Technical *Bulletin*

Subject: Compressor Turbocharging

Traditionally, Bendix has permitted compressor turbocharging with certain exceptions and limitations. Generally, original equipment installations of turbocharged compressors have prior Bendix approval. Factors affecting approval of a specific installation include the engine, turbocharger and compressor combination.

Compressor turbocharging becomes a concern in the Aftermarket when one of the components of the originally approved combination is changed or when turbocharging is considered for a previously unturbocharged compressor. For example, when a turbocharged TuFlo 501 is changed over to a TuFlo 700.

The following can be used as a guide to determine if it is acceptable to turbocharge a Bendix compressor in a specific application.

TURBOCHARGING

Definition

A turbocharger is a turbine driven compressor unit where the turbine is driven by the hot gases of the engine exhaust. Its function is to increase engine efficiency and power output by compressing air drawn through the vehicle air cleaner and directing the compressed air into the engine intake manifold. The air pressure generated can typically fluctuate between 30 psi and a slight vacuum, depending upon engine load. Turbocharger outlet pressure increases as engine load increases.

A vehicle brake system compressor is turbocharged when its inlet is connected to the outlet or PRESSURE side of the turbocharger. For example; a compressor would be turbocharged if its inlet is connected to the intake manifold of a turbocharged engine.

Advantages of Compressor Turbocharging

1. Convenience of installation – Often the location of the compressor relative to the engine manifold allows a short connecting line to be used.
2. Enhanced oil control – The elimination of inlet vacuum reduces the possibility of excessive oil passing.
3. Increased compressor capacity – Under some circumstances compressor capacity is increased. The following chart illustrates some vehicle and road conditions as related to the turbocharger output.

Vehicle/Road Condition	Engine Speed	Engine Power	Typical Turbocharger Outlet Pressure (psi)
Uphill	Governed	High Power Full Load	10 - 30 psi
Downhill	Governed	Engine Braking (i.e. downhill in gear)	Slight vacuum to slight pressure
Parked	Governed	No Load	0 to 2.0 psi

Disadvantages of Compressor Turbocharging

The primary disadvantage is reduced compressor durability when Bendix turbocharging guidelines are not followed.

TURBOCHARGING GUIDELINES

General

1. Particular attention must be given to the specified minimum inlet, discharge and coolant line sizes along with coolant flow requirements for the compressor model being turbocharged. Turbocharging of FULLY air cooled compressors is not recommended.

MINIMUM LINE SIZE AND COOLANT FLOW REQUIREMENTS

COMPRESSOR MODEL	MINIMUM I.D. INLET LINES	MINIMUM I.D. DISCHARGE LINES	MINIMUM I.D. COOLANT LINES	MINIMUM COOLANT FLOW AT MAXIMUM ENGINE R.P.M.
TuFlo 400	.625" (15.9mm)	.41" (10.4 mm)	.31" (7.9 mm)	0.5 gal/min. (1.9 L/min.) at engine idle
TuFlo 500, 501, 600, 700, and BX-2150	.625" (15.9mm)	.5 " (12.7 mm)	.375" (9.5 mm)	2.5 gal/min. (9.5 L/min.) at max.engine RPM
TuFlo 1000	Note 1	Note 2	.375" (9.5 mm)	All Bendix compressors
TuFlo 1400	.875" (22.1mm)	.75" (19 mm)	.375" (9.5 mm)	

NOTE 1: .625" (15.9 mm) I.D. to each cylinder block inlet or 1" (25.4 mm) I.D. from a common manifold between the two cylinder block inlets.

NOTE 2: .5" (12.7 mm) I.D. from each cylinder head discharge port to a common manifold with a .875 (22.1 mm) I.D. line from the manifold to the air reservoir.

2. If a previously unturbocharged compressor is being turbocharged, it is recommended that the inlet cavity screen 238948 be installed with an inlet gasket (291909) on both sides of the screen.

3. If a compressor is being turbocharged for the first time and specific turbocharger data is not available to confirm that the installation is within the stated Bendix compressor turbocharging parameters, the installation must be tested.

   A full vehicle dynomometer can be used to measure turbocharger performance at maximum engine operating conditions. For this test, temperature and pressure sensing equipment should be installed at the compressor inlet to verify that the compressor turbocharging parameters are being met. This equipment can be installed using two alcohol evaporator compressor inlet adapters (236701). See Figure 1.

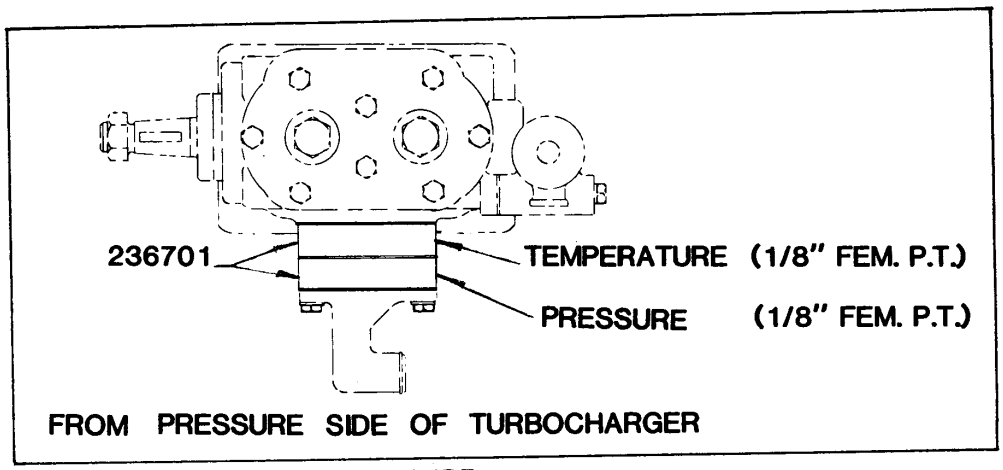

FIGURE 1

4. The Bendix inlet regulating valve (IRV) can be installed as an alternative to direct compressor turbocharging when it is found that turbocharger supply air pressure exceeds the limits of a particular compressor model. The function of the IRV is to maintain a pressure of 10 psi or less at the compressor inlet regardless of turbocharger supply air pressure. While use of the IRV eliminates concern with turbocharger pressure output, the installation must comply with all other compressor turbocharging parameters. The IRV, part number 104171, can be installed on all Bendix compressors with the exception of the BX-2150.

COMPRESSOR TURBOCHARGING PARAMETERS

TuFlo 400, 500, 501 & 1000 Compressors

1. Air entering the compressor inlet during the loaded cycle must not exceed 250F (121C). A metal inlet line is suggested to help meet this parameter.
2. Compressor crankshaft speed must not exceed 2200 rpm.
3. Air pressure at the compressor inlet must not exceed 25 psi (172 kPa).
4. Turbocharging is not recommended for fully air cooled versions of the TuFlo 500 and 1000 air compressors.

TuFlo 600, 700 & 1400 Compressors

1. Air entering the compressor inlet(s) during the loaded cycle must not exceed 250F (121C). A metal inlet line is suggested to help meet this parameter.

2. The following compressor crankshaft rotative speed and inlet pressure relationships may not be exceeded.

Crankshaft RPM	Maximum Compressor Inlet Pressure
1900 rpm	25 psi (172 kPa)
2000 rpm	22 psi (151 kPa)
2100 rpm	19 psi (131 kPa)
2200 rpm	15 psi (103 kPa)

BX-2150 Compressor

1. Air entering the compressor inlet during the loaded cycle must not exceed 250F (121C). A metal inlet line is suggested to help meet this parameter.
2. Compressor crankshaft speed must not exceed 2200 rpm.
3. Air pressure at the compressor inlet must not exceed 15 psi (103 kPa).
4. The Bendix inlet regulating valve (IRV) must not be installed on this model compressor.