SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2743 JUL2012

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Superseding J2743 SEP2007

Air Compressor Size Rating Recommended Practice - Truck and Bus

RATIONALE

The current SAE J2743 document was reviewed by all air compressor suppliers to determine if changes were needed at this 5 year review. After determining, the suppliers see no need for revisions. The committee requested that the OEM engine and OEM vehicle manufacturers be surveyed to get their inputs as well. The results of this survey were reviewed with the committee on May 1, 2012 and the decision was made to re-affirm SAE J2743 as written.

1. SCOPE

This SAE Recommended Practice is intended to describe a procedure for rating the size of single-stage reciprocating air compressors. It describes the conditions that can be used for testing and it defines a standardized rating expressed in SLPM (SCFM).

1.1 Purpose

This document establishes a uniform size rating test procedure for single-stage reciprocating air compressors used on air braked commercial vehicles.

2. REFERENCES

2.1 Applicable Publication

The following publication forms a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of the publication shall apply.

2.1.1 ISO Publication

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 1217 Displacement compressors—Acceptance tests

2.2 Related Publications

The following publications are provided for informational purposes only, and are not a part of this document.

2.2.1 Federal Publications

Available from the Superintendent of Documents, U.S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320.

Federal Motor Vehicle Safety Standard (Code of Federal Regulations Title 49 Chapter V Part 571.121)—Air Brake Systems—Trucks, Buses and Trailers

National Institute of Standards and Technology (NIST) Special Publication 250-49 - Calibration for Gas Flow Meters

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3. DEFINITIONS

3.1 Standard Conditions

Standard volumetric flow rate is expressed in Standard Liters per Minute SLPM (Standard Cubic Feet per Minute SCFM). The standard conditions must be identified when reporting standard mass flow rate. Standard conditions used by the National Institute of Standards and Technology (NIST) are 20 °C (68 °F) and 101.3 kPa (14.7 psia).

3.2 Measured Air Flow Rate, Q_m

The actual air flow rate measured during a compressor test, expressed in SLPM (SCFM). The actual air flow rate is measured with a mass flow meter that is calibrated to read SLPM (SCFM) at the same standard conditions identified in section 3.1. Since a mass flow meter uses thermodynamic principles to measure true mass flow rate, there is no need to compensate for temperature or pressure of the air entering the meter.

3.3 Standard Air Flow Rate, Q_{std}

The measured air flow rate corrected to standard conditions at the compressor inlet, expressed in SLPM (SCFM). This correction is applied when the ambient test conditions at the inlet of a naturally aspirated compressor are not at standard conditions. The intent of this correction is to provide uniform reporting of compressor air flow rate that is normalized for the operating conditions of the compressor.

$$Q_{std} = (T_{amb} / T_{std}) * (P_{std} / P_{amb}) * Q_m \quad \text{(Eq. 1)}$$

where:

T_{amb} = Ambient Air Temperature °K (°R)
T_{std} = Standard Air Temperature °K (°R)
P_{amb} = Ambient Air Pressure kPa (psia)
P_{std} = Standard Air Pressure kPa (psia)
Q_m = Measured Air Flow Rate SLPM (SCFM)

Using NIST standard conditions, then

T_{std} = 293.15 °K (527.67 °R)
P_{std} = 101.3 kPa (14.7 psia)

3.4 Ambient Air Temperature, T_{amb}

Temperature of the atmospheric air in the vicinity of the air compressor, but unaffected by the air compressor. For a naturally aspirated compressor, the inlet air temperature is assumed to be equal to the ambient air temperature.

3.5 Ambient Pressure, P_{amb}

Pressure of the atmospheric air in the vicinity of the air compressor, but unaffected by the air compressor. For a naturally aspirated compressor, the inlet air pressure is assumed to be equal to the ambient air pressure.

3.6 Load Time, t_l

The time during which the air compressor is building air pressure in the air system.

3.7 Cylinder Bore Area, A

Cross-sectional area of the compressor cylinder bore.

3.8 Stroke, L

Stroke of the compressor piston from bottom-dead-center to top-dead-center.

3.9 Number of Cylinders, n

Total number of cylinders.

3.10 Speed, N

Rotational speed of compressor crankshaft expressed in Revolutions per Minute RPM.

3.11 Swept Volume, V

Volume of the compressor swept through one revolution of the crankshaft, expressed in Liters (Cubic Feet).

$$V = A * L * n \quad \text{(Eq. 2)}$$

3.12 Theoretical Air Flow Rate, Q_{th}

Swept volume of the compressor over a given period of time at a given crankshaft speed, expressed in LPM (CFM).

$$Q_{th} = V * N \quad \text{(Eq. 3)}$$

3.13 Volumetric Efficiency, η_v

Ratio of the standard air delivery to the theoretical air delivery expressed as a percentage.

$$\eta_v = (Q_{std} / Q_{th}) * 100 \quad \text{(Eq. 4)}$$

4. INSTRUMENTATION AND EQUIPMENT

4.1 Devices to measure air temperature, ± 2 °C (3.6 °F).

4.2 Devices to measure air pressure, ± 2 % of indicated value.

4.3 Devices to measure air mass flow rate, ± 2 % of indicated value.

4.4 Devices to measure time, ± 0.5 s.

4.5 Instrumentation to record all measured data, and shall have an accuracy of ± 1 % at the measured value.

4.6 All instrumentation must be qualified by certified calibration.

5. AIR COMPRESSOR TEST PROCEDURE

5.1 The compressor is to be mounted essentially as in service.