



# Pyrometers



A pyrometer is an exhaust temperature gauge which reads exhaust temperature by a signal from a probe (thermocouple) inserted into the exhaust manifold. The monitoring of temperature alerts the driver to problems well before indications would be received from a water temperature gauge. Drivers can use pyrometers to diagnose engine problems and drive more efficiently, prolonging engine life and reducing fuel consumption.

Tectran has partnered with Isspro, Inc., premier manufacturer of pyrometers for the heavy duty, marine and industrial markets, to offer a wide variety of pyrometers.



## Contents

- Pyrometers Gauges - 2 1/16", 2 3/4", 3"
- Digital Pyrometers
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- Thermocouples
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- Pyrometer Tester
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## Pyrometers

The diesel engine takes energy from heat and converts it into motion to transport goods. **Excessive temperature is the greatest cause of damage to an engine.** By monitoring the temperature of the exhaust, you can detect changes in temperature which may be the early signs of trouble. A pyrometer, which measures and reports exhaust temperature, will indicate engine problems more efficiently than any other method.

**The pyrometer is one of the first indicators of trouble.** If an injector clogs, a cylinder or piston cracks, or an electronic injector has a problem, a pyrometer will note a change in temperature. The reason a pyrometer will call attention to engine problems faster is that a pyrometer measures the internal thermo-dynamics of an engine. The benefits are longer engine life, better fuel consumption, lower emissions and an indication of malfunctions before damage occurs.

### We offer the most widely used pyrometer system:

- Type K (chromel-alumel material), is designed for high temperature applications (to 2000°F), covering most diesel and gas engine applications.

### To design your own pyrometer system:

- Choose the proper pyrometer, by determining the temperature range you wish to measure and the size of the mounting hole for the gauge.
- Select the required thermocouple probe length and most convenient mounting style.
- Choose the appropriate length of lead wire and termination style to connect to the gauge and thermocouple.
- For highest accuracy and long life, do not mix components from different manufacturers within a pyrometer system.

### Standard features of our pyrometers:

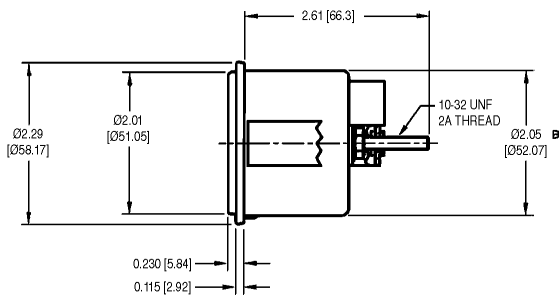
- All our pyrometers have red-orange pointers.
- 12 VDC light kit is included. For a 24 VDC lamp, see page 30 in the Specialty & Accessories section of this catalog.
- Made in the USA.

## 2 1/16" Pyrometers

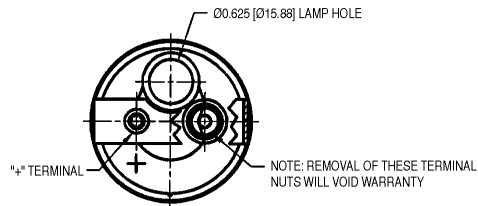
PART NUMBER	ISSPRO No.	°F SCALE	°C SCALE	SWEEP	BEZEL	REMARKS
95-5013	R607G	0-1500°	None	250°	Black	
95-5016*	R607T	0-1500°	None	250°	Black	color-coded dial
95-5019**	R607WV	0-1500°	None	250°	Black	color-coded dial
95-5242* †	R3607T	100-1500°	None	250°	Black	color-coded backlit dial
95-5243** †	R3607VW	100-1500°	None	250°	Black	color-coded backlit dial
95-5000	R605	300-1500°	200-800°	100°	Black	
95-5006	R605P	300-1500°	200-800°	100°	Chrome	
95-5007	R607	0-1800°	0-1000°	250°	Black	
95-5014	R607P	0-1800°	0-1000°	250°	Chrome	

\*Warning begins at 1100° for pre turbo installations \*\*Warning begins at 900° for post turbo installations

† These units come with a signal amplifier



Typical view of a 2 1/16" pyrometer



95-5019 2 1/16" Pyrometer  
250° sweep, black bezel,  
colored dial



95-5243 Pyrometer, 250°  
sweep, black bezel



95-5000 2 1/16" Pyrometer 100°  
sweep, black bezel



95-5006 2 1/16" Pyrometer  
100° sweep, chrome bezel



95-5007 2 1/16" Pyrometer  
250° sweep, black bezel



95-5014 2 1/16" Pyrometer  
250° sweep, chrome bezel



95-5085 2 1/16" Digital Pyrometer, black bezel



95-5040 3" Pyrometer 100° sweep, black bezel



95-5049 3" Pyrometer 250° sweep, black bezel



95-5054 3" Pyrometer 250° sweep, chrome bezel



95-5079 3" Dual pyrometer chrome bezel



95-5100 3" Turbocator and kit black bezel shown



## 2 1/16" Digital Pyrometers

All units have 0.3" LED displays. Celsius scales are also available.

PART NUMBER	ISSPRO No.	°F SCALE	PROBE	BEZEL
95-5085	R630	0-1990°	type K	Black
95-5088	R630-24VDC	0-1990°	type K	Black
95-5090	R630P	0-1990°	type K	Chrome

## 2 3/4" Pyrometer

PART NUMBER	ISSPRO No.	°F SCALE	°C SCALE	SWEEP	BEZEL	REMARKS
95-5030	R602	0-1800°	0-1000°	100°	Black	

## 3" Pyrometers

Requires pressure tubing kit for installation. For details, see page 31 of this catalog.

PART NUMBER	ISSPRO No.	°F SCALE	°C SCALE	SWEEP	BEZEL	REMARKS
95-5040	R604	0-1800°	0-1000°	100°	Black	
95-5048	R604P	0-1800°	0-1000°	100°	Chrome	
95-5049	R606	0-1800°	0-1000°	250°	Black	
95-5054	R606P	0-1800°	0-1000°	250°	Chrome	

## 3" Specialty Pyrometers

PART NUMBER	ISSPRO No.	°F SCALE	°C SCALE	BEZEL	REMARKS
95-5076	R624	300-1500°	200-800°	Black	Features dual pyrometer, two meters. Requires two thermocouples
95-5079	R624P	300-1500°	200-800°	Chrome	Features dual pyrometer, two meters. Requires two thermocouples

## 3" Turbocator

Dual scales allow monitoring of exhaust temperature on the lower scale and turbo boost pressure on the upper scale. Turbocator kits (95-5101, 95-5102) include tubing, lead wire and thermocouple. Black bezel. 100° sweep. Chrome bezel available.

PART NUMBER	ISSPRO No.	°F SCALE	°C SCALE	BOOST RANGE	BEZEL
95-5100	R609	300-1500°	None	0-30 psi	Black

The horsepower developed by a diesel engine depends on the amount of fuel burned. For maximum efficiency it is important that the fuel and air delivered to the combustion chambers is supplied in the proper ratio. It takes about 2,500 gallons of air for every gallon of fuel to provide efficient combustion. High exhaust temperature, excessive or incomplete fueling all will affect the efficiency of the engine.

Increases in exhaust temperatures are caused by:

- 1) Excessive fueling: Caused either by improper use of the throttle or by a faulty fuel system. Fueling problems on electronically controlled engines will first show up on the pyrometer, since the exhaust temperature will increase approximately by five degrees for every pound of excess fuel burned.
- 2) High intake air temperature: Every degree increase of intake air temperature will cause a three-degree rise in the exhaust temperature.
- 3) Air restriction: Caused by dirty air cleaners (intake restriction). For every increase of ten inches of engine vacuum, there will be a corresponding increase of thirty degrees in the exhaust temperature.
- 4) Vehicle operation at higher altitude: For every 1000 foot increase in operating altitude there will be a twenty five degree rise in the exhaust temperature.
- 5) Increase in rolling resistance due to improper tire inflation or operating into a headwind.
- 6) Lugging the engine due to improper throttle use or improper shifting.

Excessive heat is one of the enemies of turbochargers. The maximum input temperature to a turbocharger should be in the 1400 degree F range. Temperatures higher than this will hasten the deterioration of the turbocharger's housing through cracking, and will foul the turbocharger and may also result in damage to the intake and exhaust manifolds and cylinders.

Engine over revving through excessive fueling can give cause to many engine problems such as breaking valves, and heat damage to both the engine and the turbocharger. Over speeding of the engine past the governed speed on down grades will cause the engine governor to shut off fuel to the injectors, thereby depriving them of lubrication which can result in sticking injectors. Badly adjusted speed governors, incorrect governor settings, or wrong governor selection can all lead to engine damage.

Incomplete fueling is another cause of many engine problems. Often caused by restricted air supply, it too will lead to excessive fuel consumption. The unburned fuel will wash lubricating oil off the cylinder walls, causing burned or scored pistons and damaged piston rings. Unburned fuel may also contaminate and dilute the lubricating oil.



To determine the **safe maximum exhaust temperature**, run a well tuned engine at full RPM and horsepower on an inertia dynamometer or under full load. Note the exhaust temperature and subtract 200 F degrees, which gives the safe maximum exhaust temperature. This temperature may be exceeded for short periods of time without causing serious damage, but staying in the upper third of the temperature range of the pyrometer will give the best performance and will reduce the danger of engine problems.



95-5169 Leadwire Plug in connector



95-5173 Lead wire standard length



95-5121 Thermocouple hose clamp for easy installation



95-5127 Thermocouple for smaller diameter exhaust tubes



95-5130 Thermocouple plug-in connector



95-5131 Thermocouple probe, adjustable for depth

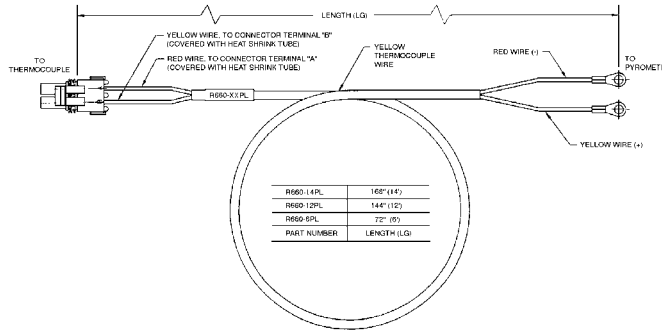


95-5138 Thermocouple plug-in connector

## Lead Wires

A type K high temperature lead wire is required for all of the pyrometers contained in this catalog. They are generally purchased separately but can also be purchased along with the gauge, thermocouple and weld bushing, as part of a convenient pyrometer system kit. Refer to the price list for kits

WITH RING TERMINAL			WITH PLUG-IN		
PART NUMBER	ISSPRO No.	LENGTH	PART NUMBER	ISSPRO No.	LENGTH
95-5165	R660-6	6 ft.	95-5169	R660-6PL	6 ft.
95-5173	R660-10	10 ft.	95-5174	R660-10PL	10 ft.
95-5175	R660-14	14 ft.	95-5176	R660-14PL	14 ft.

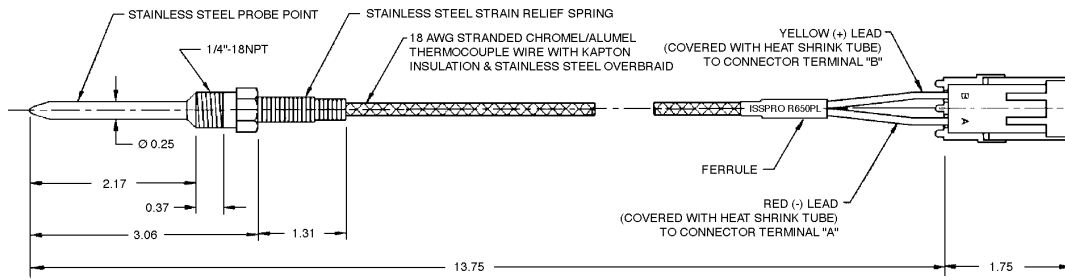


## Thermocouples

The **thermocouple** is the primary element of the pyrometer system. Two different types of metal are induction welded together to form the tip of the thermocouple. This assures a fast reaction time because the tip and thermocouple wire are the same and this junction is protected from damage. The tip is made of stainless steel and is filled with a ceramic material, making the probe solid and protecting the internal wires from damage.

The aircraft quality Kapton® leads are encased in a flexible stainless steel wire braid for protection from heat and abrasion. A spiral wound strain relief spring protects the wire at the exit point of the probe. When heat is applied to the thermocouple a voltage proportional to the amount of heat applied is produced, and this voltage is read by the pyrometer and interpreted as a temperature. Note that it is important to never introduce any solder joints between the thermocouple and the pyrometer as such joints would introduce further voltages which would affect the calibration of the pyrometer and produce erroneous readings. The pyrometers cataloged here are calibrated to a type K thermocouple which produce -1.63nV at 0°F and 26.03mV at 1200°F (Ref. Junc. 75°F)

PART NUMBER	ISSPRO No.	MOUNTING	°F SCALE	PROBE LENGTH	EXHAUST TUBE DIAMETER	GAUGE CONNECTION
95-5120	R650	1/4" NPTF	0-1600°	2.25"	Standard	Bolt-on
95-5126	R650PL	1/4" NPTF	0-1600°	2.25"	Standard	Plug-in
95-5127	R650S	1/4" NPTF	0-1600°	1.6"	Small	Bolt-on
95-5130	R650SPL	1/4" NPTF	0-1600°	1.6"	Small	Plug-in
95-5131	R658	1/4" NPTF	0-1600°	Adjustable	Standard	Bolt-on
95-5134	R658PL	1/4" NPTF	0-1600°	Adjustable	Standard	Plug-in
95-5135	R658S	1/4" NPTF	0-1600°	Adjustable	Small	Bolt-on
95-5138	R658SPL	1/4" NPTF	0-1600°	Adjustable	Small	Plug-in
95-5124	R650HT	1/4" NPTF	0-2000°	2.25"	Standard	Bolt-on
95-5125	R650HT-PL	1/4" clamp	0-2000°	2.25"	Standard	Plug-in
95-5128	R650SHT	1/4" NPTF	0-2000°	1.6"	Small	Bolt-on
95-5129	R650SHT-PL	1/4" NPTF	0-2000°	1.6"	Small	Plug-in
95-5132	R658-HT	1/4" NPTF	0-2000°	Adjustable	Standard	Bolt-on
95-5133	R658HT-PL	1/4" NPTF	0-2000°	Adjustable	Standard	Plug-in
95-5136	R658SHT	1/4" NPTF	0-2000°	Adjustable	Small	Bolt-on
95-5137	R658SHT-PL	1/4" NPTF	0-2000°	Adjustable	Small	Plug-in
95-5121	R650A-HT	clamp	0-2000°	Adjustable	Standard	Bolt-on
95-5123	R650A-HT-PL	clamp	0-2000°	Adjustable	Standard	Plug-in



95-5126 Thermocouple

### Thermocouple Accessories

PART NUMBER	ISSPRO No.	TYPE	DESCRIPTION
95-5155	R680	Weld Bushing	Weld onto exhaust tube for a 1/4" NPTF connection to mount thermocouple.
95-5156	R681	Compression Fitting	Brass, 1/8-27 NPTF
95-5157	R682	Compression Fitting	Brass, 1/4-18 NPTF
95-5158	R683	Compression Fitting	Steel, 1/8-27 NPTF
95-5160	R7980	Fiberglass sleeve	Protects thermocouple leads from shorting.



95-5155 Weld bushing



95-5156 Compression fitting brass, 1/8-27 NPTF

### Pyrometer Tester

#### 95-5221 Pyrometer Tester

We have found that over 75% of all warranty claims are for non-defective parts. Mechanics have not had an inexpensive way of testing the pyrometer system. Our **Pyrometer System Tester** (illustrated below) eliminates guess work by checking the thermocouple and lead wire continuity. It allows running the meter through the entire scale to check its operation, thus diagnosing the complete system in a few minutes.



## Technical Tips

Hot engine shutdown is a major cause of turbocharger damage. To prevent this, engine manufacturers recommend idling an engine for a period of time before it is shut down. This allows oil to flow through the bearings to cool them. The goal is to reduce bearing temperature to 300°F. Using Tectran's Turbo Temp Monitor can achieve this (see page 30 in the Specialty & Accessories section). A thermocouple is mounted downstream of the turbocharger and monitors exhaust gas temperature and delays shutdown until 300°F is reached. Shutting the engine down after proper cooling prevents dangerous deposits from forming and turbo life is increased.



Refer to the Specialty Products and Accessories section of this catalog for more information about Turbo Temp Monitors and Engine Shutdown/Protection Kits.



All too often, a mechanic will install a replacement gauge only to find that the fault condition still exists with the new gauge. When trouble-shooting pyrometer systems, be sure to test the lead wire, its connections and the thermocouple as well as the gauge. Tectran can supply complete kits that include all of the components needed in the pyrometer system. This kit approach is also convenient for retrofitting vehicles that do not have exhaust temperature measurement systems.

## Design Your Own Pyrometer System...

Pyrometers	Step 1	Thermocouples	Step 2	Lead Wires	Step 3
List Your Part Number Selections Here	1. _____	List Your Part Number Selections Here	1. _____	List Your Part Number Selections Here	1. _____
	2. _____		2. _____		2. _____
	3. _____		3. _____		3. _____
	4. _____		4. _____		4. _____
	5. _____		5. _____		5. _____
Select Your Pyrometer (see pages 12 -13)		Select Your Thermocouple (see page 15)		Select Your Leadwire (see page 15)	

**Congratulations! Your Pyrometer System Is Complete.**