Manual of Petroleum Measurement Standards, Chapter 22.4

Testing Protocol for Pressure, Differential Pressure, and Temperature Measuring Devices

FIRST EDITION, JULY 2018

ERRATA 1, NOVEMBER 2022

Special Notes

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

Neither API nor any of API's employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. Neither API nor any of API's employees, subcontractors, consultants, or other assignees represent that use of this publication would not infringe upon privately owned rights.

Classified areas may vary depending on the location, conditions, equipment, and substances involved in any given situation. Users of this *Manual of Petroleum Measurement Standards* should consult with the appropriate authorities having jurisdiction.

Users of this *Manual of Petroleum Measurement Standards* should not rely exclusively on the information contained in this document. Sound business, scientific, engineering, and safety judgment should be used in employing the information contained therein.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to ensure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any authorities having jurisdiction with which this publication may conflict.

API publications are published to facilitate the broad availability of proven, sound engineering and operating practices. These publications are not intended to obviate the need for applying sound engineering judgment regarding when and where these publications should be utilized. The formulation and publication of API publications is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

Foreword

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

The verbal forms used to express the provisions in this document are as follows.

Shall: As used in a standard, "shall" denotes a minimum requirement in order to conform to the standard.

Should: As used in a standard, "should" denotes a recommendation or that which is advised but not required in order to conform to the standard.

May: As used in a standard, "may" denotes a course of action permissible within the limits of a standard.

Can: As used in a standard, "can" denotes a statement of possibility or capability.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 200 Massachusetts Avenue, NW, Washington, DC 20001. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually by API, 200 Massachusetts Avenue, NW, Washington, DC 20001.

Suggested revisions are invited and should be submitted to the Standards Department, API, 200 Massachusetts Avenue, NW, Washington, DC 20001, standards@api.org.

Contents

Figures

Contents

Tables

Introduction

This document defines the testing protocol and reporting protocols for families of devices used to measure differential pressure, pressure, and temperature for the purpose of determining flow rates for hydrocarbon fluids. This testing protocol is designed to supply industry with capabilities of these devices that can be compared when they are used under similar operating conditions. The objectives of this testing protocol are to:

a) Ensure that the user of any differential pressure, pressure, and temperature device knows its performance characteristics under the prescribed Chapter 22.4 testing conditions (units should only be compared when tested at the same time),

b) Facilitate both the understanding and the introduction of new technologies,

c) Provide information about relative performance characteristics of the differential pressure, pressure, and temperature devices under standardized API 22.4 testing protocol, and

d) Provide a standardized process for reporting transmitter API 22.4 tested performance.

To accomplish these objectives, this testing protocol defines the test limits for operating conditions of the devices, the requirements of the facility or facilities to perform the tests and encompasses any device capable of measuring differential pressure, pressure, and temperature.

Testing Protocol for Pressure, Differential Pressure, and Temperature Measuring Devices

1 Scope

This testing protocol documents the method for testing the performance characteristics specific to pressure, differential pressure, and temperature sensors and transmitters used in petroleum measurement. The testing protocol includes a listing of parameters affecting the performance of the devices, a description of the tests required, requirements for the test facility, a data reporting format, and an uncertainty determination methodology.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*

IEC 60770-2: 2010, *Transmitters for use in industrial-process control systems— Part 2: Methods for inspection and routine testing*

ISO/IEC Guide 98-3 (GUM:1995): 2008, *Uncertainty of measurement —Part 3: Guide to the expression of uncertainty in measurement*

3 Terms and Definitions

3.1
Hysteresis
The difference between the indications of a measuring instrument when the same value of the quantity measured is reached by increasing or decreasing the quantity.

3.2
API 22.4 baseline accuracy
A measure of the accuracy at a near ambient temperature determined by the testing procedure defined in this document. The API 22.4 baseline accuracy is calculated from the combination of the linearity, hysteresis and repeatability data calculations. API 22.4 baseline accuracy is used to compare the result to other transmitters tested at the same time and is also used in the calculation of influence factor effects.

3.3
Analog signal
A signal that varies continuously in amplitude rather than in discrete steps.

3.4
Digital signal
A signal that varies in discrete steps rather than continuously.

3.5
Dp pressure limit
The maximum working pressure that can be applied to one side of a differential pressure device as defined by the manufacturer.