GUIDE TO MANIFOLD ABSOLUTE PRESSURE TRANSDUCER REPRESENTATIVE SPECIFICATION—SAE J1347 JUN81

SAE Information Report

Report of the Electronic Systems Committee, approved June 1981.

Introduction—This document is intended as a guide for technical personnel of both using and supplier firms whose duties include specifying, calibrating, testing, developing, or demonstrating the performance characteristics of Manifold Absolute Pressure (MAP) transducers. By basing users' specifications as well as suppliers' technical advertising and reference literature on this document, or by referencing portions thereof, as applicable, a clear understanding of the users' needs and of the transducers' performance capabilities will be provided. Adhering to the specification outline, terminology, and procedures shown will result in simple, complete specifications; it will also reduce design time, procurement lead time, and labor, as well as material costs.

This guide is also intended for use as a general example for specifying other types of transducers.

The MAP Transducer Representative Specification is referenced to and dependent upon SAE J1346, Guide to Manifold Absolute Pressure Transducer Representative Test Method.

Scope—This guide is intended to cover specifications applicable to MAP transducers. It is also applicable to transducers such as Barometric (Ambient) Absolute Pressure transducers, Manifold Vacuum transducers, and similar pressure transducers used in automotive systems. Although this guide is oriented towards active devices (those using internal signal conditioning), it can be applied to passive devices with minor modifications.

Values—The guide is intended to be general in nature. Specific values for performance data are not included in order to maintain generality. Exemplary values are contained in the Appendix in an attempt to clarify the text. *The SAE does not imply any recommendations regarding these values.*

SPECIFICATION
MANIFOLD ABSOLUTE PRESSURE TRANSDUCER

1. Operating Pressure Range—The operating pressure range is from *a–b* kPa exclusive of abnormal pressure excursions. (All pressures in this document are given an absolute pressures.)

2. Electrical

2.1 Power Supply Voltage—The normal operating supply voltage is $c \pm d$ V DC.

2.2 Reference Voltage—The nominal reference voltage is $e \pm f$ V DC.

2.3 Overvoltage Protection

EITHER: The supplied voltage is free from transients and voltage reversals.

OR: Devices must survive the following without degradation of performance.

LIST: (The list shall contain a short description, the name and number of times it may be encountered with reference to a figure showing voltage versus time. A recommended test circuit should be included if available.)

2.4 Current Draw

2.4.1 POWER SUPPLY CURRENT—Maximum allowable current draw shall be *h* mA.

2.5 Transducer Input/Output Functional Relationship

NOTE: Y may be in units of volts, ohms, henries, farads, hertz, seconds, etc.

EITHER: The output parameter, Y_o, shall correspond to the following:

$$Y_o = AP + B$$

where: P is the pressure in kilopascals
A is *i* Y units/kPa
B is *j* Y units

OR: The output parameter, Y_o, shall correspond to the following:

$$Y_o = V_r(AP + B)$$

where: P is the pressure in kilopascals
V_r is either the power supply voltage, or the reference voltage
A is *k* Y/volt-kPa
B is *l* Y/volt

2.5.1 Sensors which exhibit a non-linear input-output relationship shall be specified in a similar manner as determined by the purchaser. Where possible, a power series expression is preferred.

2.6 Output Load—The transducer must meet the accuracy requirements while driving a load of *m* Ω returned to the *n* supply, or as otherwise specified.

2.7 Output Parameter Range—The maximum and minimum output parameter range over the full required pressure range (and supply voltage range) are from *o* X–*p* X units (see paragraph 2.5–Y units).

2.8 Output Error—The allowable output error will be expressed as an equivalent change in the measurand and will be within the limits shown in Figs. 1 and 2. The error limits shown in the figures include all sources of error. (The figures shall show error in kPa versus applied pressure.)

2.9 Warm-Up Time—The transducer shall be operating within the allowable error band no more than *q* s after the application of power.

2.10 Output Noise and Ripple—The output ripple shall not exceed that shown in Fig. 3. (The figure shall show allowable output peak-to-peak ripple versus frequency.) The output noise shall be as specified by the purchaser.

2.11 Generated and Radiated Noise—(As specified by the purchaser. Adherence to SAE Recommended Practice J1113a is urged.)

2.12 Susceptibility to Conducted and Radiated Noise—(As specified by the purchaser. Adherence to SAE Recommended Practice J1113a is urged.)

3. Mechanical

3.1 Measurement Cavity Leakage (Body Leak)—The measurement cavity shall not leak at a rate greater than *r* cm^3/min when subjected to a pressure of *s* kPa.

3.2 Pressure Response Time—The device shall have a response time to a step input of pressure of no more than *t* ms. The input pressure step shall be from *u–v* kPa with a 10–90% rise time not to exceed *w* ms. The response time of the device is defined as the time duration from the 0.1 time until the time it takes the output to settle to within $\pm x$ kPa of its final value.

3.3 Location—The device shall be located _____.

3.4 Materials—Selections of materials are the prerogative of the supplier. However, certain goals of the purchaser of the device may make the use of certain classes of material preferable. These goals, listed as follows, shall be discussed with supplier.

LIST OF GOALS:

3.5 Packaging and Termination—The device shall meet the critical dimensions noted in Fig. 4 and shall have electrical terminations as shown in that drawing.

3.6 Marking—The device shall be marked in accordance with Fig. 4.

4. Environmental

4.1 Life—The target life of this device is *y* years with a minimum of *z* h of powered operation per year. During this time, the target failure rate is less than *aa* failures/one thousand devices per year. The target shelf life shall not be less than *bb* years. The device or a basically similar device must show field experience indicating compliance or, in the absence of field experience, the design and manufacturing plan must show reasonable expectations of being able to meet those goals through some means such as failure mode and effect analysis.

4.2 Maintenance—The device shall meet all of the requirements of this specification without maintenance during the life of the device.

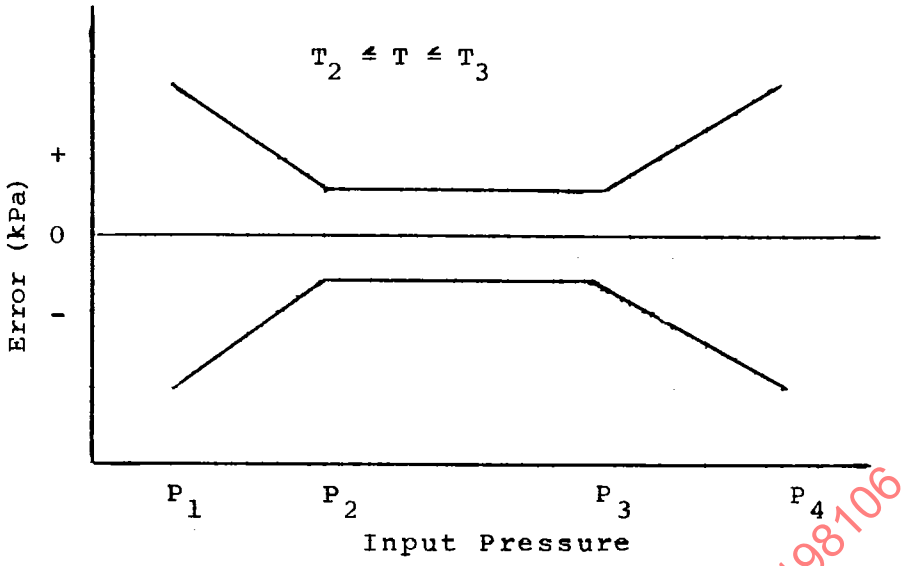
4.3 Overpressure—The device shall meet all of the requirements of this specification after *cc* applications of a pressure of at least *dd* kPa.

4.4 Ambient Pressure—The device shall meet all of the requirements of this specification when subjected to ambient pressure between *ee* and *ff* kPa.

4.5 Shock—Devices shall meet all of the requirements of this specification after being subjected to *gg* number of shocks in each of the specified directions as shown in Fig. 4. Each shock shall be a half sine wave of *hh* ms duration having a peak acceleration of *ii* g's.

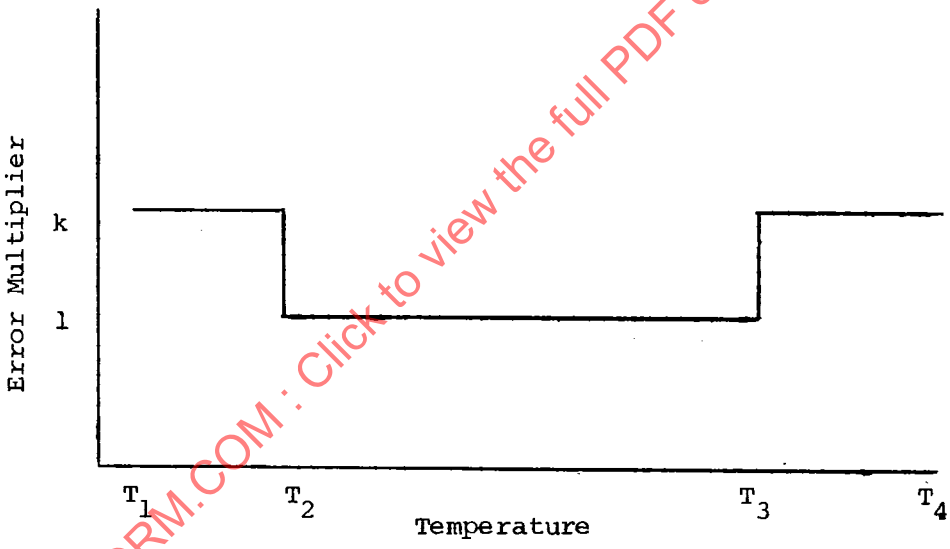
4.6 Vibrations—The device shall meet all of the requirements of this specification during and after subjection to *jj* cycles of sinusoidal vibration applied on each axis as specified in Fig. 4. Each cycle shall consist of a frequency sweep from *kk–ll* Hz and back at a constant acceleration, velocity, or displacement over the appropriate portion of the frequency range. Each cycle of vibration shall last *mm* min.

4.7 Humidity—The device shall meet all of the requirements of this specification during and after being subjected to *nn* h of *oo*% relative humidity at a temperature of *pp*°C.



Error = Indicated Pressure-Actual Pressure

FIG. 1



Error Multiplying Factor over Temperature Range

FIG. 2

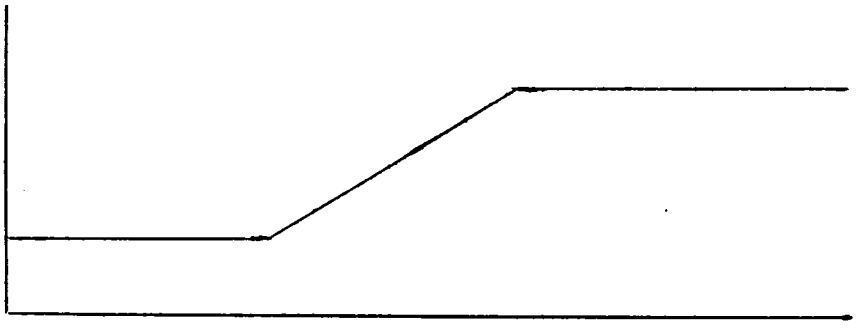


FIG. 3