Test Method for Measuring Power Consumption of Air Conditioning and Air Brake Compressors for Trucks and Buses -SAE J1340 JUL81

SAE Recommended Practice
Approved July 1981

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PREPRINT

TEST METHOD FOR MEASURING POWER CONSUMPTION OF AIR CONDITIONING AND AIR BRAKE COMPRESSORS FOR TRUCKS AND BUSES—SAE J1340 JUL81

SAE Recommended Practice

Report of the Truck and Bus Fuel Economy Committee, approved July 1981.

1. Purpose—The purpose of this SAE Recommended Practice is to provide a recommended test procedure for establishing the power consumption of an air brake compressor or an air conditioning compressor. It is intended that this test procedure be used to determine compressor power consumption over a range of operating conditions, including both the loaded and unloaded modes. The resulting data is intended for use in the measure of probable vehicle fuel consumption under operating conditions.

2. Scope—The testing techniques outlined in this SAE Recommended Practice were developed as part of an overall program for testing and evaluating fuel consumption of heavy-duty trucks and buses. The technique outlined in this recommended practice provides a general description of the type of equipment and facility which is necessary to determine the power consumption of these engine-driven components.

It is recommended that the specific operating conditions suggested throughout the test be carefully reviewed on the basis of actual data obtained on the specific vehicle operation.

If specific vehicle application is not known, see SAE J1343, "Information Relating to Duty Cycles and Average Power Requirements of Truck and Bus Engine Accessories," Section 3, Air Brake Compressors and Section 5, Air Conditioning Compressor.

3. Test Equipment and Instrumentation

3.1 A test stand capable of driving the compressor over the recommended range of operating rpm.

3.2 A torque transducer calibrated over the full operating range of the compressor or other suitable means of determining torque.

3.3 A control source of cooling water, lubricating oil, cooling air and/or refrigerant as required to meet the test conditions.

4. Test Procedure—Air Brake Compressors

4.1 Operating Conditions—The operating conditions are to be selected to simulate the duty cycle determined from vehicle in-service application.

4.2 Lubricating Oil

Temperature at Compressor Inlet:	180 ± 5° F
Oil Viscosity:	SAE 30
Oil Pressure:	40 ± 10 psig

4.3 Coolant (As Recommended by Manufacturer)

Flow:	3 ± 0.5 gpm
Temperature, Inlet:	185 ± 10° F

4.4 Ambient Air Temperature

85 ± 15° F

4.5 Air Inlet—Compressor to run with an open inlet without manifold connector or filter.

4.6 Air Flow—(If Air Cooled)—Is 500 ± 20 cfm at 2700 ± 300 ft/min measured at either corner of the cylinder head where the air impinges the head. The air flow shall impinge the compressor head from the top along the air compressor crankshaft center line and at a 45 ± 10 deg angle to the air compressor crankshaft center line.

4.7 Discharge Temperature—Must be stabilized for 5 min at each operating speed to be measured.

4.8 Operating Pressure and Inlet Condition—Power readings (or torque) are to be taken throughout the speed range (from 600 rpm to maximum rated speed) at each of the following four conditions:

Condition	Inlet	Discharge
1	Open to atmosphere	100 psi
2	Open to atmosphere	Unloaded
3	25 psi	100 psi
4	25 psi	Unloaded

Discharge reservoir must have a minimum capacity of 1000 in^3. Other operating pressures and inlet conditions can be selected based on the duty cycle determined from vehicle operation.

4.9 Test Procedure—To determine the power for the compressor being tested, the compressor must be run at the stabilized condition at each speed and operating mode. A torque transducer is installed at the input shaft to determine mean torque input requirements at each condition. Power will be calculated from the torque and speed measurements and should be corrected to a standard barometric pressure of 29.4 in Hg.

4.10 Formatting Data Useful for Vehicle Computer Simulation Purposes—The duty cycle must be known for this activity. Data from these tests can be utilized to develop data in tabular form showing speed versus torque in 100 rpm increments which will be useful in vehicle computer simulation programs.

5. Test Procedure—Air Conditioning Compressors—Tests are to be made at both heavy- and light-load conditions, because the power required to operate an air conditioning compressor is directly related to the compressor rpm and the density of the gas being pumped.

5.1 Operating Conditions—The compressor is operated through an rpm range from 500 minimum (or manufacturer's recommended minimum) to 3000 maximum (or manufacturer's recommended maximum) under the following conditions:

5.1.1 Heavy Compressor Load Conditions—(Example: Truck or bus engine idling at stop light on a 90° F day.)

65° F return gas to compressor
240 psig compressor head pressure
40° F evaporator temperature

5.1.2 Light Compressor Load Conditions—(Example: Truck or bus engine operating on interstate at 55 mph on a 90° F day.)

65° F return gas to compressor
240 psig compressor head pressure
30° F evaporator temperature

Note: Power is to be measured at the compressor input shaft with a torque transducer.

5.2 Formatting Data Useful for Vehicle Computer Simulation Purposes—The duty cycle has to be known for this activity. Data from these tests can be utilized to develop data in tabular form showing speed versus torque in 100 rpm increments which will be useful in vehicle computer simulation program.