

SERVICE INSTRUCTION

DATE: May 23, 1997

Service Instruction No. 1187J
(Supersedes Service Instruction No. 1187H)
Engineering Aspects are
FAA Approved

SUBJECT: Turbocharger Density Controller Adjustment

MODELS AFFECTED: TIO-540-A1A, -A1B, -A2A, -A2B, -A2C, -C1A, -F2BD, -J2B, -J2BD,
-N2BD, -AA1AD, -AB1AD, -AF1A, -AF1B, -AG1A; LTIO-540-F2BD,
-J2B, -J2BD, -N2BD.TIME OF COMPLIANCE: On newly installed engines; before aircraft is flown. Also recommended at
100 hour inspection or at owner's discretion.

Although engines are thoroughly tested after manufacture, it is impossible to duplicate the individual installation characteristics an engine will encounter in the aircraft; consequently, the density controller, which governs the turbocharging, must be adjusted after the engine is installed and before the aircraft is flown.

NOTE

Accuracy of the manifold pressure gage should be established prior to any readjustment of the density controller.

To insure the engine is developing rated full throttle power, it is necessary to periodically check the adjustment of the density controller. This comparatively simple procedure consists of measuring air compressor discharge temperature (deck temperature) under operating conditions and comparing it with indicated manifold pressure. Then, if necessary, adjust the density controller accordingly. The details for accomplishing the density controller check are as follows:

1. Installation of Deck Temperature Thermocouple Probe:

TIO-540-A1A, -A1B, -A2A and -A2B: To install the deck temperature thermocouple probe on the early models of the engine, remove the 3/8-16 bolt (P/N LW-38-0.59) which is the lower mounting bolt of the differential pressure controller. See Figure 1. Install the deck temperature probe, Lycoming Tool No. ST-264-B (See Figure 8) in the hole from which the 3/8-16 bolt was removed. On later models of the above engine, remove the 3/8-16 bolt (P/N LW-38-0.59) located directly in back of the air valve assembly in the air inlet housing. See Figure 3. Install the deck temperature thermocouple probe, Lycoming Tool No. ST-264-B in the hole from which the bolt was removed.

TIO-540-C1A: Remove the 7/16-20 plug (P/N AN-814-4L) or the 3/8-16 bolt (P/N LW-38-0.59) located on the left side of the air inlet housing directly below fuel injector. See Figure 2. Install the correct deck temperature thermocouple probe according to the size of the plug or bolt removed (See Figure 8).

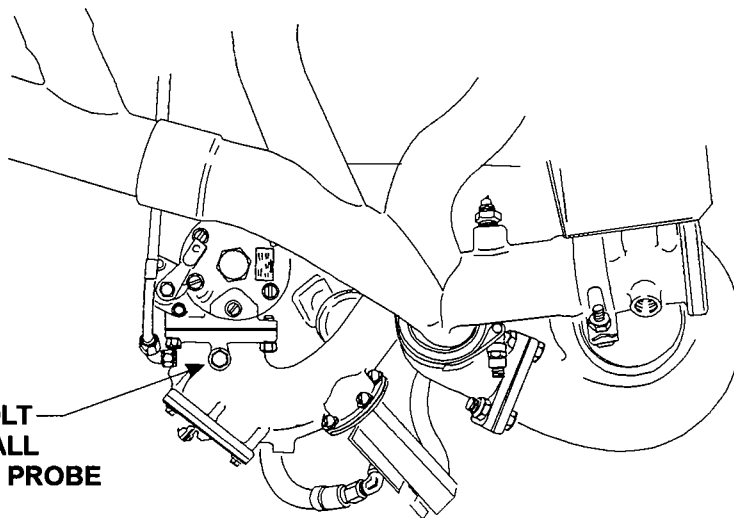
TIO-540-A2C; LTIO/TIO-540-F2BD, -J2B, -J2BD, -N2BD: Remove the 3/8-16 bolt (P/N LW-38-0.59) located directly in back of the air valve plate assembly in the air inlet housing. See Figure 3. Install the deck temperature thermocouple probe (Lycoming Tool No. ST-264-B) (See Figure 8) in the hole from which the 3/8-16 bolt was removed.



**ON EARLY MODELS REMOVE 3/8- 16 BOLT
FROM THIS LOCATION AND INSTALL
THERMOCOUPLE PROBE ST-264-B**

**ON LATER MODELS REMOVE BOLT FROM
LOCATION AS SHOWN IN FIGURE 3.
INSTALL PROBE ST-264-B**

Figure 1. Left Side View - TIO-540-A1A, -A1B, -A2A and -A2B



**REMOVE 7/16 PLUG OR 3/8-16 BOLT
FROM THIS LOCATION AND INSTALL
CORRECT SIZE THERMOCOUPLE PROBE**

Figure 2. Left Side View - TIO-540-C1A

TIO-540-AB1AD: Remove the 3/8-16 bolt (P/N LW-38-0.59) located on the side of the air inlet housing facing the front of the engine. (See Figure 4.) Install the deck temperature thermocouple probe (Lycoming Tool No. ST-264-B, Figure 8) in the hole from which the 3/8-16 bolt has been removed.

TIO-540-AA1AD: Remove the 3/8-16 bolt (P/N LW-38-0.59) located on the right side of the air inlet housing. (See Figure 5.) Install the deck temperature thermocouple probe (Lycoming Tool No. ST-264-B) in the hole from which the bolt was removed.

TIO-540-AF1A, -AF1B: Remove the 7/16-20 plug (P/N AN-814-4L) from the left side of the air inlet housing (Figure 6). Install the deck temperature thermocouple probe (Lycoming Tool No. ST-264-C).

TIO-540-AG1A: Remove the 7/16-20 plug (P/N AN-814-4L) from the bottom of the air inlet housing (Figure 7). Install the deck temperature thermocouple probe (Lycoming Tool No. ST-264-C).

2. Connect Probe to Thermocouple Extension and Potentiometer: Connect leads of the thermocouple extension, Lycoming Tool No. ST-265 to the probe and to the potentiometer as indicated in Figure 9.

NOTE

Potentiometer to be used with thermocouple extension ST-265 must be an 8 ohm instrument, in accordance with AN 5536. Lewis Engineering Co.'s model 23B2F Type J, Minimate Model 31101 Type J, or equivalent with scale range 0°F. to 400°F. (600°F. maximum) is satisfactory for this purpose. However, regardless of the instrument used, it is necessary for the resistance of the instrument to equal the total resistance of the probe, the extension and the leads within 0.1 ohm; otherwise, erroneous temperature readings will be obtained.

3. Stabilize Aircraft Temperature: Start the engine and ground run the aircraft until normal operating temperature is obtained; do not exceed engine speed and manifold pressure stated in Table 1. On TIO-540-C1A, -AB1AD, -AF1A, -AF1B and -AG1A engines, it is required to shut the engine down after the initial warm-up for 4 to 5 minutes to allow proper heat soak of engine components. To insure this temperature has stabilized, readings and adjustments must be made with the aircraft cowling installed. Restart engine and run (minimum (2) minutes) until induction air temperature as indicated on the potentiometer has stabilized.

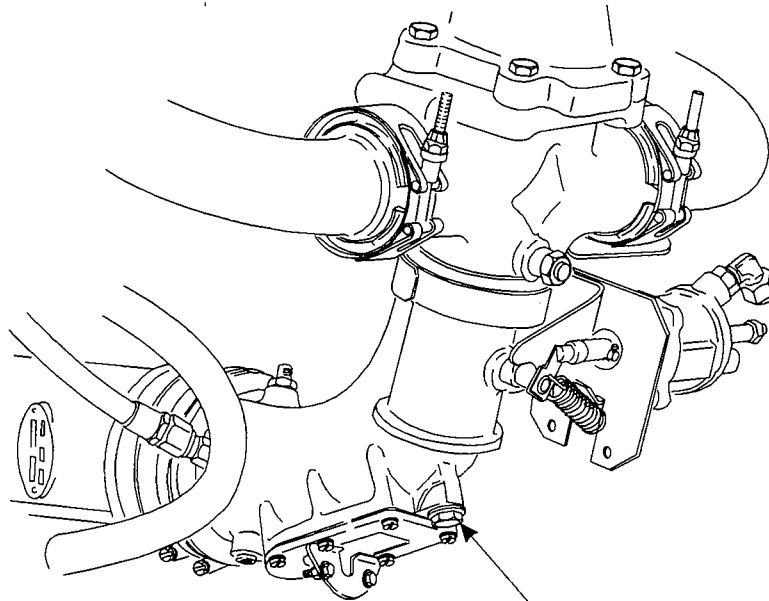
4. Check Induction Air Temperature with Manifold Pressure: Note both engine manifold pressure and compressor discharge temperature at full throttle and compare with the chart shown in Figure 10 for TIO-540-A1A, -A1B, -A2A, -A2B and Figure 11 for TIO-540-C1A. See Figure 12 for TIO-540-A2C and Figure 13 for LTIO/TIO-540-J2B, -J2BD and -N2BD. See Figure 14 for LTIO/TIO-540-F2BD, Figure 15 for TIO-540-AB1AD, Figure 16 for TIO-540-AA1AD, Figure 17 for TIO-540-AF1A, -AF1B, and Figure 18 for TIO-540-AG1A.

CAUTION

TO PREVENT POSSIBLE ENGINE DAMAGE DURING INITIAL OPERATION OF A NEW ENGINE OR OF A NEWLY INSTALLED DENSITY CONTROLLER, DO NOT EXCEED THE GROUND-DETERMINED MANIFOLD PRESSURE LISTED IN TABLE 1. IT MAY BE NECESSARY TO DECREASE DENSITY-CONTROLLER ADJUSTMENTS BEFORE ATTEMPTING FULL-THROTTLE OPERATION, AND THEN TO ESTABLISH FINAL ADJUSTMENT SETTINGS IN CONFORMANCE WITH THE CURVES SHOWN IN FIGURES 10 THROUGH 18.

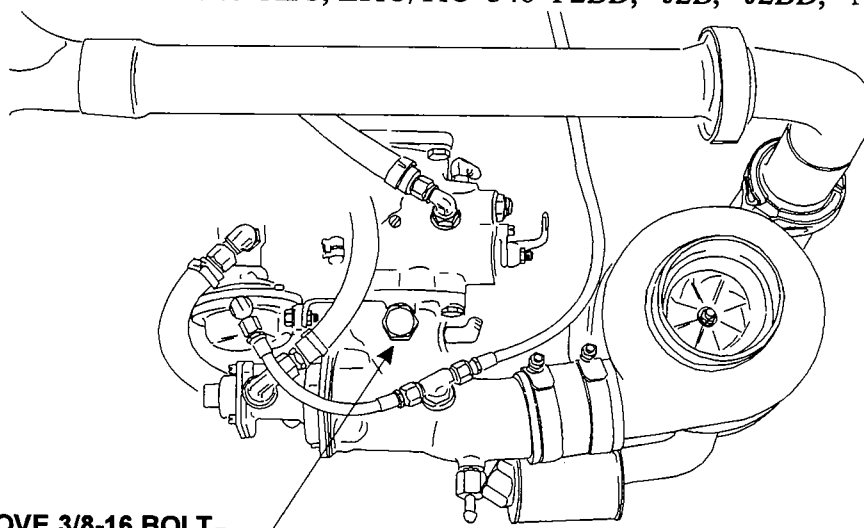
TABLE 1

MODEL	RPM	MAXIMUM MP
TIO-540-A1A, -A1B, -A2A, -A2B	2575	42 in. Hg.
TIO-540-C1A	2575	36 in. Hg.
TIO-540-A2C	2575	43.6 in. Hg.
LTIO/TIO-540-F2BD	2575	47 in. Hg.
LTIO/TIO-540-J2B, -J2BD, -N2BD	2575	46.5 in. Hg.
TIO-540-AA1AD	2575	39 in. Hg.
TIO-540-AB1AD, -AF1A, -AF1B,	2575	38 in. Hg.
TIO-540-AG1A	2575	39 in. Hg.



REMOVE 3/8-16 BOLT FROM THIS LOCATION AND INSTALL PROBE NO. ST-264-B

Figure 3. Rear View - TIO-540-A2C; LTIO/TIO-540-F2BD, -J2B, -J2BD, -N2BD



REMOVE 3/8-16 BOLT FROM THIS LOCATION AND INSTALL THERMOCOUPLE PROBE ST-264-B

Figure 4. Left Side View - TIO-540-AB1AD

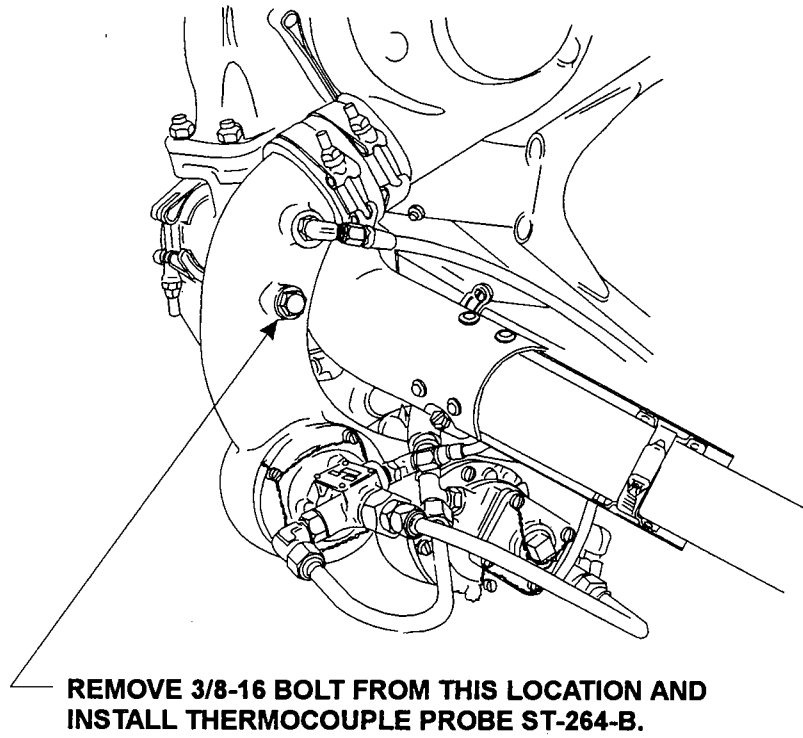


Figure 5. Right Side View - TIO-540-AA1AD

**REMOVE 7/16-20 PLUG FROM THIS LOCATION
AND INSTALL THERMOCOUPLE PROBE
ST-264-C.**

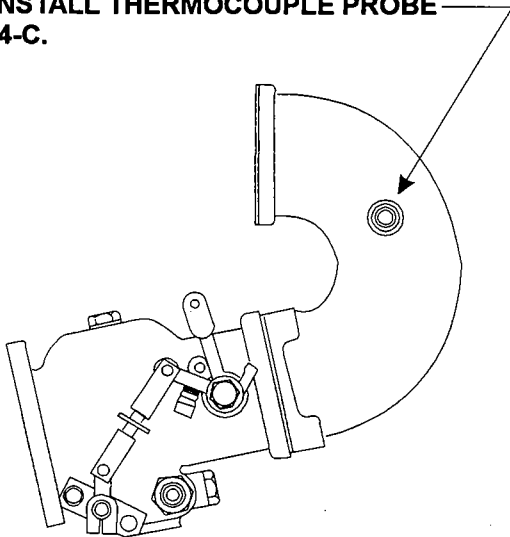


Figure 6. Left Side View -
TIO-540-AF1A, -AF1B

**REMOVE 7/16-20 PLUG FROM THIS LOCATION
AND INSTALL THERMOCOUPLE PROBE
ST-264-C.**

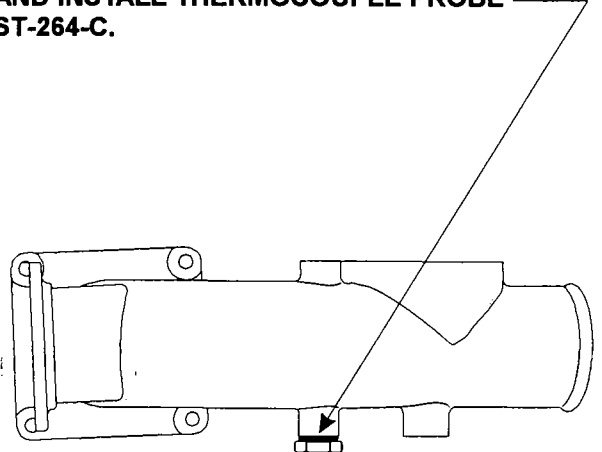
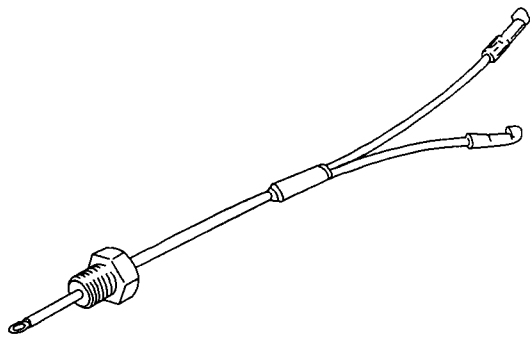
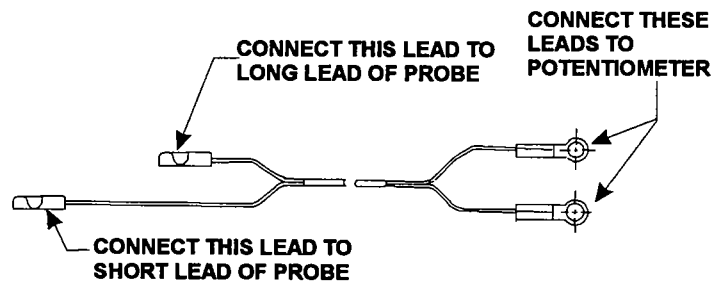


Figure 7. Rear View - TIO-540-AG1A



ST-264-B 3/8-16 THD.
ST-264-C 7/16-20 THD.



NOTE: POTENTIOMETER TO BE 8 OHM INSTRUMENT. LEWIS INSTRUMENT CO. MODEL 2382 WITH SCALE RANGE 0° TO 600°F. IS SUITABLE.

■ Figure 8. Deck Temperature Thermocouple Probe ■ Figure 9. Thermocouple Extension No. ST-265

NOTE

If manifold pressure, at the observed compressor discharge temperature, falls within the limits indicated in Figures 10 through 18, the density controller does not require adjustment. If manifold pressure is not within limits, however, adjust the density controller as described for the following models.

5. TIO-540-A1A and -A2A Engines - Adjustment of Density Controller: The density controller is mounted on the right side of the air induction housing. Remove lockwire from the access plug and remove plug from controller. Insert a screwdriver in the hole and engage the adjusting screw. Turning the screw inward, or clockwise will increase manifold pressure; turning it counter-clockwise (outward) will decrease manifold pressure.

CAUTION

TURNING THE ADJUSTING SCREW 1/16 TURN WILL CHANGE THE MANIFOLD PRESSURE APPROXIMATELY 2 INCHES; THEREFORE, CARE MUST BE EXERCISED TO TURN THE SCREW IN VERY SMALL INCREMENTS UNTIL CORRECT ADJUSTMENT IS OBTAINED.

On TIO-540-A1B, -A2B, -A2C, -C1A, -AA1AD, -AB1AD, -AF1A, -AF1B, -AG1A and LTIO/TIO-540-J2B, -J2BD, -F2BD, -N2BD engines, the adjustment is made in the same manner except that a cover plug is not incorporated with the density controller; simply remove the lockwire from the adjusting fitting, and by means of a small wrench, turn the square head of the fitting clockwise or counter-clockwise to accomplish the adjustment. Be very careful when reinstalling safety wire to avoid turning the adjusting fitting.

NOTE

On twin engine aircraft, during full power operations, differences in manifold pressure between engines may be accepted as indicated between maximum and minimum on manifold pressure tables. This is typical of normal operation of the density controllers as they respond to slight differences in induction air temperature caused by filters, heat soak and other variations in the induction systems.

NOTE

Density controller with P/N LW-10682 has superseded density controllers with P/N's 78451, 78328, LW-11801 and LW-12067. The adjustment procedure for the new density controller is the same as that for the superseded controllers.

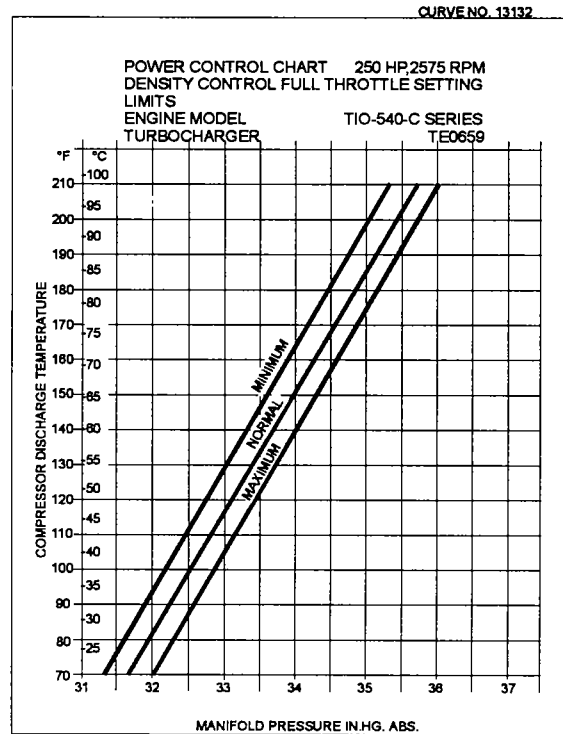
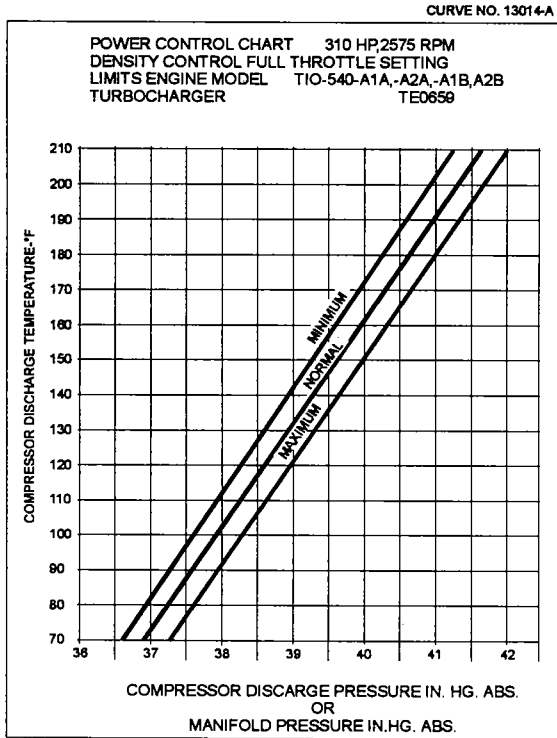


Figure 10. TIO-540-A1A, -A1B, -A2A, -A2B
 Induction Air Temperature vs. Manifold Pressure

Figure 11. TIO-540-C1A
 Induction Air Temperature vs. Manifold Pressure

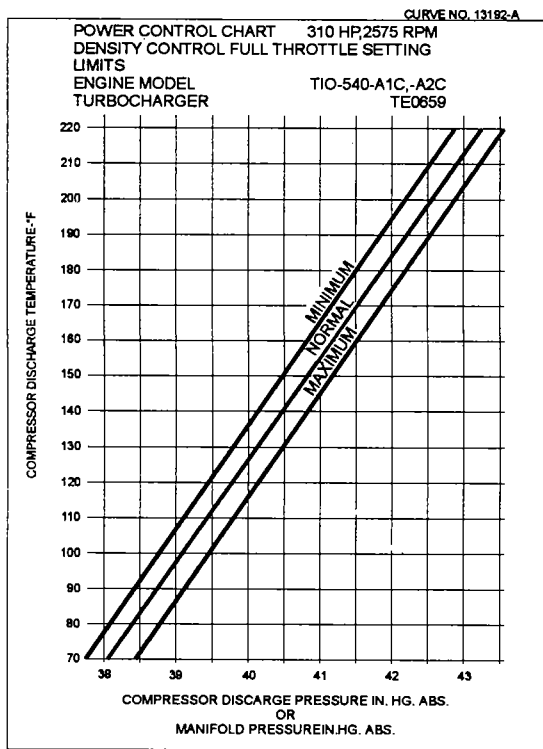


Figure 12. TIO-540-A2C
 Induction Air Temperature vs. Manifold Pressure

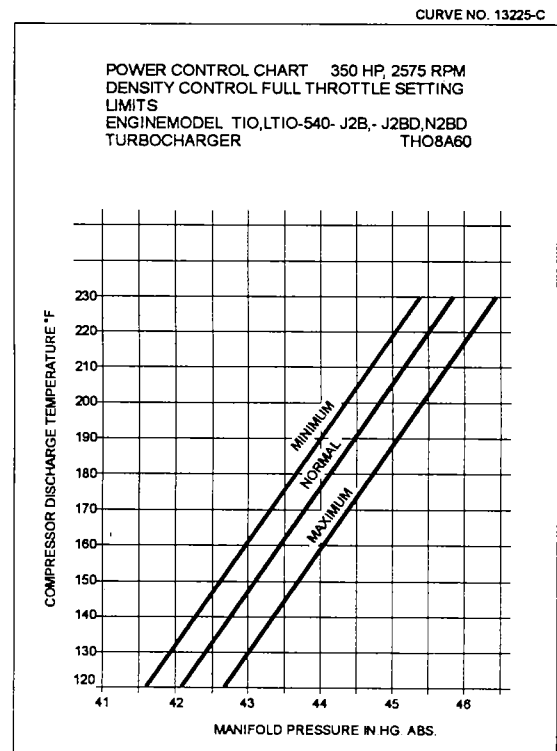


Figure 13. LTIO/TIO-540-J2B, -J2BD, -N2BD
 Induction Air Temperature vs. Manifold Pressure

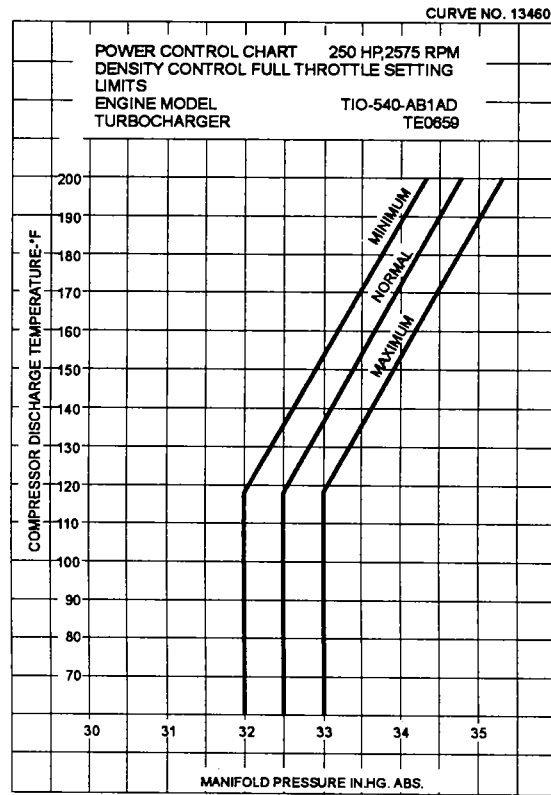
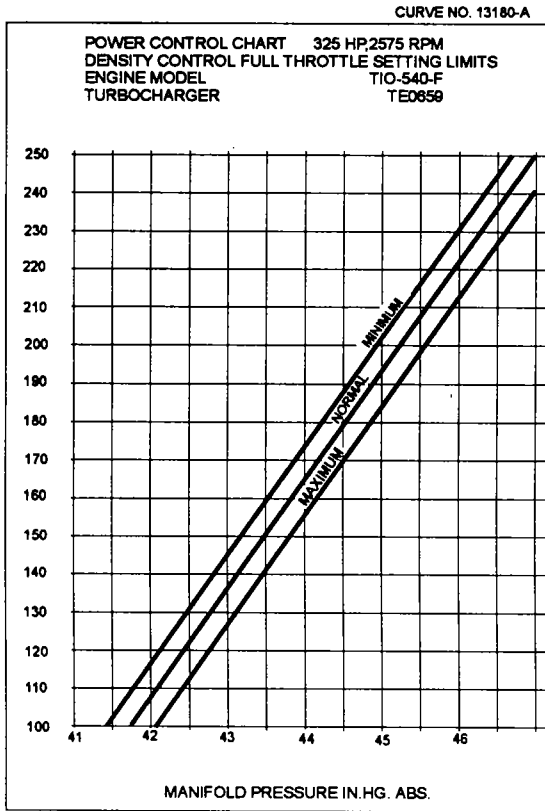


Figure 14. LTIO/TIO-540-F2BD
Induction Air Temperature vs. Manifold Pressure

Figure 15. TIO-540-AB1AD
Induction Air Temperature vs. Manifold Pressure

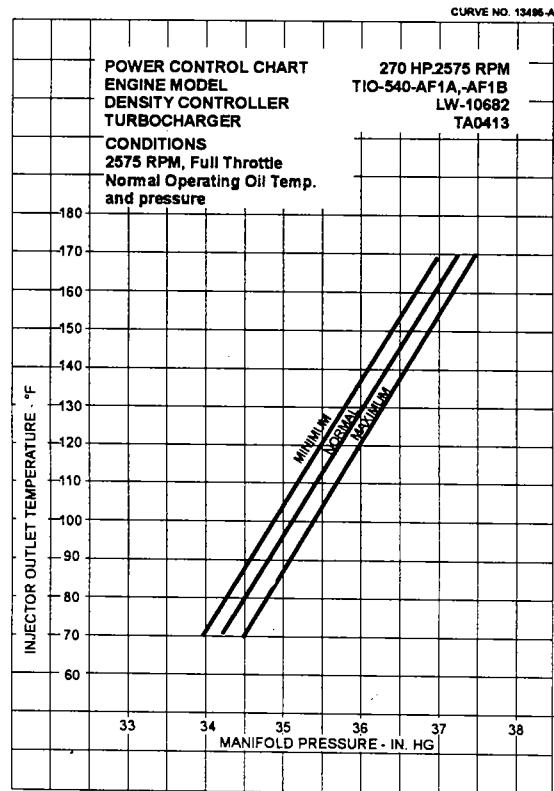
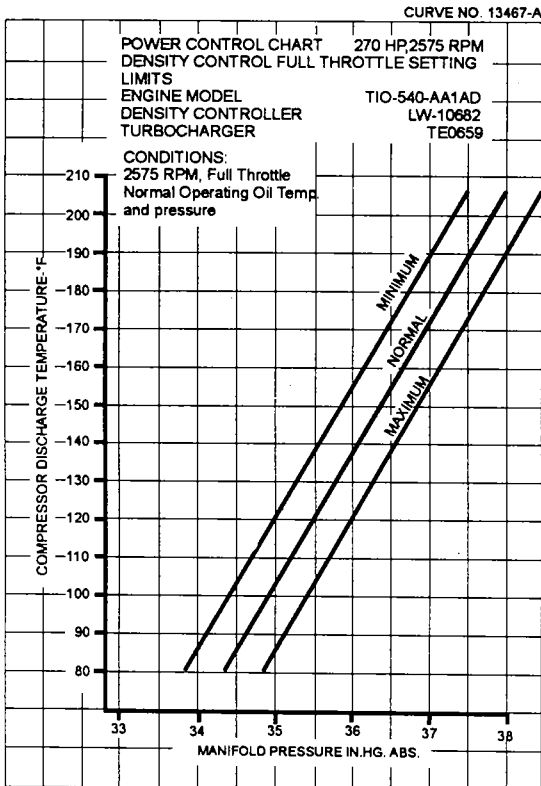


Figure 16. TIO-540-AA1AD
Induction Air Temperature vs. Manifold Pressure

Figure 17. TIO-540-AF1A, -AF1B
Induction Air Temperature vs. Manifold Pressure

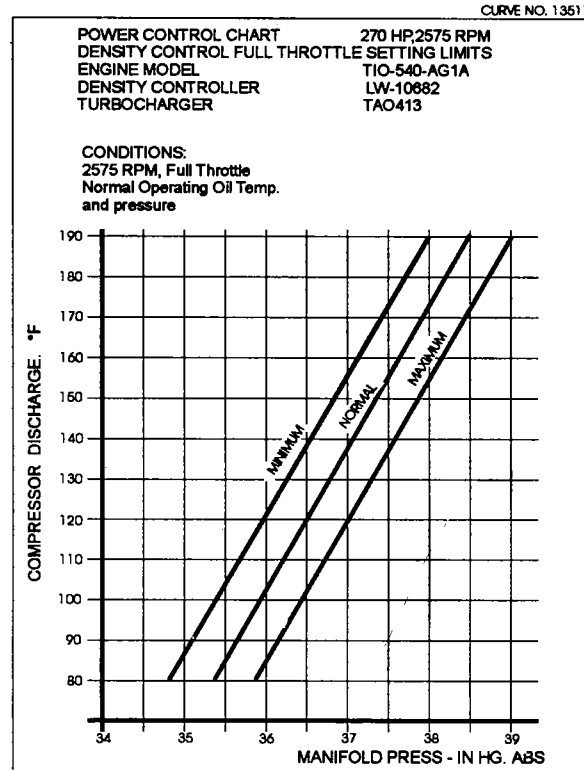


Figure 18. TIO-540-AG1A
Induction Air Temperature vs. Manifold Pressure

SPECIAL TOOLS REQUIRED:

ST-264-B	Deck Temperature Thermocouple Probe (3/8-16 Thd.)
ST-264-C	Deck Temperature Thermocouple Probe (7/16-20 Thd.)
ST-265	Thermocouple Extension

Digital Thermocouple Thermometer,
may be procured from:

Model 872 Type J
Model HH-70 Type JF
Omega Engineering, Inc.
One Omega Drive
Box 4047
Stanford, CT 06907
Phone: (203) 322-1666

or

Model 714J
Precision Digital Corp.
80 Coolidge Hill Rd.
Watertown, MA 02172
Phone: (617) 924-2256

Potentiometer – may be procured from:

Lewis Model 23B2F Type J
Lewis Engineering Co.
238 Water Street
Naugatuck, CT 06770
Phone: (203) 729-5253

or

Minimite Model 31101 Type J
Thermo Electric Co.
107 5th Street
Saddlebrook, NJ 07662
Phone: (201) 843-5800

NOTE: Revision "J" adds model TIO-540-AG1A, revises Figures 12, 13 and 14.