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COMPLIANCE IS MANDATORY

John C. Stennis Space Center CLASSIFICATION OF PRESSURE TRANSDUCERS

Approved in DDMS by:

Todd Mannion
NASA SSC Center Operations
Directorate Facility Services Branch

8-16-2021
Date

Concurrence in DDMS by:

Brennan Sanders
NASA SSC Center Operations Directorate
Test Complex Support Branch

8-24-2021
Date

John Stealey
NASA SSC Engineering
& Test Directorate

9-14-2021
Date

Issued by

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SUBJECT: Classification of Pressure Transducers	

Document History Log

Change/ Revision	Change Date	Originator/ Phone	Description
Basic	10.21.2011	Dawn Davis/ ext. 1657	Initial release, supersedes SSC 66-011.
A	08.22.2016	Dawn Davis / Ext. 1657	Five-year review. Administrative changes throughout document. Revised cover sheet to reflect approval by NASA SSC Center Operations Directorate Operations and Maintenance Division, and concurrence by NASA SSC Center Operations Design & Construction Project Management Division and NASA SSC Engineering & Test Directorate. Updated references and acronyms.
B	08.12.2021	David Carver / Ext. 1429	Five-year review. Updated references and acronyms. Revised cover sheet and content to reflect Center Operations organizational changes from Design and Construction Project Management Division to Test Complex Support Branch and Operations and Maintenance to Facility Services Branch.

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1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) defines the three (3) classifications of pressure transducers used at SSC and the major error contributing factors. Standard classification of transducers can be used for specifying user requirements and inventory control.

2.0 APPLICABILITY

This SSTD applies to NASA SSC, contractors, and/or subcontractors involved with pressure transducers at SSC.

3.0 REFERENCES

All references are assumed to be the latest version unless otherwise indicated.

NASA-HDBK-8739.19-2, *Measuring and Test Equipment Specifications, NASA Measurement Quality Assurance Handbook*

SSC Specification 54B00-GX04, *Pressure Transducers (Resistive Strain Gage, Type)*

SPR 1440.1, *SSC Records Management Program Requirements*

SSTD-8070-0005-CONFIG, *SSC Preparation, Review, Approval, and Release of SSC Standards*

4.0 RESPONSIBILITIES

- a. Users of this SSTD shall comply with its requirements, ensure use of the correct version of this SSTD and the documents it references, and inform the appropriate organization of needed changes in accordance with SSTD-8070-0005-CONFIG.
- b. Responsibilities for the use and control of this SSTD and for the review and approval of revisions or cancellation of this SSTD shall be as specified in SSTD-8070-0005-CONFIG and the applicable documents referenced therein.

5.0 TRANSDUCER CLASSIFICATION

5.1 General

- a. The highest number of errors for transducers at SSC have come from the random error category; all other contributing errors are equal to or less than .01% full scale.
- b. Maximum deviation and non-repeatability are basic contributors to transducer random error. Since both can be considered approximately independent normally distributed variables, both shall be treated with the classical approach to propagation of random errors.

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- c. Classification of pressure transducers at SSC shall be based on UML-based Specification Environment (USE) specifications found in Section 5.2 of this SSTD. When calibrated, the random error contributed by the transducer shall be equal to or less than the specified tolerances in Section 5.2.

5.2 Classification

Test Instrument Characteristics	Class A	Class B	Class C
Error Range	±0.25% Full Scale	±0.75% Full Scale	±3.0% Full Scale
Maximum Deviation	±0.0067 mV/V	±0.0217 mV/V	±0.0894 mV/V
Non Repeatability	±0.003 mV/V	±0.005 mV/V	±0.01 mV/V
Zero Balance	±0.42 mV/V	±0.42 mV/V	±0.42 mV/V
Full Scale Sensitivity (Spare)	3.0 ±0.3 mV/V	3.0 ±0.3 mV/V	3.0 ±0.3 mV/V
Shunt to Pressure Non-Correlation (80%) for sub classes			
1 (0.5% full scale)	±0.015 mV/V	±0.015 mV/V	±0.015 mV/V
2 (1.0% full scale)	±0.03 mV/V	±0.03 mV/V	±0.03 mV/V
3 (5.0% full scale)	±0.15 mV/V	±0.15 mV/V	±0.15 mV/V

6.0 RECORDS AND FORMS

- a. Records and forms required by the procedures of this SSTD shall be maintained in accordance with SPR 1440.1.
- b. All records and forms are assumed to be the latest edition unless otherwise indicated. Forms may be obtained from the SSC Electronic Forms repository or from the NASA SSC Forms Management Officer. Quality Records are identified in the SSC Master Records Index.
- c. No specific forms are called out in this standard.

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7.0 DEFINITIONS

Deviation The deviation from a straight line connecting the output at zero load with the output at rated capacity (full scale pressure) is calculated as follows:

$$D_x = R_x - \frac{R_{100} X}{100}$$

Where:

X = Percent full scale calibration point, i.e. 0%, 20%, 40%, 60%, 80%, or 100%

D_x = Deviation in mV/V at the X percent calibration point

R_x = Output in mV/V (zero corrected) corresponding to the X percent calibration point

R_{100} = Full scale output in mV/V (zero corrected)

Full Scale Sensitivity The zero corrected output of the transducer expressed in mV/V with full scale load applied.

Maximum Deviation The maximum value of deviation from the straight line connecting the output at zero load with the output at rated capacity (full scale pressure). Hysteresis, non-linearity, and non-return to zero errors are included in this parameter.

Non-Repeatability The maximum difference between transducer output readings for repeated loadings under identical loading and environmental conditions. Maximum non-repeatability is determined to be the maximum value obtained for any pressure calibration level.

Non-Return to Zero The difference in transducer output between zero load points of one continuous cycle when the gage is first loaded from zero to full scale and then full scale to zero without prior exercising of the gage.

Shunt to Pressure Non-Correlation Some measurements require tighter shunt-to-pressure non-correlation. Therefore, in addition to Classes A, B, and C requirements listed in Section 5.2, each classification is sub-divided into three sub-classes to provide limits on maximum shunt to pressure non-correlation.

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USE Specification USE is a system for the specification of information systems. It is based on a subset of the Unified Modeling Language (UML). A USE specification contains a textual description of a model using features found in UML class diagrams (classes, associations, etc.).

Zero Balance The output signal of the pressure transducer with no pressure applied and the circuit excited, expressed in mV/V.

6.0 ACRONYMS AND ABBREVIATIONS

HDBK	Handbook
mV/V	millivolts per Volt
NASA	National Aeronautics and Space Administration
SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
SPR	Stennis Procedural Requirements
UML	Unified Modeling Language
USE	UML-based Specification Environment