7 ohms @ 1650°F
202A-7B	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202A-7BG	46244	2 1/4 SE EGT C/A 240"	TR dial, 7.6 ohms @ 1650°F
202A-7BY	46500-2	2 1/4 SE EGT C/A 100"	3.7 ohms @ 1650°F
202A-7G	46244	2 1/4 SE EGT C/A 240"	TR dial, 7.6 ohms @ 1650°F
202A-7H	46162	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202A-7T	46500-4	2 1/4 SE EGT C/A 96"	TR dial, 3.5 ohms @ 1650°F
202-7B	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
202B-7BG	46244	2 1/4 SE EGT C/A 240"	TR dial, 7.6 ohms @ 1650°F
202B-7H	46162	2 1/4 SE EGT C/A 78"	3.3 ohms @ 1650°F
202-7BG	46244	2 1/4 SE EGT C/A 240"	TR dial, 7.6 ohms @ 1650°F
202-7BH	46162	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1650°F
202-7BR	46500-16	2 1/4 SE EGT C/A 100"	3.7 ohms @ 1400°F
202-7BT	46500-4	2 1/4 SE EGT C/A 96"	TR dial, 3.5 ohms @ 1650°F
202-7BY/100	46500-2	2 1/4 SE EGT C/A 100"	3.7 ohms @ 1650°F
202-7BY/140	46500-2	2 1/4 SE EGT C/A 140"	Re-cal, 4.8 ohms @ 1650°F
202-7BY/65	46500-2	2 1/4 SE EGT C/A 65"	Re-cal, 2.7 ohms @ 1650°F
202-7BYPB/90	46500-2 w/UCS 80825	2 1/4 SE EGT CS7 C/A 78"	Re-cal, 3.3 ohms @ 1650°F
202-7BYPB/100	46500-2 w/UCS 80825	2 1/4 SE EGT CS7 C/A 100"	3.7 ohms @ 1650°F
202-13ATR	46500-6	2 1/4 SE EGT C/A 140"	TR dial, 4.8 ohms @ 1650°F Redline
202-13BTR	46500-6	2 1/4 SE EGT C/A 140"	TR dial, 4.8 ohms @ 1650°F Redline
202-17BTR	46500-8	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms @ 900°C
202-18B	No Direct Cross	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1725°F
202-20BY/100	46500-13	2 1/4 SE EGT 100" VERT.	TR dial, 3.7 ohms @ 1650°F
202-20BY/140	46500-13	2 1/4 SE EGT 140" VERT.	TR dial, Re-cal, 4.8 ohms @ 1650°F
202-20BY/PB/82	46500-13 w/UCS 80826	PB ANALYZER 82"	TR dial, Re-cal, 3.2 ohms @ 1650°F
204-9A	46199-10	3 1/8 TE TIT/TIT C/C 16'	TR dial, 7.3 ohms @ 1650°F
204-9B	46199-10	3 1/8 TE TIT/TIT C/C 16'	TR dial, 7.3 ohms @ 1650°F
204-9BL/24	46199-3	3 1/8 TE TIT/TIT C/C 16'	TR dial, 7.3 ohms @ 1650°F
204-10A	45993	3 1/8 TE EGT/EGT C/C 16'	Re-cal, 7.3 ohms @ 1650°F
204-10B/20	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @ 1550°F
204-10B/16	45993	3 1/8 TE EGT/EGT C/C 16'	Re-cal, 7.3 ohms @ 1550°F
204-10BL/24/16	46199-1	3 1/8 TE EGT/EGT C/C 16" L24V	7.3 ohms @ 1550°F

COMPONENT ITEMS AND FUNCTION

1. **Heater Receptacle** provides regulated power for both CHT and EGT heaters when used with heater reference thermocouples.

Caution: Never plug heater into heater receptacle or any 110-V receptacle without first connecting reference thermocouple.

2. **Heater Light** comes on when Heater Switch (Item 11) is turned to selected heater. A steady light will indicate that the heater is on and receiving continuous 110-AC voltage and is 100 degrees F. or more below desired set point temperature. A blinking light indicates voltage is being regulated and the temperature is 25 to 50 degrees F from target temperature. The light will be off if heater switch or power switch is turned off or heater has exceeded its set point and is in a cool down mode back to its pre-set point.

3. **Reference Thermocouple Receptacle** receives the heater control reference probe for both CHT (probe externally located) and EGT (probe internally located) heaters. Plug spade ends are different sizes so plug can go into receptacle only one way.

4. **Terminal Posts** provides a connection for the Test Cable (Item 28) clips in order to read actual heater temperature. **Polarity must be correct for proper temperature readout in display.**

5. **Color Code Reference Bars** represent the correct color code of type J, K, and E systems and their corresponding polarity (+/-). Type J may also be red - and white+, per military specifications. Also be aware that non-ALCOR® systems may have other color codes.

6. **Battery Compartment** houses the 9-Volt battery that powers the LCD display and the millivolt-input circuit. A second wafer battery located on the circuit board powers the millivolt output circuit. (See Chapter V. Gen Info/Maintenance)

7. **Celsius/Fahrenheit Toggle Switch:** selects the type of temperature readout, Fahrenheit or Celsius, depending on requirements of the technician and system being tested.

8. **Liquid Crystal Display (LCD)** indicates the temperature of the heaters, the temperature produced by the thermocouple being tested, or the simulated temperature the meters are calibrated to. Battery voltage of 9-Volt battery is also viewed when Battery Test Button (Item 19) is pressed.

9. **Thermocouple Type Switch** selects type of system being tested, either "Type J" (Iron/Constantan), Type "K" (Chromel/Alumel), or "Type E" (Chromel/Constantan).

10. **Test Cable Receptacle** receives Test Cable (Item 28) to input/output a millivolt signal when testing thermocouples or meters.

11. **Heater Switch** selects type of thermocouple being tested.



FIGURE 9

12. **Fuse** is located below Compartment/Heater Storage Cover (Figure 9) and provides overload protection for the heater power circuit. For replacement information see Chapter V, Maintenance.

13. **Main Power Cord** provides power for heater operation only and is plugged into a standard 110-V AC grounded outlet. A notch is provided in the right cover (Item 21) to allow cover to be closed while cord is being used.

14. **Heater Temperature Dial** sets the desired heater temperature. The knob controls temperatures for EGT, Type E, and K from 900 F to 1800 F around the red ring and 100 F to 600 F for CHT, Type J, around the yellow ring. This is an approximate setting with the actual temperature noted in digital LCD display, Item 8.

15. **Reset Switch** is used to reset unit in the event of a circuit malfunction. Reset can also be achieved by switching main power switch to off momentarily.

16. **Indicate/Calibrate Switch** is used to select item being tested. Indicate position receives a millivolt signal and is used to test a probe (Millivolt output adjust knob not used while in this position). Calibrate position sends out a millivolt signal and is used to test and calibrate a meter (Heater switch and heater temperature dial not used while in this position).

17. **Millivolt Output Adjust Knob** sets output millivolt to meter when in calibrate mode only. The output simulates the voltage that a thermocouple would produce when heated.

18. **Power On/Off Switch:** the main power switch for your **ALCAL® 2000**. Ensure switch is in the off position when not in use to prolong battery life.

19. **Battery Test Button** tests for voltage output of 9-Volt battery located in battery compartment (Item 6) only. Wafer battery located on the main circuit board will be inspected/replaced during re-calibration/inspection of **ALCAL® 2000** by the **ALCOR®** Repair Department. (See Chapter V.Gen Info/Maintenance)

20. **Case:** (See Chapter V. Gen Info/ Maintenance)

21. **Compartment/Heater Storage Cover** provides both heater storage and cable and component storage. The heaters must be installed in the proper position for correct fit and secured when shipped. A convenient notch is provided in the cover to allow power cord use while cover is in place.



FIGURE 10

PART NO.	NEW ALCOR PART NO.	DESCRIPTION	NOTES
46241	46241	2 1/4 SE EGT/CHT C/A	EGT 3.63 ohms @ 1600°F / CHT 8.0 ohms @ 500°F
46242	46242	2 1/4 TE EGT/EGT	7.44 ohms @ 1600°F
46243	46243	2 1/4 SE TIT C/A	3.63 ohms @ 1650°F
46347	No Direct Cross	2 1/4 SE TIT/EGT C/A AMP'D L24V	Scale @ 1300-1800°F 0-25
46349	No Direct Cross	2 1/4 SE TIT C/A AMP'D L24V	Scale @ 1300-1800°F 0-25
46350	No Direct Cross	2 1/4 SE TIT C/A AMP'D	Scale @ 1300-1800°F 0-25
46351	No Direct Cross	2 1/4 SE TIT/EGT CS6 C/A AMP'D	Scale @ 1300-1800°F 0-25
46353	46353	3 1/8 EGT MCCA 6 C/A AMP'D	
46354	46354	3 1/8 EGT MCCA 4 C/A AMP'D	
46356	No Direct Cross	2 1/4 SE TIT C/A AMP'D	Scale at 1300-1800°F 0-25
46357	No Direct Cross	2 1/4 SE TIT/EGT C/A AMP'D	Scale at 1300-1800°F 0-25
46358	46000-10	3 1/8 TE EGT/EGT (Radair)	7.93 ohms @ 1650°F
46361	46361	2 1/4 SE EGT C/A (Light option)	3.63 ohms @ 1600°F
46362	46362	2 1/4 SE EGT C/A 90" L28V	3.63 ohms @ 1600°F
46365	46365	MCCA CHT INDICATOR	Proprietary meter, call Piper
47004	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76" 100"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
47005	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76" 100"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
47010	46150 w/UCS 80825	2 1/4 SE EGT CS6 C/A 90"PB	3.6 ohms @ 1600°F
47011	46500-4 w/UCS 80825	2 1/4 SE EGT CS7 C/A 90"PB	3.3 ohms @ 1650°F
47012	46500-2 w/UCS 80825	2 1/4 SE EGT CS7 C/A 100"PB	Re-cal, 3.63 ohms @ 1600°F
47013	46500-13 w/UCS 80825	PB Analyzer 82"	3.2 ohms @ 1650°F
47029	47029	2 1/4" SE CHT W/ color dial	8.0 ohms @ 500°F
47030	47030	2 1/4"TE EGT/CHT IndicatorW/colordia	EGT 5.26 ohms @ 1600°F / CHT 8.0 ohms @ 500°F

PART NO.	NEW ALCOR PART NO.	DESCRIPTION	NOTES
46077	46125	2 1/4 TE EGT/EGT C/A 240" L24V	TR dial, L24V, 7.6 ohms @ 1600°F
46078	46000-1	3 1/8 TE EGT/EGT C/A 28"	TR dial, 6.8 ohms @ 1650°F
46079	46159	3 1/8 TE EGT/EGT C/A 16"	Re-cal, 6.2 ohms @ 1550°F
46080	46155	3 1/8 TE EGT/EGT C/A 20" L24V	Re-cal, L24V, 7.6 ohms @ 1550°F
46081	46162	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms @ 1650°F
46082	46244	2 1/4 SE EGT C/A 240"	TR dial, 7.6 ohms @ 1650°F
46083	46500-8	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms @ 900°C
46084	46000-1	3 1/8 TE EGT/EGT C/A 20"	TR dial, 7.6 ohms @ 1650°F
46085	46155	3 1/8 TE EGT/EGT C/A 18"	Re-cal, 6.9 ohms @ 1600°F
46086	46150	2 1/4 SE EGT C/A 90"	TR dial, L24V, re-cal, 3.3 ohms @ 1650°F
46087	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1650°F
46088	46500-5	2 1/4 SE EGT C/A 90" L12V	TR dial, 3.3 ohms @ 1650°F
46089	46164	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms @ 1650°F
46090	45993	3 1/8 TE EGT/EGT C/C 20"	8.9 ohms @ 1550°F
46091	46199-1	3 1/8 TE EGT/EGT C/C 20" L24V	L24V, 7.3 ohms @ 1550°F
46092	46199-2	3 1/8 TIT/TIT C/C 16" L24V	L24V, 7.3 ohms @ 900°C
46093	46199-1	3 1/8 TE EGT/EGT C/C 16" L24V	L24V, 7.3 ohms @ 1550°F
46094	46199-3	3 1/8 TE TIT/TIT C/C 16" L24V	L24V, 7.3 ohms @ 1650°F
46095	46150	2 1/4 SE EGT C/A 90" L12V	TR dial, L12V, 3.3 ohms @ 1600°F
46096	46150	2 1/4 SE EGT C/A 90" L24V	TR dial, L24V, 3.3 ohms @ 1600°F
46098	46000-8	3 1/8 TE EGT/EGT C/A 250"	7.7 ohms @ 1650°F
46099*	46150	2 1/4 SE EGT C/C 90"	L12V, 3.8 ohms @ 1550°F
46125	46125	2 1/4 TE EGT/EGT C/A	7.44 ohms @ 1600°F
46126	46126	2 1/4 SE EGT/CHT C/A	EGT 3.63 ohms @ 1600°F / CHT 8.0 ohms @ 500°F
46139*	46150	2 1/4 SE EGT C/C 90" L24V	L24V, 3.8 ohms @ 1550°F
46150	46150	2 1/4 SE EGT C/A 90"	3.63 ohms @ 1600°F
46154	No Direct Cross	3 1/8 TE EGT/EGT C/C	13.5 ohms @ 1600°F
46155	46155	3 1/8 TE EGT/EGT C/A	7.44 ohms @ 1600°F
46156	46156	3 1/8 TE EGT/CHT C/A I/C	EGT 3.63 ohms @ 1600°F / CHT 8.0 ohms I/C @ 500°F
46158	46000-11	3 1/8 TE EGT/EGT C/A 20"	TR dial, 7.6 ohms @ 1650°F
46159	46500-14	2 1/4 SE EGT C/A 90"	TR dial, 3.63 ohms @ 1650°F
46160	46160	3 1/8 TE EGT/EGT C/A	TR dial, 7.6 ohms @ 1650°F
46164	46164	2 1/4 SE EGT C/A 90"	TR dial, 3.63 ohms @ 1650°F
46200	No Direct Cross	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1725°F
46201	No Direct Cross	2 1/4 TE EGT C/A 240"	7.6 ohms @ 850°C
46202	46150	2 1/4 SE EGT C/A 144" L24V	L24V, re-cal, 4.9 ohms @ 1500°F
46203	46000-7	3 1/8 TE EGT/EGT C/A 240"	TR dial, 7.6 ohms @ 1650°F
46204	No Direct Cross	2 1/4 SE TIT C/A	3.3 ohms @ 1650°F
46205	No Direct Cross	3 1/8 TE EGT/EGT C/A 240"	7.6 ohms @ 1725°F
46206	46000-6	3 1/8 TE TIT/TIT C/A	TR dial, 6.2 ohms @ 1650°F
46208	46155	3 1/8 TE EGT/EGT C/A 18"	Re-cal, 6.9 ohms @ 1550°F
46217	46500-16	2 1/4 SE EGT C/A 100"	3.7 ohms @ 1400°F
46218	46500-13	2 1/4 SE EGT 100" VERT.	TR dial, 3.7 ohms @ 1650°F
46220	46500-6	2 1/4 SE EGT 140" VERT.	TR dial, 4.8 ohms @ 1650°F
46224	46224	3 1/8 TE TIT/TIT C/A	TR dial, 7.44 ohms @ 1650°F
46225	46225	2 1/4 SE EGT V.100 L24V C/A	L24V, 3.7 ohms @ 1650°F
46226		2 1/4 SE EGT VERT. L24V	3.3 ohms @ 1500°F
46227		2 1/4 SE EGT CS C/A 82"	3.2 ohms @ 1650°F
46231	46231	CHT/TIT INDICATOR	TIT 3.63 ohms @ 1650°F / CHT 8.0 ohms @ 500°F
46232	46232	2 1/4 SE EGT 240" C/A	7.6 ohms @ 1650°F
46233	46233	SE TIT INDICATOR	3.63 ohms @ 1650°F
46235	46235	CHT/TIT INDICATOR L14V	TIT 3.63 ohms @ 1650°F / CHT 8.0 ohms @ 500°F
46236	46236	TIT INDICATOR L14V	TR dial, L143V, 7.6 ohms @ 1500°F
46237	46237	EGT/CHT INDICATOR L14V	L14V, EGT 3.63 ohms @ 1600°F / CHT 8.0 ohms @ 500°F
46238	46238	CHT/TIT IND. L28V	L28V, TIT 3.63 ohms @ 1650°F / CHT 8.0 ohms @ 500°F
46239	46239	TIT IND. L28V	L28V, 3.63 ohms @ 1650°F
46240	46188-1	EGT/CHT IND. L28V	L28V, EGT 3.63 ohms @ 1600°F / CHT 8.0 ohms @ 500°F

22. **Field Operating Instructions**, P/N 40190, is located on a laminated card located in the lid of the **ALCAL® 2000** provides the operator quick setup and testing information at a glance. This card provides sufficient information to perform all tests while in the field without needing to resort to this Users Guide.

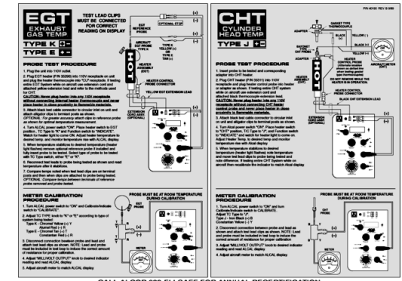


FIGURE 11

23. **Users Guide**, P/N 59207, is this operating manual and contains complete operating instructions for your **ALCAL® 2000**.

24. **CHT Heater**, P/N 35311, is designed to test quarter turn locking bayonet probes that use a pipe thread adapter (Item 31) and gasket-type thermocouples that mount under the spark plug.



FIG. 12

The heater can be plugged directly into the Heater Receptacle (Item 1) or hung in an aircraft's engine compartment in order to heat the thermocouple while it is providing output to the aircraft meter. This allows calibration of the entire system, including thermistor type systems. Extension Lead (Item 29) must be used for this application. (See Item 2, for Heater Light function and operation.) Ground heater to engine using grounding wire clip provided when checking CHT thermistors. **NOTE: WHEN TESTING TYPE K GASKET AND BAYONET THERMOCOUPLES USE REFERENCE PROBE, P/N 86264.**

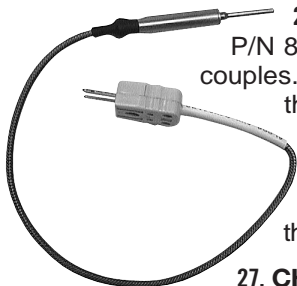
CAUTION: NEVER PLUG HEATER INTO 110V AC RECEPTACLE WITHOUT FIRST CONNECTING EXTERNAL REFERENCE THERMOCOUPLE. (SEE CHAPTER V. GEN INFO/SAFETY PRECAUTIONS)

25. **EGT Heater**, P/N 35290, comes equipped with an internal heater control thermocouple and can be used to test any Type K or E thermocouple. The heater can be plugged directly into the Heater Receptacle (Item 1) or hung in an aircraft's engine compartment in order to heat the thermocouple while it is providing power to the aircraft meter. This allows calibration of the entire system consisting of meter, lead(s), and probe(s). Extension Lead (Item 29) must be used for this application. **Note: ALCAL® 2000 not compatible with old style ALCAL® heater**, P/N 35309 (P/N 35290 uses ungrounded reference thermocouple).



FIGURE 13

CAUTION: NEVER PLUG HEATER INTO 110V AC RECEPTACLE WITHOUT FIRST CONNECTING AN INTERNAL OR EXTERNAL REFERENCE THERMOCOUPLE. (SEE CHAPTER V. GEN INFO/SAFETY PRECAUTIONS)



26. Optional External EGT Reference Thermocouple, P/N 86188, is used for more accurate testing of thermocouples. It measures the exact same location in the heater that the probe tested will measure.

Note: The heater has a separate internal thermocouple that regulates the heater temperature and should not be confused with this external reference thermocouple. Contact **ALCOR®** to order

27. CHT Heater Control Thermocouple, Type J, is used to control the set point established with the Heater Temperature Dial (Item 14). It does so in the same way that the internal EGT heater probe regulates temperature except it is external and not a part of the heater core assembly. It is inserted into the hole in the top of the CHT Heater (Item 24) near the test hole or in the side of the copper CHT Gasket Adapter (Item 32) when testing gasket type CHT thermocouples. (See Chapter V. Gen Info/Safety Precautions”)

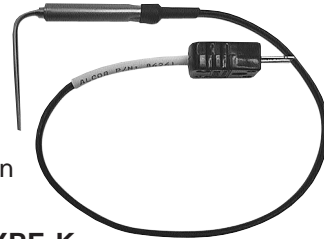


FIGURE 15

NOTE: CANNOT BE USED TO CHECK TYPE K THERMOCOUPLES.

CAUTION: NEVER PLUG HEATER INTO ANY 110-V AC RECEPTACLE WITHOUT FIRST CONNECTING CONTROL THERMOCOUPLE. FAILURE TO DO SO WILL CAUSE A RUNAWAY CONDITION, CAUSING HEATER CORE MELTDOWN AND HEATER FAILURE!

28. Test Cable, P/N 42399, this test cable contains 8 wires, one copper and three thermocouple lead pairs (Type K, J, and E).

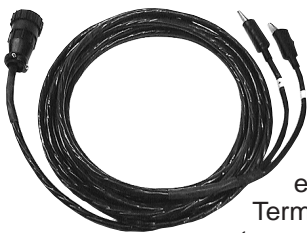


FIGURE 16

These wires input the temperature millivolt signal when testing thermocouples. The copper wires output a millivolt signal to the system/meter being tested/calibrated, simulating temperature from a thermocouple. The clip ends marked + and - are to be used to connect the **ALCAL® 2000** either to a probe or meter being tested or to its own Terminal Posts (Item 4) to check actual heater core temperature. The plug end incorporates a positive locking feature that ensures a secure connection while a test is being performed. The technician must assure correct polarity when connecting clips (Item 5) to terminal posts when reading heater temperature or testing/calibrating.

Note: Do not attempt to lift or move the ALCAL® 2000 with the Test Cable attached as cable damage may occur.

29. Extension Lead, P/N 97076, is a heavy-duty extension cord that incorporates two external thermocouple extension leads, black for the CHT Heater (Item 24) and yellow for the EGT Heater (Item 25). It is used to remotely

PART NO.	NEW ALCOR PART NO.	DESCRIPTION	NOTES
45994	46155	3 1/8 TE EGT/EGT C/A 18"L12V	Re-cal, 7.6 ohms @ 1550°F, L12V
45995	46199-10	3 1/8 TE TIT/TIT C/C 16"	TR dial, 7.3 ohms @ 1650°F
45996*	46150,42525, & 86255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
45998	46150 w/UCS 80825	2 1/4 SE EGT C/A 90" PB	TR dial, 3.3 ohms @ 1550°F
45999	46500-12	2 1/4 SE EGT C/A 90"	TR dial, 3.3 ohms @ 1600°F
46000	46500-12 w/UCS 80825	2 1/4 SE EGT C/A 90" PB	TR dial, 3.3 ohms @ 1600°F
46001	46002 w/switch	3 1/8 TE EGT/EGT C/A 20' TR	TR dial, 7.6 ohms @ 1600°F
46002	46002	3 1/8 TE EGT/EGT C/A 20' TR	TR dial, 7.6 ohms @ 1600°F
46003	46002 w/switch	3 1/8 TE EGT/EGT C/A 20' TR	TR dial, 7.6 ohms @ 1600°F
46004	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @1550°F
46005	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @1550°F
46006	No Direct Cross	3 1/8 CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @1600°F
46007	No Direct Cross	3 1/8 CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @1600°F
46008	46150	2 1/4 SE EGT C/A 90" L12V	TR celsius dial, L24V, re-cal, 3.3 ohms @ 900°C
46009	46164	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1650°F
46010	46199-5	3 1/8 TE EGT/EGT C/C 20'	TR dial, 8.9 ohms @ 1600°F
46011*	46164	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1600°F
46012	46150	2 1/4 SE EGT C/A 90" L12V	L12V, 3.3 ohms @ 1550°F
46013		2 1/4 SE EGT C/A 90"	3.3 ohms @ 1550°F
46015	46500-7	2 1/4 SE EGT C/A 90"	TR dial, upside down, 3.3 ohms @ 1650°F
46016	46500-11	2 1/4 SE TIT C/A 90"	TR dial, 3.3 ohms @ 1650°F
46019	No Direct Cross	2 1/4 SE CHT/EGT I/C L12V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1600°F
46020	46000-6	3 1/8 TE TIT/TIT C/A 16"	TR dial, 6.2 ohms @ 1650°F
46022	46260	3 1/8 TE TIT/TIT C/A 16" L24V	TR dial, 6.2 ohms @ 900°C
46023*	46150,42525,86255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
46024	46155	3 1/8 TE EGT/EGT C/A 20' L24V	TR dial, L24V, re-cal, 7.6 ohms @ 1600°F
46026	46500-1	2 1/4 SE EGT C/A 90" L24V	L24V, 3.3 ohms @ 1500°F
46027	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @ 1550°F
46029	46500-9	2 1/4 SE EGT C/A 90" L24V	TR celsius dial, L24V, 3.3 ohms @ 900°C
46031	46000-13	3 1/8 TE TIT/TIT C/A 16"	TR dial, 6.2 ohms @ 900°C
46033	46155	3 1/8 TE EGT/EGT C/A 20' L24V	Re-cal, L24V, 7.6 ohms @ 1550°F
46034	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1550°F
46035	46199-8	3 1/8 TE EGT/EGT C/C 100°F 250'	F: 4.2 ohms R: 9.2 ohms @ 843°C
46036*	46150,42525,86255	2 1/4 SE EGT C/C 100"	4.2 ohms @ 1650°F
46037	No Direct Cross	2 1/4 TE EGT/EGT CS 100°F 250R	F: 4.2 ohms R: 9.2 ohms @ 1550°F
46038	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A L24V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
46042	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A L12V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
46046	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A L24V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
46048	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A L12V	CHT 2.0 ohms @ 500°F / EGT 3.3 ohms @ 1550°F
46049	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
46051*	46150,42525,86255	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1650°F
46052	No Direct Cross	2 1/4 SE EGT C/A 90"	TR dial, upside down, 3.3 ohms @ 1725°F
46053	46500-10	2 1/4 SE EGT C/A 90" L12V	TR dial, L12V, 3.3 ohms @ 900°C
46055*	46150	2 1/4 SE EGT C/C 90" L24V	L24V, 3.8 ohms @ 1550°F
46056	46150	2 1/4 SE EGT C/C 90" L24V	L24V, 3.8 ohms @ 1550°F
46057	46150	2 1/4 SE EGT C/A 90"	TR celsius dial, re-cal, 3.3 ohms @ 900°C Rd.Ln.
46058	46500-9	2 1/4 SE EGT C/A 90" L24V	TR dial, L24V, 3.3 ohms @ 900°C
46059	46155	3 1/8 TE EGT/EGT C/A 25'	TR dial, 6.1 ohms @ 1650°F
46061	No Direct Cross	2 1/4 SE CHT/EGT PB	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
46064	No Direct Cross	2 1/4 TE EGT/EGT C/A 240"	7.6 ohms @ 1650°F
46065	46150	2 1/4 SE EGT C/A 65"	Re-cal, 2.7 ohms @ 1650°F
46066	46150	2 1/4 SE EGT C/A 140"	Re-cal, 4.8 ohms @ 1650°F
46068	No Direct Cross	2 1/4 EGT C/A L12V	4.8 ohms @ 1650°F
46069	46199-6	3 1/8 TE EGT/EGT C/C 250"	9.2 ohms @ 1700°F
46070	46155	3 1/8 TE EGT/EGT C/A 20' L12V	TR dial, L12V, Re-cal, 7.6 ohms @ 1600°F
46074	46164	2 1/4 SE EGT C/A 90" L24V	L24V, 3.63 ohms @ 1650°F
46075	46125	2 1/4 TE EGT/EGT C/A 240" L12V	L12V, re-cal, 7.6 ohms @ 1500°F

PART NO.	NEW ALCOR PART NO.	DESCRIPTION	NOTES
45893	46000-5	3 1/8 TE EGT/EGT C/A 20' L24V	7.6 ohms @ 1550°F
45894	46000-2	3 1/8 TE TIT/TIT C/A 16'	TR dial, 6.2 ohms @ 900°C
45895	46000-2	3 1/8 TE TIT/TIT C/A 16' L24V	TR dial, L24V, 6.2 ohms @ 900°C
45896	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
45897	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
45898	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F L24V
45899	46002	3 1/8 TE EGT/EGT C/A 20' TR	TR dial, 7.6 ohms @1600°F
45901	46000-8	3 1/8 TE EGT/EGT C/A 225"	7.2 ohms @ 1700°F
45904	46000-3	3 1/8 TE EGT/EGT C/A 100 F 250 F	F 3.6 ohms R 7.8 ohms @ 1550°F
45905	46000-3	3 1/8 TE EGT/EGT C/A 100 F 250 F	F 3.6 ohms R 7.8 ohms @ 1550°F
45908	46155	3 1/8 TE EGT/EGT C/A 25'	TR dial, 6.1 ohms @ 1650°F
45909	46155	3 1/8 TE EGT/EGT C/A 42'	TR dial, 9.7 ohms @1650°F
45910	46155	3 1/8 TE EGT/EGT C/A 25'	TR dial, re-cal for 25' leads 6.1 ohms @1650°F
45911	No Direct Cross	DUAL C/A 20'	7.6 ohms @ 1550°F
45912	No Direct Cross	DUAL C/A 20'	7.6 ohms @ 900°C
45933	46150	2 1/4 SE EGT C/A 78"	Re-cal, 3.3 ohms @ 1450°F
45934	46150	2 1/4 SE EGT C/A 90" L24V	L24V, 3.3 ohms @ 1550°F
45942	46162	2 1/4 SE EGT C/A 90"	3.3 ohms @1650°F
45944	46150	2 1/4 SE EGT C/A 90"	TR dial, re-cal, 3.3 ohms @1650°F
45945	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
45946	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @1600°F
45947	No Direct Cross	2 1/4 TE EGT/EGT C/A 20'	7.6 ohms @ 1600°F
45949	No Direct Cross	2 1/4 TE EGT/EGT C/A 20'	7.6 ohms @ 1600°F
45951	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
45952	45993	3 1/8 TE EGT/EGT C/C 18'	Re-cal, 8.1 ohms @ 1550°F
45953	No Direct Cross	2 1/4 TE EGT/EGT C/A 25'	6.1 ohms @ 1650°F
45954	46125	2 1/4 TE EGT/EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
45955	45993	3 1/8 TE EGT/EGT C/C 16'	Re-cal, 7.3 ohms @ 1550°F
45956	46000-2	3 1/8 TE TIT/TIT C/A 16'	TR dial, 6.2 ohms @900°C
45957	46000-4	3 1/8 TE TIT/TIT C/A 16' L24V	TR dial, 24VL, 6.2 ohms @ 1650°F
45958*	46150	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1550°F
45959	46500-3	2 1/4 SE TIT C/A L24V	TR dial, 3.3 ohms @ 1650°F, 24VL
45962	46150 w/UCS 80825	2 1/4 SE EGT PB ANALYZER	3.3 ohms @1500°F
45963	46244	2 1/4 SE EGT PB ANALYZER TR	TR dial, 7.6 ohms @ 1650°F
45964	46125	2 1/4 TE EGT/EGTCS L/R C/A 240"	Re-cal, 7.6 ohms @1600°F
45965	46150 w/UCS 80825	2 1/4 SE EGT C/A 90" PB	3.3 ohms @ 1550°F
45966	46500-12 w/UCS 80825	2 1/4 SE EGT C/A 90" PB	3.3 ohms @ 1600°F
45967	46155	3 1/8 TE EGT/EGT C/A 20' PB	Re-cal, 7.6 ohms @ 1550°F
45968	46002	3 1/8 TE EGT/EGT C/A 20' TR	7.6 ohms @1600°F
45969	No Direct Cross	2 1/4 TE EGT/EGT C/A 240"	7.6 ohms @ 1550°F
45970	46500-4	2 1/4 SE EGT C/A 96"	TR dial 3.5 ohms @ 1650°F
45973	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @1550°F
45974	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @1600°F
45975	No Direct Cross	3 1/8 SE CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @1600°F
45976	No Direct Cross	2 1/4 SE CHT/EGT I/C C/A 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @1550°F
45977*	46164	2 1/4 SE EGT C/C 90" TR	TR dial, 3.8 ohms @ 1600°F
45978	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45980	46000-1	3 1/8 TE EGT/EGT C/A 22'	8.2 ohms @ 1650°F
45981	46000-5	3 1/8 TE EGT/EGT C/A 16' L24V	6.2 ohms @ 1550°F
45986	No Direct Cross	2 1/4 TE EGT/EGT C/A 20'	7.6 ohms @ 900°C
45987	46150	2 1/4 SE EGT C/A 90" L12V	L12V, 3.3 ohms @ 1500°F
45988	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45989	46155	3 1/8 TE EGT/EGT C/A 20'	Re-cal, 7.6 ohms @ 1550°F
45990	45990	2 1/4 SE EGT C/A 90" L12V	L12V 3.3 ohms @ 1550°F
45991	45991	2 1/4 SE EGT C/A 90" L24V	L24V 3.3 ohms @ 1550°F
45992	46199-9	3 1/8 TE TIT/TIT C/C 16'	TR dial, 7.3 ohms @ 900°C
45993	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @ 1550°F



FIGURE 17 power source.

operate a heater with its corresponding Heater Control or Reference Thermocouple. This cable allows the operator to do thermocouple testing while connected to the aircraft system. It is used when checking a thermocouple system for accuracy as a whole or can be used when testing thermistor type thermocouples where the non-thermocouple type meter in the aircraft is checked for accuracy. When not being used for remote heater use it can be used for plugging the **ALCAL® 2000** into a remote

Caution: Never plug heater into any 110-V receptacle without first connecting Reference Thermocouple. Only a grounded 110-V receptacle may be used with the power cord!

30. **“Type-K” Transition Adapter**, P/N 23946, is used only when External Reference EGT Thermocouple (Item 26) is used providing a convenient place to attach Test Cable (Item 28) clips to Reference Thermocouple.



FIGURE 18

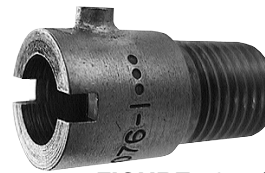


FIGURE 19

31. **CHT Bayonet Adapter**, P/N 28202, is inserted into CHT heater in order to test bayonet type thermocouples or thermistors. It is the same adapter that allows bayonet thermocouple installation below the lower spark plug on most horizontally opposed engines (AN4076-1).

32. **CHT Gasket Adapter**, P/N 28283 is used to test CHT gasket type thermocouples. CHT Heater Control Thermocouple (Item 27) is placed in the side of the adapter while the probe to be tested is placed between the copper adapter and top insulator. The entire unit is then screwed into the CHT heater. See Field Operating Instructions (Item 22).



FIGURE 20

33. **Calibration Screwdriver**, P/N 89222, is used to calibrate front adjustable meters only. It is non-magnetic to eliminate error in meter movement magnets and non-metallic to prevent damage to delicate carbon potentiometer. **Note: It only fits front adjust meters manufactured since 1993. Older meters require a smaller diameter screwdriver.**



FIGURE 21

ALCOR® METER AND PROBE ACCESSORIES

UCS Switch, P/N 80825 & 80827, (Universal Cylinder Selector Switch) is an inexpensive way to upgrade any **ALCOR®** 2 1/4" diameter meter to an analyzer. This modification can be done in the field by removing the meter from the panel, attaching UCS wires, and inserting into the switch.

Note: Un-amplified meters, manufactured since the early eighties, will have a third terminal stud on the back. This is used in conjunction with a special Universal Cylinder Selector Switch box that has a secondary potentiometer adjustment (P/N 80828, 80826). This was provided to be able to have a separate channel, either the fifth or seventh, in order to calibrate separately for TIT, (Turbine Inlet Temperature), or for true absolute temperature.

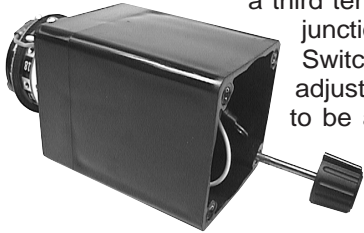


FIGURE 22

Reverse stagger jumper, P/N 42523, was designed to correct the reverse stagger problem when replacing old (1970's) Economix line of thermocouples. Wires may be pulled together or this Alumel wire jumper may be used.



FIGURE 23

Exhaust Hole Adapter, P/N 74291 is a thermocouple exhaust adapter developed to either oversize a leaking thermocouple exhaust hole for an **ALCOR®** probe or allow an **ALCOR®** probe to replace a larger competitors probe. Hole in exhaust must be enlarged to 15/64's of an inch.



FIGURE 24

Fire Sleeve, P/N 49297, is provided with each thermocouple to protect the probe/lead connection and prevent shorting to the airframe/engine. It is recommended to be used in all installations.

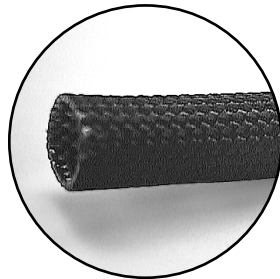


FIGURE 25

Optional EGT Heater, P/N 35291, is designed to test competitor's probes that are approximately 1/8" (.125") diameter. Call **ALCOR®** for details.

Optional CHT Heater Control Thermocouple, P/N 86264, is used when testing both Type J as well as Type K Bayonet/Gasket Thermocouples. Call **ALCOR®** for details.

PART NO.	NEW ALCOR PART NO.	DESCRIPTION	NOTES
45804	46164	2 1/4 SE EGT C/A 90"	TR Dial 3.3 ohms @ 1650°F
45806	46500-2	2 1/4 SE EGT C/A 100"	Re-cal 3.7 ohms @ 1650°F
45807	46150	2 1/4 SE EGT C/A 78"	Re-cal 3.0 ohms @ 1650°F
45808	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45809	46150	2 1/4 SE EGT C/A 90" L12V	TR Dial 3.3 ohms @ 1500°F
45810	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45811	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45812	46500-2	2 1/4 SE EGT C/A 100"	3.7 ohms @ 1650°F
45813	46244	2 1/4 SE EGT C/A 240"	7.6 ohms @ 1650°F
45814	46500-2	2 1/4 SE EGT C/A 100"	3.3 ohms @ 1650°F
45815	46244	2 1/4 SE EGT C/A 240"	7.6 ohms @ 1650°F
45816	46162	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1650°F
45817	46500-6	2 1/4 SE EGT C/A 140"	4.8 ohms @ 1650°F
45818	46199-7	3 1/8 TE C/C	F: 4.2 ohms, R: 9.2 ohms @ 1550°F
45819*	46150,42525,86255*	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
45820*	46150,42525,86255*	2 1/4 SE EGT C/C 90"	3.8 ohms @ 1550°F
45821*	46150,42525,86255*	2 1/4 SE EGT C/C 7.5"	3.8 ohms @ 1550°F
45822*	46150,42525,86255*	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1600°F
45823*	46164	2 1/4 SE EGT C/C 90"	TR dial, 3.8 ohms @ 1650°F
45824*	46150,42525,86255	2 1/4 SE EGT C/C 100"	4.2 ohms @ 1650°F
45826		2 1/4 SE EGT C/A 90"	TR dial upside down dial, 3.3 ohms @ 1725°F
45827	46500-7	2 1/4 SE EGT C/A 90"	TR dial upside down dial, 3.3 ohms @ 1600°F
45828	46150	2 1/4 SE EGT C/A 90"	TR dial, re-cal 3.3 ohms @1650°F
45829	46150	2 1/4 SE EGT C/A 90" L24V	TR dial, re-cal, 3.3 ohms @1650°F L24V
45830	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1550°F
45831	46150	2 1/4 SE EGT C/A 90" L24V	L24V 3.3 ohms @ 1550°F
45832	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1550°F
45833	46150	2 1/4 SE EGT C/A 90" L	3.3 ohms @ 1550°F
45834	46500-12	2 1/4 SE EGT C/A 90"	TR dial & red ptr., 3.3 ohms @ 1600°F
45835	46500-11	2 1/4 SE TIT C/A 90"	3.3 ohms @ 1650°F
45837	46125	2 1/4 TE EGT/EGT C/A 240"	Re-cal, 7.6 ohms @1500°F
45838	46125	2 1/4 TE EGT/EGT C/A 240" L24V	Re-cal, 7.6 ohms @1500°F
45839	46125	2 1/4 TE EGT/EGT C/A 240"	Re-cal, 7.6 ohms @1500°F
45840	46125	2 1/4 TE EGT/EGT C/A 240"	Re-cal, 7.6 ohms @1500°F
45841	46125	2 1/4 TE EGT/EGT C/A 240"	Re-cal, 7.6 ohms @1500°F
45847	No Direct Cross	2 1/4 SE CHT I/C 76" VERT	2.0 ohms @ 500°F
45848	No Direct Cross	METER W/PB SWITCH EGT C/A	3.3 ohms @ 1500°F
45849	No Direct Cross	METER W/PB SWITCH EGT C/A	3.3 ohms @ 1500°F
45850	No Direct Cross	EGT ANALYZER C/A 90"	3.3 ohms @ 1500°F
45851	No Direct Cross	EGT ANALYZER C/A 90"	3.3 ohms @ 1500°F
45864	46150	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45867	No Direct Cross	VERTICAL 7.5"	3.3 ohms @ 900°C
45869	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @ 1550°F
45870	46199-5	3 1/8 TE EGT/EGT C/C 20'	TR dial, re-cal, 8.9 ohms @1550°F
45871	45993	3 1/8 TE EGT/EGT C/C 18'	Re-cal, 8.1 ohms @ 1550°F
45872	45993	3 1/8 TE EGT/EGT C/C 18'	Re-cal, 8.1 ohms @ 1550°F
45873	46199-7	3 1/8 TE EGT/EGT C/C 100°F 250R	F: 4.2 ohms R: 9.2 ohms @ 1550°F
45874	46119-7	3 1/8 TE EGT/EGT C/C 100°F 250R	F: 4.2 ohms R: 9.2 ohms @ 1550°F
45877	46199-10	3 1/8 TE TIT/TIT C/C 16'	TR Dial, re-cal, 7.3 ohms @1650°F
45878	45993	3 1/8 TE EGT/EGT C/C 16'	Re-cal, 7.3 ohms @1650°F
45879	45993	3 1/8 TE EGT/EGT C/C 250"	F: 4.2 ohms R: 9.2 ohms @ 1550°F
45880	46199-8	3 1/8 TE EGT/EGT C/C 100°F 250R	F: 4.2 ohms R: 9.2 ohms @ 843°C
45881	46199-9	3 1/8 TE TIT/TIT C/C 16'	7.3 ohms @ 900°C
45882	45993	3 1/8 TE EGT/EGT C/C 20'	8.9 ohms @1550°F
45890	46000-6	3 1/8 TE TIT/TIT C/A 16'	TIT dial, re-cal, @ 1650°F
45891	46000-4	3 1/8 TE TIT/TIT C/A 16' L24V	TIT dial, L24V, re-cal, 6.2 ohms @ 1650°F
45892	46155	3 1/8 TE TIT/TIT C/A 20'	Re-cal, 7.6 ohms @1550°F

**ALCOR PRODUCT CROSS REFERENCE
METER CROSS-REFERENCE P/N 05546 TO 47030**

PART NO.	NEW ALCOR PART NO.	DESCRIPTION	NOTES
05546	No direct cross	2 1/4 SE CHT I/C 76" VERT.	2.0 ohms @ 500°F
05547	No direct cross	2 1/4 SE CHT I/C 76" VERT.	2.0 ohms @ 500°F
05550	No direct cross	3 1/8 SE CHT/EGT I/C C/A	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05551	No direct cross	3 1/8 SE CHT/EGT I/C C/A	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05552	46155	3 1/8 SE CHT/EGT C/A 20"	7.6 ohms @ 1550°F
05553	46155	3 1/8 SE CHT/EGT C/A 20"	7.6 ohms @ 1550°F
05554	No direct cross	3 1/8 TE ANALYZER	8.9 ohms @ 1550°F
05555	No direct cross	3 1/8 TE ANALYZER	9.7 ohms @ 1550°F
05556	No direct cross	3 1/8 TE ANALYZER	9.7 ohms @ 1550°F
05557	46150	2 1/4 SE EGT C/A 90" ANALYZER	3.3 ohms @ 1550°F
05558	46150	2 1/4 SE EGT C/A 90" ANALYZER	3.3 ohms @ 1550°F
05559	46150	2 1/4 SE EGT C/A 90" ANALYZER	3.3 ohms @ 1550°F
05560	46150	2 1/4 SE EGT C/A 78" ANALYZER	Re-cal, 3.30 ohms @ 1450°F
05561	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
05562	46125	2 1/4 TE EGT/EGT C/A 240"	Re-cal, 7.6 ohms @ 1500°F
05563	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
05564	No direct cross	CS6 ANALYZER	4.9 ohms @ 1550°F
05564	46150	2 1/4 SE EGT C/A 90"	3.63 ohms @ 1600°
05568	46150	2 1/4 SE EGT C/A 90"	3.63 ohms @ 1600°
05580	No direct cross	2 1/4 TE EGT/EGT C/A 240"	7.6 ohms @ 1500°F
05581	No direct cross	2 1/4 TE EGT/EGT C/A 20"	7.6 ohms @ 1600°F
05582	No direct cross	2 1/4 TE EGT/EGT C/A 20" CS4	7.6 ohms @ 1600°F
05583	No direct cross	2 1/4 TE EGT/EGT C/A 240"	7.6 ohms @ 1550°F
05584	No direct cross	2 1/4 TE EGT/EGT C/A 20"	7.6 ohms @ 1600°F
05585	No direct cross	2 1/4 TE EGT/EGT C/A 20"	7.6 ohms @ 1600°F
05600	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05601	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05602	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05603	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05604	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05605	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05612	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05613	No direct cross	2 1/4 SE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05620	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05621	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05622	No direct cross	2 1/4 TE CHT/EGT CS4 W/ TIT	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05623	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1550°F
05624	No direct cross	2 1/4 TE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05625	No direct cross	2 1/4 TE CHT/EGT CS6 W/ TIT	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1600°F
05640	46164	2 1/4 SE EGT C/A 90" TR	TR Dial 3.3 ohms @ 1650°F
05641	46164	2 1/4 SE EGT C/A 90" TR	TR Dial 3.3 ohms @ 1650°F
05642	46164	2 1/4 SE EGT C/A 90" TR	TR Dial 3.3 ohms @ 1650°F
05643	46164	2 1/4 SE EGT C/A 90" TR	TR Dial 3.3 ohms @ 1650°F
05650	46500-12	2 1/4 SE EGT C/A 90"	TR Dial 3.3 ohms @ 1600°F
05651	46500-12	2 1/4 SE EGT C/A 90" CS4 W/ TIT	TR Dial 3.3 ohms @ 1650°F
05652	46500-12	2 1/4 SE EGT C/A 90"	TR Dial 3.3 ohms @ 1650°F
05653	46500-12	2 1/4 SE EGT C/A 90" CS6 W/ TIT	TR Dial 3.3 ohms @ 1650°F
05660	No direct cross	3 1/8 SE CHT/EGT I/C CA 76" 90"	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1500°F
05661	No direct cross	3 1/8 TE CHT/EGT I/C CA 76" 90" W/TIT	CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1500°F
05662	No direct cross		CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1500°F
05663	No direct cross		CHT 2.0 ohms @ 500°F/EGT 3.3 ohms @ 1500°F
45796	No Direct Cross	2 1/4 TE EGT/EGT CS L/R C/A	7.6 ohms @ 1500°F
45797	46500-4	2 1/4 SE EGT C/A 96"	3.5 ohms @ 1650°F
45800	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45801	46500-1	2 1/4 SE EGT C/A 90"	3.3 ohms @ 1500°F
45802	46500-1	2 1/4 SE EGT C/A 90" L12V	L12V 3.3 ohms @ 1650°F
45803	46500-1	2 1/4 SE EGT C/A 90" L12V	L12V 3.3 ohms @ 1650°F

TECHNICAL SPECIFICATIONS

Case Dimensions:

16 inches long, 13 inches wide and 7 inches deep

Total Weight:

12 lbs. including heaters and accessories

Battery Power:

Millivolt Input/Indicator Circuit, 9 Volt Lithium Battery, P/N 89050

Millivolt Output/Calibrator Circuit, 3 Volt Wafer Style, P/N 89250

Note: 3-volt battery not field replaceable

Battery Life:

9 Volt, Replace before reaching 7.30 volts (approximately 60 hours use)

3 Volt Wafer, minimum 3 years

Battery Condition Indicator:

Push Button Switch selectable for 9 volt
Output unattainable for 3 volt

Readout Display:

Solid State LCD
Display resolution 1°F, from 0° to 1999°

Fuse

Field Replaceable P/N 29721
Type 2 amp Fast BLO

Operating Temperature:

25° F to 130° F
Avoid direct sunlight

Calibration Accuracy:

Type K and E
+/- 0.5% of full scale
+/-0.25% @ 1650°F

Type J

+/- 3°F from 200°F to 600°F
+/- 1.5°F @ 500°F

Calibration Standard, NT (National Institute of Standards and Technologies)

Response Time:

<1.0 seconds

Reference Junction Compensation:

CHT 0.03 degrees/degree
EGT 0.022 degrees/degree

Heater Controller:

Temperature Range
CHT @ 100° F-600°F
EGT @ 900° F-1800°F
Voltage 110-volt AC

EGT Heater Assembly:

Voltage 110-volt AC @ 150 watts
Maximum Temperature Intermittent @ 1700°F
Maximum Temperature Continuous @ 1500°F

CHT Heater Assembly:

Voltage-110-volt AC @ 150 watts
Maximum Temperature Continuous @ 500°F

II TESTING & CALIBRATING METERS

This chapter will cover calibration procedures to test **ALCOR**® EGT, CHT, and TIT meters using a simulated millivolt source provided by the **ALCAL**® **2000** or using millivolts provided by a probe located in an **ALCAL**® **2000** heater. Before using your tester, first visually inspect the EGT, CHT, or TIT system on the aircraft for obvious defects, such as bad connections, or heat damaged and shorted wires. Quick resistance measurements of the thermocouple with a multimeter can also save time in detecting the problem. Refer to Chapter IV. Troubleshooting and Chapter III. Testing Thermocouples, for additional help.

METHOD 1: SIMULATING THERMOCOUPLE OUTPUT

This test will check the meter for function and calibration error with lead and probe connected. For testing just the meter, refer to Bench Testing Meters at the end of this chapter. Place **ALCAL**® **2000** so that the operator can view the display and have access to controls while viewing/calibrating aircraft meter unless help is available. **The following detailed instructions are contained in an abbreviated schematic form in the lid of the ALCAL® 2000. (Field Operating Instructions, Item 22) also refer to Components Items/Function which can be found on Page 7.**

A. ALCAL® 2000 Setup

1. Check calibration sticker to ensure that **ALCAL**® **2000** certification by the **ALCOR**® Repair Department has not expired.
2. Turn Power Switch (Item 18) to on and push Battery Test (Item 19) to ensure adequate voltage is above 7.3 volts.
3. Plug and lock Test Cable (Item 28) into Test Receptacle, (Item 10) and place Indicate/Calibrate Switch (Item 16) to calibrate.
4. Select the type of system being tested, either J (CHT), K, or E (EGT/TIT) with the TC TYPE Switch (Item 9). Using Fahrenheit/Celsius Switch, (Item 7) choose correct temperature readout of meter being tested.
5. Disconnect wire between the lead and probe. If Type K or E system disconnect the red wire. If Type J system disconnect the yellow wire. It is not necessary to remove probe from cylinder or exhaust.
6. If Type K or Type E, clip the + Test Cable clip to the red probe wire and the - Test Cable clip to the red lead wire. If Type J, clip the +Test Cable clip to the yellow probe wire and the -Test Cable clip to yellow lead wire. This puts the **ALCAL**® **2000** in series with the system to be checked and will simulate the millivolt output of the probe as if it was

TEMPERATURE VS MILLIVOLT REFERENCE JUNCTION TEMPERATURE

EGT MILLIVOLT TABLE

Type K, Chromel/Alumel Yellow (+)/ Red (-)				Type E, Chromel/Constantan Brown (+)/ Red (-)			
75° F		25° C		75° F		25° C	
F°	MV	F°	MV	F°	MV	F°	MV
1000	21.31	550	21.78	1000	38.63	550	39.55
1025	21.90	575	22.84	1025	39.76	575	41.58
1050	22.49	600	23.91	1050	40.88	600	43.60
1075	23.08	625	24.98	1075	42.01	625	45.63
1100	23.68	650	26.03	1100	43.13	650	47.63
1125	24.27	675	27.08	1125	44.26	675	49.64
1150	24.86	700	28.14	1150	45.38	700	51.64
1175	24.25	725	29.18	1175	46.50	725	53.64
1200	26.03	750	30.23	1200	47.61	750	55.62
1225	26.62	775	31.27	1225	48.73	775	57.61
1250	27.20	800	32.30	1250	49.84	800	59.58
1275	27.79	825	33.32	1275	50.96	825	61.54
1300	28.37	850	34.34	1300	52.07	850	63.49
1325	28.96	875	35.35	1325	53.18	875	65.43
1350	29.54	900	36.36	1350	54.28	900	67.35
1375	30.12	925	37.36	1375	55.38	925	69.27
1400	30.70	950	38.35	1400	56.49	950	71.18
1425	31.27	975	39.34	1425	57.59	975	73.08
1450	31.85	1000	40.31	1450	58.68	1000	74.95
1475	32.42			1475	59.78		
1500	32.98			1500	60.87		
1525	33.55			1525	61.96		
1550	34.12			1550	63.04		
1575	34.68			1575	64.13		
1600	35.24			1600	65.20		
1625	35.81			1625	66.27		
1650	36.36			1650	67.33		
1675	36.92			1675	68.41		
1700	37.48			1700	69.47		
1725	38.02			1725	70.53		
1750	38.58			1750	71.59		
1775	39.12			1775	72.64		
1800	39.67			1800	73.69		

CHT MILLIVOLT TABLE

Type J, Chromel/Constantan Yellow (-)/ Black (+)			
75° F		25° C	
F°	MV	F°	MV
100	0.72	50	1.30
125	1.45	75	2.64
150	2.19	100	3.99
175	2.94	125	5.35
200	3.69	150	6.72
225	4.44	175	8.11
250	5.20	200	9.50
275	5.96	225	10.85
300	6.72	250	12.28
325	7.49	275	13.66
350	8.26	300	15.05
375	9.03	325	16.43
400	9.81	350	17.81
425	10.58	375	19.19
450	11.37	400	20.57
475	12.12		
500	12.90		
525	13.66		
550	14.43		
575	15.20		
600	15.96		
625	16.73		
650	17.50		
675	18.27		
700	19.04		

CROSS REFERENCE TABLE #3, COMPETITORS

COMPETITOR	METERS	APPROVAL & SYSTEM TYPE
Allegro Avionics (520) 327-3695	Digital Amplified, Analog	Homebuilt only
Electronics International (541) 318-6060	Amplified, LCD, Digital	STC/PMA, EGT/CHT Type K, ungrounded
Grand Rapids Digital Technology (616) 583-8000	Digital	Homebuilt Only Grounded probes
Horizon (714)524-1919 (800) 541-8128	Analog/Digital Reverse LCD	Both, ungrounded & grounded Type K & J
Insight, GEM (716) 852-3217	Amplified, LED, Bargraph, and Digital	Type K grounded Type J grounded
JP Instruments (714) 557-3805	Amplified, LED, Bargraph, and Digital Analog, Amplified,	Both, ungrounded & grounded Type K & J Call JPI with analyzer serial number.
K&S (800) 346-4469	Analog, Amplified	Type K ungrounded
Mitchell Aircraft (847) 615-2887	Analog	Selected Models , PMA Type K Ungrounded, Type J Ungrounded
Norwich Aero (607) 336-7636	Not Compatible	All types
Rocky Mountain (307) 864-9300	Digital LCD	Homebuilt only
UMA (800) 842-5578	Un-amplified Analog	
Universal (970) 242-5262	Probes only	All types
Vision Microsystems (360) 714-8203	Digital	Homebuilt Only Type K Ungrounded Type J Ungrounded
Westburg (Westach) (707) 938-2121	Un-amplified Analog	TSO, Selected Models EGT Type K, CHT Type J No Temperature Compensation!

**Note: An attempt has been made to include all pertinent manufacturers but list may not be complete or up to date.
Call for compatibility with Alcor® replacement parts.**

in operation. **It is important that the probe and lead be included in this procedure to provide proper system resistance for calibration.**

B. FUNCTIONAL TEST

1. Slowly rotate the Millivolt Output Knob (item 17) clockwise and note movement of meter needle (disregard **ALCAL® 2000** temperature read-out for now). Needle movement should be smooth with no pauses or jumping from first dial mark to full scale. Repeat this procedure several times. If movement needle is not smooth (erratic movement) then jewel bearings are worn and meter needs to be repaired or replaced.
2. If smooth needle movement is confirmed then put the needle mid-scale and gently tap the meter face and note movement (the handle of a small screwdriver/phillips may be rotated against case also to simulate vibration). If needle moves more than 25° or 1° increment then the jewel in the movement is worn and has friction requiring the meter to be repaired or replaced.
3. If there is no reading at all, recheck all connections and settings. If still no reading is obtained bypass the probe and connect test cable directly to lead terminals and note reading. If meter reading is obtained then remove probe from aircraft and test. Refer to Chapter III. Testing Thermocouples.

C. TEST AND CALIBRATION

Calibration of **ALCOR®** EGT/TIT and CHT meters manufactured after 1980 are performed through a small hole in the front of the meter. A small plastic slotted screwdriver is recommended because a metal screwdriver, if not used carefully, may damage the potentiometer. **ALCOR®** provides one, P/N 89222, with new meters since 1993 which should remain in the cockpit after installation for future calibration needs. Older indicators manufactured before 1980 have the calibration adjustment from the rear and may not be repairable due to unavailability of parts. See Chapter I.INTRO/METERS

All Meters Displaying Actual Temperature

1. Complete FUNCTIONAL TEST above and reinstall a functioning probe if removed.
2. Reconnect Test Cable to probe and lead and ensure proper type system being tested is selected as described in **ALCAL® 2000** Setup.
3. Adjust the Millivolt Output knob to the desired calibration temperature as noted in LCD Display of the **ALCAL® 2000**. To find the correct calibration temperature for meter being tested, refer to Chapter VI. TABLES, ALCOR PRODUCT CROSS-REFERENCE where code "TR" is found in the notes column. If meter part number is not listed see operating limits in the Pilot Operating Handbook (POH) for the

aircraft being tested. Find the maximum redline temperature for the type of system being calibrated and calibrate the meter to that temperature. Typically for CHT it would be 450°-500° F and for EGT/TIT it would be 1600°-1700° F. In this way redline temperature would be the most accurate since meter accuracy is not 100% linear. This is why it is also important to check temperature at other points of the display scale (25° per increment) as necessary to check for excessive calibration errors.

4. Adjust the potentiometer so that the critical or redline temperature matches the readout of the **ALCAL® 2000**. (See Chapter I.INTRO/METERS, for potentiometer locations.)

EGT Meters with Relative Scale

1. Ensure that the meter, lead, and probe are still connected as outlined in Setup.
2. Turn the Millivolt Output Knob clockwise and note a reading of approximately 1600° F on the LCD Display then note the meter reading which should be 4/5 scale or at the asterisk mark *. This calibration applies to most meters when they leave the factory (meters before early 80's were 1550° F). If used with the correct lead however the meter can be used just like a true temp meter if the factory calibration has not been changed. However, it is recommended to calibrate the meter to the * or 4/5 scale in flight where peak occurs, using EGT Meter Installation Instructions, P/N 59185. In this way the indication has a greater temperature range for the pilot to use. It must be noted that peak will not always occur at the asterisk because of variables influencing peak, such as altitude, power settings, and ambient air temperature as well as changes in system resistance of meter, lead, and probe over time.

NOTE: The above procedures do not take into account the error of the thermocouple. The following heater method allows more accurate calibration of the entire system by compensating for variations in probe output.

METHOD 2: USING THERMOCOUPLE OUTPUT

This is the most accurate method for calibrating not only a Type K, E, or J Type system but also thermistor type systems as long as the sensor fits in the appropriate **ALCAL® 2000** Heater. This method calibrates the system as a whole and takes into account not only resistance variations as noted in the previous procedures but also millivolt output variations of the probe. This method also confirms the function (not accuracy) of the thermocouple without performing a separate test. **The following detailed instructions are contained in an abbreviated schematic form in the lid of the **ALCAL® 2000**, Field Operating Instructions, (Item 22) and Component Item List which can be found on Page 7. See Chapter V, General Information/Safety, for precautions on heater use.**

ALCAL® 2000 TROUBLESHOOTING

Frequently Asked Questions, FAQ's

I'm getting a reading in the LCD display 1) that is off by several hundred degrees. 2) That shows the number "1" in the display.

- 1) Check that the Fahrenheit/Celsius switch is in the correct location.
- 2) Probe has no continuity/open.

Have a BAT indication in the display but the battery checks OK.

Polarity is reversed when checking a thermocouple. Switch lead clips.

Can't seem to reach temperature selected with Heater Temperature Dial.

Check battery voltage and replace if below 7.3 volts.

All EGT/TIT probes I test seem to read about 30° to 100° F low.

Probes are not being fully inserted into heater.

When testing Type K CHT Thermocouples I get extremely high readings in the display.

Use optional CHT Heater Control Thermocouple, P/N 86264.

WARRANTY INFORMATION

To activate warranty and receive customer referrals **ALCOR® must receive a completed warranty card!**

ALCOR® Inc., warrants all parts in your new **ALCAL® 2000**, product to be free from defects in material and workmanship under normal use. Our obligation under this warranty is limited to repair or exchange of any defective part of this unit if returned, transportation prepaid, **within one year** from the date of purchase. The replacement parts carry a warranty for the balance of the warranty.

Under this warranty, **ALCOR®**, is not responsible for any service charges or any other consequential damages.

This warranty is void on any product which has been subjected to misuse, accident, negligent damage, repaired by other than the **ALCOR®** Repair Department, or damaged in transit handling. If in the opinion of **ALCOR®**, the warranty seal has been altered or defaced, the warranty is voided.

This warranty is in lieu of all other warranties expressed or implied and all other obligations of liability on **ALCOR®**'s part, and it neither assumes nor authorizes any other person to assume for **ALCOR®** any other liability in connection with the sale of **ALCOR®** products.

CONTACT **ALCOR®**

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Please visit **ALCOR®**'s Web Page www.alcorinc.com, Email support@alcorinc.com or call 1-800-FLI-SAFE (800-354-7233) or 210-349-6491. Fax us at 210-308-8536.

replaced when the voltage drops below 7.3 volts DC. Alkaline batteries may be used but longevity will be compromised. Periodically check the Battery Compartment for battery leakage. The 3 volt wafer battery is located on the circuit board and is not field replaceable, but is replaced if necessary when the **ALCAL® 2000** is sent in for calibration.

Fuse

Fuse, (Item 12), is accessed beneath Compartment/Heater Cover (Item 21). If fuse fails repeatedly then a problem exists somewhere in the circuit and the **ALCAL® 2000** must be returned to Alcor for repair. **Only use the recommended type as a higher rating can cause internal failure to electronic components.**

SAFETY PRECAUTIONS

In order to test thermocouples, your **ALCAL®2000** comes equipped with heaters that can cause injury and fire if not handled correctly.

Caution:

Never plug heater into any 110-V receptacle without first connecting reference thermocouple. Without the reference thermocouple the heater will exceed its design limits and burn up! The CHT heater will melt! DO NOT place heater in close proximity to flammable materials. Never leave a heater unattended while it is on! The CHT heater can exceed 500° F and the EGT heater can exceed 1800° F! It is best to allow the heater to cool before handling, but if that is not possible, use a kitchen pot holder/mitt and the convenient hook built into the heater. Avoid placing a hot heater on any flammable materials such as plastic, wood, paper, etc. The life of the heating element will be greatly increased if the unit is turned off when not immediately in use. Use extreme care when removing hot thermocouples from heater after testing!

CALIBRATION & REPAIR OF YOUR **ALCAL® 2000**

ALCOR® recommends calibration and inspection on an annual basis. Calibration and repairs may only be done by qualified **ALCOR®** repair technicians. Calibrations are traceable to National Institute of Standards and Technology, and include a letter of certification. Call **ALCOR®** to schedule repair/calibration and include your name, telephone number, and a full description of the problem. Keep shipping box that **ALCAL®2000** was shipped in so that it may be reused to return **ALCAL®2000** for certification/repair.

A. **ALCAL® 2000** Setup for either Thermocouple or Thermistor, RTD systems showing true temperature.

1. Check calibration sticker to ensure that **ALCAL® 2000** certification by the **ALCOR** Repair Department has not expired.
2. Plug Power Cord (Item 13) into a standard grounded 110-Volt AC socket and plug and lock Test Cable (Item 28) into Test Receptacle (Item 10).
3. Clip Test Cable to Terminal Posts (Item 1) ensuring correct polarity so that correct heater temperature will show in **ALCAL® 2000** Display (Item 8).
4. Plug one end of heater Extension Lead (Item 29) into Heater Receptacle (Item 1) and the other end into **ALCAL® 2000** heater being used.

Important: Also plug the external thermocouple extension lead (Black for Type J, Yellow for Type K or E) that is part of heater Extension Lead into corresponding Heater Reference Thermocouple. The Reference Thermocoupler is internal on EGT Heater (unless optional method is used) and external on CHT Heater.

5. Disconnect lead wire(s) from thermocouple/thermistor. Remove from cylinder/exhaust then screw/insert thermocouple/thermistor into appropriate heater. Hang on nearby cylinder, cable, etc. keeping heater clear of surrounding wires.

EGT

Plug Internal Reference Thermocouple into Reference Thermocouple Receptacle (Item 3). Clamps on clamp style probes must be opened wide to allow full insertion into heater. All types must be inserted as far down as possible for best thermal conductivity.

CHT

Bayonet Type J Thermocouple

First screw in CHT Bayonet Adapter (Item 31) into CHT Heater (Item 24), then insert and lock bayonet thermocouple to be tested into adapter. Insert CHT Heater Control Thermocouple (Item 27) in hole next to adapter. NOTE: Some are direct screw in type that do not utilize an adapter and may not be as accurate as ones that contact the bottom of the thermal well.

Gasket Type Thermocouple

Insert CHT Gasket Adapter (Item 32) fitted with gasket thermocouple to be tested into heater. Then insert CHT Heater Control Thermocouple (Item 27) into side of adapter and associated plug into Reference Thermocouple Receptacle (Item 3).

Resistance Type Device

This is the easiest way to check the function and accuracy of this type of system since it is based on resistance and not millivolts. RTD's

come in both bayonet and screw-in styles as noted above but the most accurate design is one that has a spring loaded tip that ensures full contact at bottom of thermal well. It is imperative that the grounding clip on the CHT Heater be secured to engine while performing this test. Be careful in handling as RTDs are more fragile than thermocouples.

Note: Do not plug heater into any 110V AC receptacle without first connecting Reference Thermocouple. (See Chapter V. General Information/Safety Precautions)

6. Reconnect lead wires from aircraft meter to thermocouple/thermistor.
7. Place Indicate/Calibrate Switch (Item 16) to Indicate and select the type of system being tested with the TC Type Switch (Item 9) which will be the same as heater type being used, CHT, Type J or EGT, Type K and E.
8. Ensure correct temperature readout is selected depending on meter dial readout using Fahrenheit/Celsius Switch (Item 7).
9. Set Heater Temperature Dial (Item 14) to the temperature you wish to check meter accuracy.
10. If meter is amplified, turn aircraft power on first, then turn **ALCAL® 2000** Power Switch (Item 18) to On. Heater Light (Item 2) should be on. Push Battery Test Button (Item 19) and check for a minimum of 7.3 volts displayed in LCD.

B. System Test

1. Once selected temperature has stabilized, read temperature displayed on aircraft meter and compare with reading in **ALCAL® 2000** LCD Display (Item 8).
2. Recalibrate **ALCOR®** meter as noted previously in CALIBRATION TEST. With all other meters contact the meter manufacturer. See list in Chapter VI. TABLES.

BENCH TESTING EGT/TIT/CHT METERS

The **ALCAL® 2000** can be used to provide a millivolt source to calibrate any Type J, K, or E. meters. But in order to calibrate an un-amplified meter correctly you must first find the resistance value on the meter label or measure the loop resistance of the lead and probe that will be used with the meter. Input these values into a Decade Box or similar device then calibrate the meter (See Chapter VI. TABLES). The most accurate method for calibrating true temperature reading meters is to heat the probe to a known temperature and then re-calibrate the meter in the aircraft as shown previously in Chapter II.

Note: In some cases meters that test favorably on the bench will not operate correctly in the aircraft. This may be due to the millivolt test box on the bench producing more milliamps than a thermocouple. The same holds

V GENERAL INFORMATION

MAINTENANCE

Heaters

If heaters are operated within their temperature limits for short periods, they should provide many hours of reliable operation. It is recommended on EGT heaters (P/N 35290) however to periodically keep the test hole cleaned with a .#44 drill bit (.086). This allows maximum insertion depth for greater accuracy. CHT heaters require that the threads be lubricated occasionally with a high temp spark plug type lubricant or equivalent. Take care not to drop heater as insulation damage may occur.

Case

Your **ALCAL® 2000** Tester/Calibrator is rigidly mounted in a durable airtight and watertight plastic case resistant to most oils, fuels, and chemicals. It comes equipped with an E-Z PURGE pressure control. If the case will not open after air travel/altitude change (i.e. high to lower altitude), open black plastic knob behind handle to equalize pressure. If necessary, the case can be locked with an ordinary padlock, which is not provided. The case may be cleaned by ordinary household cleaners. Periodically inspect case for loose components (i.e., tightness of control knob allen set screws, lid hinge pins, etc.). Inspect case hinges and latches for proper operation. Periodically inspect condition of o-ring seal located in lid perimeter and lubricate with silicon.

Moisture

Your **ALCAL® 2000** is neither waterproof nor water-resistant while in use. **It must never be exposed to nor operated in wet conditions, especially with unit plugged into a 110-Volt outlet!** If the unit is exposed to water, unplug power cord immediately, invert and drain excess water, and wipe off any remaining water. Allow to air dry thoroughly before attempting to power up or damage to internal electronic circuit may result.

Battery replacement

The **ALCAL® 2000** has two batteries, one 9 volt to provide input power, and one 3 volt wafer battery to provide output power. Your unit comes supplied with a 9 volt Lithium, P/N 89050, for long life and is easily replaced by pushing Battery Compartment Cover (Item 6) down and forward and then pulling upward. It is recommended that this battery be

ENGINE PROBLEMS IN FLIGHT USING EGT

SYMPTOM	PROBABLE CAUSE	SOLUTION
75-100°F rise for one cylinder (usually sudden but sometimes gradual)	Spark plug not firing due to fouling, faulty plug, lead, or distributor. During rich mixture operation such as take-off and climb, this symptom can also mean a leaking intake pipe.	<ol style="list-style-type: none"> 1. Enrich mixture to return EGT to cylinder with high EGT. 2. Go to single magneto operation. When magneto firing bad spark plug is selected, EGT will suddenly drop to bottom of scale, defining plug that is not firing. 3. Replace plug.
75-100°F rise for ALL cylinders	One magneto not operating.	<ol style="list-style-type: none"> 1. Enrich mixture to return EGT to normal. 2. Have magneto repaired
Increase or decrease, especially after ignition system maintenance	Improper ignition timing. An increase in EGT means retarded ignition. A decrease means advanced ignition.	<ol style="list-style-type: none"> 1. Check EGT rise for each mag to determine any uneven timing. 2. Take corrective action.
Loss of peak EGT	Poor ignition or if fuel injection engine, this symptom can be caused by vapor in fuel system.	Have magneto tested.
Decrease in EGT for all cylinders with no change in mixture setting.	Carbureted engines: Enrichment of mixture possibly due to carburetor ice. All engines: Decrease in total airflow to engine, such as induction ice.	Check for change in manifold pressure.
Decrease in EGT for one cylinder	<ol style="list-style-type: none"> 1. Intake valve not opening fully, such as faulty lifter or carbon or lead fouling on valve stem. 2. Scored cylinder or broken piston rings to cause low compression (Can also cause increase in EGT due to plug fouling from high oil consumption). 	<ol style="list-style-type: none"> 1. Have valve lift checked 2. Go to single mag operation to check for plug fouling. 3. Have compression checked.
Slow rise in EGT for one cylinder	Burned exhaust valve	Have compression checked
Decrease in peak and flat	Detonation, usually the result of putting 80-octane fuel into a 100-octane engine.	Enrich mixture, reduce power, and relean mixture. Repeat, if necessary, to find power setting where normal peak is obtained or run rich.
--SUDDEN-- OFF SCALE RISE for one cylinder	PREIGNITION!	<p>DURING TAKE OFF Abort if possible and if not, go to full rich and reduce power if excess power is available.</p> <p>DURING CRUISE Cut throttle back quickly and reopen until EGT returns to normal and if it does not, reduce power to point of eliminating pre-ignition.</p>
ANY Decrease	If one of the above causes is not in evidence, then suspect a low reading probe or faulty connection.	Check calibration with <i>ALCAL</i> ® 2000 or reverse probes to determine whether low reading moves with probe or stays with cylinder.
ANY Increase	TROUBLE Because any malfunction of exhaust probe, lead or meter can only cause a decrease in EGT	

true when a previously inoperative meter begins working with a new thermocouple only to have it become inoperative soon after. This is because the milliamp output of a new probe is slightly greater than the old probe temporarily overcoming the excess resistance of a bad potentiometer found in meters made before 1980. See Chapter I. INTRO/BASIC METER THEORY.

If you do not have a Decade Box or the appropriate probe/lead combination then the following table is provided to allow bench checking/calibrating of meters. Refer to Chapter II, TESTING & CALIBRATING METERS but ignore section that refers to disconnecting lead and probe and connect Test Cable Clips directly to meter to ensure correct polarity. **Please note that the actual temperature that you are setting the meter to is the METER READING column, not the *ALCAL*® 2000 READING.**

VALUES TO BENCH CHECK METERS WITHOUT LEAD/PROBE

SYSTEM TYPE	RESISTANCE	METER READING	ALCAL READING
TYPE J I/C	8.00 Ohms	500° F	375° F
TYPE K C/A	3.30 Ohms 3.63 7.60 7.44	1500° F 1600° F 1650° F 1700° F	1276° F 1358° F 1085° F 1094° F
TYPE E C/C	8.90 Ohms	1550° F	1254° F

MISCELLANEOUS, NON-ALCOR METERS

The *ALCAL*® 2000 can be used to test meters other than those manufactured by *ALCOR*®. If the system uses a Type J, K, or E thermocouple, follow the instructions in Chapter II. to verify function and accuracy. Contact the appropriate manufacturer for individual instructions on proper calibration procedures.

Note: Some manufacturers may only authorize factory calibration, especially if meter/analyzer is in warranty. Probe fit in *ALCAL*® 2000 EGT heaters (except P/N 35291) may pose a problem with most non-*ALCOR*® systems. Refer to Chapter VI. TABLES, for list of *ALCOR*® competitors.

TESTING THERMOCOUPLES

This chapter will cover test procedures to test thermocouples using both resistance and heat. Before using your **ALCAL® 2000**, visually inspect the EGT, TIT, or CHT systems on the aircraft for obvious defects, such as bad connections, or heat damaged and shorted wires. The following methods will verify correct operation/accuracy of any Type J, K, and E Type thermocouples, given limitations due to heater test hole size. Limited thermistor testing is also described. (See Chapter IV. Troubleshooting, for solutions to common problems, and Chapter VI. TABLES, for resistance values.)

METHOD 1: RESISTANCE TEST, EGT/TIT/CHT

This is a simple test to determine the integrity of a thermocouple by verifying loop resistance at room temperature using a multimeter. **The ALCAL® 2000 is not required for test method 1 and 2.**

A. Setup

Multimeter capable of sensing tenths of an ohm, preferably digital, with clips on test lead.

1. With thermocouple at room/ambient temperature while still installed in cylinder/exhaust, disconnect thermocouple lead wire. Clip lead terminals with multimeter test lead clips (polarity is unimportant).
2. Set multimeter to read in tenths of an ohm.

Note: Do not connect multimeter directly to lead wire going to back of meter to check meter condition because relative high voltage from multimeter may quickly snap and loop an un-amplified meter hair-spring.

B. Test

1. Make note of resistance displayed on multimeter while moving thermocouple lead back and forth. This will test for internal condition of the thermocouple wire and determine if there is an intermittent problem due to broken wire strands. Extreme fluctuations in the resistance reading indicate that the probe should be discarded but ensure fluctuation is not due to multimeter clips shifting on terminals. See Chapter VI. TABLES/PROBE CROSS REF., for resistance values to test to.
2. If the probe passes resistance test then it is probably in working condition. The following test using uncalibrated heat can only determine function and not the accuracy of the thermocouple output. See Chapter IV. TROUBLESHOOTING

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wiggle the probe lead to check for changes in reading. See Chapter III, Testing TC/Method I.

Do EGT/TIT probes require periodic maintenance and can they be repaired?

No, probes do not require cleaning but deposits may have a negligible effect on response time. Probes are sealed and cannot be repaired.

How do I re-calibrate a relative reading meter in flight?

See EGT Meter Installation Instructions P/N 59185.

Can I have my meter repaired by any instrument shop?

This is not recommended. To control quality, **ALCOR®** does not sell replacement parts and as a result when a shop says it has overhauled your meter it may have only cleaned and re-calibrated it at an inflated price. If meter has a small hole (manufactured after 1980) in front for calibration, it is repairable. **Rely only on Genuine ALCOR® Parts.**

Refer to Product Installation Instruction booklets:

EGT/CHT Indicators	P/N 59185
Probe, CHT	P/N 59188
Probe, EGT	P/N 59180
Lead	P/N 59181
Universal Cylinder Selector Switch	P/N 59187
Multi Cylinder Combustion Analyzer	P/N 59182

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It is not recommended. The correct type thermocouple wire may be added or removed, as long as meter is re-calibrated either in flight or with **ALCAL® 2000**. If amount added or removed causes maximum potentiometer adjustment, full-scale meter linearity may be compromised. Terminals need not be thermocouple type material (ie: Type J, K, or E) unless connection is at a bulkhead/firewall and terminals are different temperatures. Otherwise the temperature differential will be indicated on aircraft meter.

Should I be concerned about the gray stains around the EGT probe?

Yes. This indicates a loose/leaking thermocouple causing exhaust gas leakage and may result in rapid erosion of the exhaust system thermocouple hole. Oversize the hole and insert **ALCOR®** exhaust hole Adapter P/N 74291 if using **ALCOR®** thermocouples; otherwise close hole by welding or other FAA approved methods and drill new hole.

What does it mean when engine reaches lean misfire before peak indication is reached?

Probe is located in one of the richest running cylinders. Move probe to another cylinder . Plug hole with old probe or weld hole using FAA approved methods.

Should I lubricate the threads on a screw-in probe before I install it?

Yes, but use only high-temperature anti-seize lubricant for such as Fel-Pro C5-A or equivalent. If not high temperature probe may be difficult to remove later.

What should I do if the lead and probe stagger connection doesn't match?

Just pull the wires together keeping the color codes matched. An alumel wire jumper adapter, P/N 42523, is available for those who wish a neater installation.

Does it matter how I route the lead wires?

Yes, otherwise you might introduce stray induction if a lead is routed with current carrying alternator/generator wire or high voltage ignition wires. This may cause higher than normal readings in un-amplified systems. To test for this simply turn Master and Alternator/Generator Switch to off and see if reading drops simultaneously.

Do I need to remove an EGT probe to test it?

No, just perform a resistance check with the disconnected lead wires of the probe. While reading the ohms (approximately 1-ohm for EGT/TIT),

METHOD 2: SIMPLE FUNCTIONAL TESTS USING HEAT

A. Setup for EGT/TIT Thermocouples

Safety Glasses with side shields
Propane torch or equivalent
Multimeter capable of sensing millivolts, preferably digital with clips on test lead.

1. Disconnect probe from leads and remove from exhaust/cylinder.
2. Set multimeter to millivolts, DC and connect test clips to probe terminal ends.
3. Move to an area away from aircraft and flammable materials and use sensible safety precautions. Use fire resistant gloves or equivalent and have fire extinguisher ready.

Test

1. Carefully heat just the probe element tip with a propane torch until it begins to glow a dark cherry red color. At this point, the probe should be producing approximately 33 to 36 millivolts (1500°F-1650°F) for red/yellow, Type K or 61 to 67 millivolts (1500°F-1650°F) for red/brown, Type E systems. See Chapter VI. TABLES/TEMPERATURE VS MILLIVOLT.

B. Setup for CHT Thermocouples

Safety glasses with side shields
Boiling water
Candy thermometer or equivalent
Multimeter capable of sensing millivolts, preferably digital

1. Bring water to a boil and verify 212°F with thermometer.
2. Set multimeter to millivolts, DC and connect test clips to probe terminal ends.

Test

1. Place Type J (Black/Yellow) probe into boiling water
2. Check multimeter millivolt reading of 3.69.

C. Functional Test, Thermistors (RTDs)

Heat probe to a known temperature and then read corresponding temperature on aircraft meter as noted in Chapter II.Method 2, Using Thermocouple Output.

METHOD 3: ACCURACY TEST, EGT/TIT/CHT THERMOCOUPLES

These tests will utilize the **ALCAL® 2000**, and its EGT and CHT heaters to accurately test thermocouples and thermistors up to their max operating range. If the probe drives a true reading TIT indicator then it should be tested to 1650°F, being the typical redline for most turbochargers otherwise 1500°F is adequate to prolong heater life. CHT, probes should be checked at a redline temperature of 400-500°F. For optimum TIT or CHT system accuracy, refer to Chapter 2., Method 2. **The following detailed instructions are contained in an abbreviated schematic form in the lid of the **ALCAL® 2000** (Field Operating Instructions, Item 22). Also refer to Component Items and Function which can be found on page 7. See Chapter V, General Information/Safety, for precautions on heater use.**

A. Setup, EGT

1. Check calibration sticker to ensure that **ALCAL® 2000** certification by the **ALCOR** Repair Department has not expired.
2. Plug power cord into a standard grounded 110-Volt AC socket and plug and lock Test Cable (Item 28) into Test Receptacle.
3. Attach Test Cable clips to Terminal Posts (Item 4) ensuring correct polarity so that heater temperature will show in **ALCAL® 2000** Display.
4. Place Indicate/Calibrate Switch (Item 16) to Indicate.
5. Select the type of thermocouple being tested, either J (CHT), K, or E (EGT/TIT), with the TC Type Switch (Item 9). Using Fahrenheit/Celsius Switch (Item 7), choose preferred temperature scale.
6. Select heater type, either EGT (Type K or E), or CHT (Type J) with Heater Switch (Item 11) and plug corresponding heater into Heater Receptacle (Item 1).

EGT

Plug internal reference thermocouple in EGT Heater (Item 25) into Reference Thermocouple Receptacle (Item 3). Clamps on clamp style probes must be opened wide to allow full insertion into heater. All types must be inserted as far down as for best thermal conductivity.

CHT

Bayonet Type J Thermocouple

First screw in CHT Bayonet Adapter (Item 31) into CHT Heater (Item 24), then insert and lock bayonet thermocouple to be tested into adapter. Insert CHT Heater Control Thermocouple (Item 27) in hole next to adapter. NOTE: Some are direct screw in type that do not utilize an adapter and may not be as accurate as the ones that contact the bottom of the thermal well.

Frequently Asked Questions, FAQ's

What cylinder should I install my new EGT or CHT thermocouple on?

EGT probe should be located on the leanest cylinder, which is the cylinder that peaks first (1450°F-1650°F) while leaning the mixture (this may not necessarily be, the hottest cylinder). This can be different on identical aircraft too because of differences in fuel/air flow characteristics, altitude, ambient air temp/humidity, power settings (RPM and Manifold), injector flow rates, etc. On carbureted engines it is sometimes the cylinder farthest from the carburetor or cylinder with the shortest intake pipe on injected engines. If lean misfire is reached before peak then probe is incorrectly installed in the richest running cylinder. Poor mixture distribution can be improved by moderate use of carburetor heat. Refer to Alcor publication *EGT Combustion Analysis in a Nutshell*. CHT must be installed on the hottest cylinder, which is usually the one that gets the least airflow. This is typically a rear cylinder for horizontal engines, or number one cylinder on radial engines. The hottest cylinder can be determined by moving probe to each cylinder and test flying the aircraft. It is best to use the bayonet style if possible for better accuracy because gasket type can run hotter (50° to 100°F, usually about 60°F). **Correct CHT meter calibration is crucial for engine to reach TBO.**

Where do I find identification on an Alcor Lead, Probe, or Meter?

All **ALCOR®** products are STC/FAA approved and will have FAA/PMA and an **ALCOR®** part number printed on their labels. Leads have a shrink label at either the thermocouple or meter ends. It has the part number and the week and year it was manufactured for warranty purposes. Yellow lead is Type K, brown is Type E, and black is Type J. Thermocouples have a high temp shrink label (older ones have a stamped aluminum placard) that shows the part number and the week and year it was manufactured. Meters have a placard on top, which shows its part number and the probe-lead loop resistance it is calibrated to. A round paper sticker located on the side will show the Quality Inspector's stamp and the date of manufacture/inspection. The rear of a meter will have color-coded label between the terminal studs depicting the type of system, either J, K, or E.

Can I replace an Alcor® probe with a competitor's or a competitor's probe with ALCOR?

Yes, as long as the same type, either J, K, or E, with same fit, and same style whether grounded or un-grounded is used. But since **ALCOR®**'s EGT probes are smaller than most other probes, a special adapter, **ALCOR®** P/N 74291, must be used. Incompatibility between lead and probe connectors may be solved by replacing with compatible aviation grade connectors. **Use Genuine Alcor Replacement Parts,** which will extend replacement interval periods resulting in lower labor costs for the owner.

Can I cut (or add) lead wire when I install an un-amplified system?

ALCOR® METERS AND THERMOCOUPLES

SYMPTOM	PROBABLE CAUSE	SOLUTION
No indication on meter.	Shorted or open lead and probe circuit.	Repair lead/replace probe and recheck lead and probe loop resistance. Do system check with ALCAL® 2000 .
	Possible probe/meter/lead incompatibility.	Check that meter, lead, and thermocouple are the same type by checking Color Codes/Part Numbers.
	Meter out of calibration.	Re-calibrate in flight if relative reading or with ALCAL® 2000 if true temperature reading meter.
	Friction in movement.	Worn jewels. Call ALCOR® for meter repair or replacement.
Low reading.	Bad or dirty and corroded potentiometer.	Attempt to move pot back and forth to self-clean and then recalibrate. If no solution, call ALCOR® to repair or replace.
	Meter out of calibration.	Re-calibrate in flight if relative reading EGT or with ALCAL® 2000 if true temperature reading meter.
	Thermocouple wire touching together other than at probe tip causing secondary thermocouple junction.	Inspect thermocouple and lead connection and insulation. Perform loop resistance check of lead and probe. If Ok do heat check on probe. Correct connection or replace component.
	EGT Type K probe on Type E system.	Install Type E probe or replace entire system.
High reading.	High resistance in system	Check probe and lead loop resistance. Replace if out of tolerance.
	Bad or dirty and corroded potentiometer.	Attempt to move pot back and forth to self-clean and then recalibrate. If no solution, call ALCOR® to repair or replace.
	Meter out of calibration.	Re-calibrate in flight if relative reading EGT or with ALCAL® 2000 if true temperature reading meter.
	EGT Type E Probe on Type K system.	Install Type K probe.
Erratic Reading.	An open thermocouple, RTD, or connection on some types of amplified systems.	Test and if found defective replace component.
	CHT Engine cooling baffling is leaking.	Repair/replace baffling.
	CHT Gasket Thermocouple is used.	Spark plug is higher temperature than cylinder.
	Lead receiving bus current through induction. Test by turning off Master Switch and alternator/generator.	Re-route lead away from current carrying wire.
	Bad potentiometer or friction in movement.	Call ALCOR® to repair or replace.
Indicator Changes when tapped.	Internal probe lead wires broken causing intermittent connection.	Check probe resistance while wiggling wire and replace if out of tolerance or fluctuates.
	Lead chafed and grounding intermittently.	Insulate from airframe.
No Indication at run-up.	Friction in movement or old style pot needs exercising or replacing.	Call ALCOR® to repair or replace.
	EGT Indicator begins at 1200° F, all Engines may not reach 1200° F at run-up power while leaned.	Check operation while in Flight.
Indicator works on bench, but not in flight.	CHT Needs adequate time for warm up, meter out of calibration, or meter/probe inop.	Test System.
	Check probe/lead resistance. If OK excessive resistance/friction in meter or pot in poor condition.	Call ALCOR® Repair or Replace.

Gasket Type Thermocouple

Insert CHT Gasket Adapter (Item 32) fitted with gasket thermocouple to be tested into heater. Then insert CHT Heater Control Thermocouple into side of adapter and associated plug into Reference Thermocouple Receptacle (Item 3).

Resistance Type Device

This is the easiest way to check the function and accuracy of this type of system since it is based on resistance and not millivolts. RTD's come in both bayonet and screw-in styles as noted above but the most accurate design is one that has a spring loaded tip that ensures full contact at bottom of thermal well. It is imperative that the grounding clip on the CHT Heater be secured to engine while performing this test. Be careful in handling, RTDs are more fragile than thermocouples.

Note: Do not plug heater into any 110V AC receptacle without first connecting Reference Thermocouple. (See Chapter V, General Information/Safety Precautions)

1. Turn Power Switch (Item 18) to ON and push Battery Test (Item 19) to ensure adequate voltage is above 7.3 volts.
2. Ensure Heater Light (Item 2) is on and set Heater Temperature Dial (Item 14) to desired test temperature.

B. Test

1. When temperature has stabilized (heater light is blinking) check temperature in Display (Item 8) and make final adjustment to establish correct test temperature.
2. Once desired temperature is set, disconnect Test Cable clips that were previously connected in setup and connect to test thermocouple leads ensuring correct polarity. Reverse connection will cause incorrect temperature readout. Refer to Color Code Reference Bars (Item 5).
3. Compare temperatures. Small thermocouple errors can be corrected by following system calibration procedures in Chapter 2, Method 2.

METHOD 4: OPTIONAL METHOD

EGT/TIT Probes

For greater accuracy, an external EGT Reference Thermocouple is used to measure actual temperature of thermal test well of heater. This is because of distance between thermal well (test probe location) and internal reference thermocouple in the Heater. Measuring the actual temperature in the test hole with a calibrated EGT Reference Thermocouple will allow greater accuracy than the standard method.

A. *ALCAL*® 2000 SETUP

1. Complete Setup as outlined in Method 3, but instead of using internal reference probe in EGT Heater, the optional external EGT Reference Thermocouple (Item 26) is used to set heater temperature.
2. Insert Reference Thermocouple into small test hole in EGT Heater. Plug Transition Adapter (Item 30) into Reference Thermocouple Receptacle (Item 3).
3. Remove Test Cable clips from Terminals (as attached in Method 2) and clip to tips of Transition Adapter ensuring correct polarity.
4. When temperature has stabilized, readjust Heater Temperature Dial (Item 14) to desired temperature.

B. CALIBRATE

1. When temperature has stabilized (heater light is blinking and *ALCAL*® 2000 LCD readout matches Heater Temperature Dial control set point) read meter in the cockpit and compare the two temperatures.
2. Recalibrate meter per Test and Calibration procedure.

IV TROUBLESHOOTING

METERS AND THERMOCOUPLES

Thermocouples (Probes)

ALCOR® probes usually work up until an open condition occurs. The likely failures are 1) In the probe lead where it exits the body/radiator, 2) Near or at the spot weld connection between the element tip and the lead wire in the probe body, 3) The tip itself becoming eroded, which is rare. In all three cases probe replacement is required. Clamp breakage can also be found on earlier probes manufactured before 1983. A quick resistance check can usually determine the condition of the probe. (See Chapter VI Tables, for resistance values.)

Meters (Indicators)

ALCOR® meters built before 1980 have wire wound type potentiometers which are susceptible to corrosion and wear. If the meter is that age and the pilot or mechanic has to tap meter glass to get movement to move, most likely the problem is in the potentiometer. Exercising calibration potentiometer may restore meter function, otherwise the movement has friction from jewel wear and must be overhauled or replaced. Meters built after 1980 are free of problems associated with potentiometer corrosion and wear but exercising of movement can often help.

Leads

ALCOR® leads should never need attention. The only problems could be incorrect resistance requiring re-crimping of terminals or wire becoming burned/damaged. If a lead becomes damaged and if replacement is not cost effective then a new piece of lead wire may replace damaged portion as long as splice connection is not located at a bulkhead.

Note: It is very important that correct thermocouple type wire be used for correct meter operation. Meter must be re-calibrated if CHT or true temp reading EGT/TIT.