Resistance Thermometers
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FOREWORD

Standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining without delay the proper product for his particular need. Existence of a Standard does not in any respect preclude any member or non-member from manufacturing or selling products not conforming with the standard.

INTRODUCTORY NOTES

This Standard supersedes Standard RC 5-10-1955, Resistance Thermometers.

The purpose of this revision is to further clarify terminology, and provide dimensional standards.

A further purpose is to promote interchangeability between Resistance Thermometers and other types of temperature measuring systems using the Bushings and Wells defined in Bushings and Wells for Temperature Sensitive Elements.

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1. Scope and Purpose

1.1 This standard applies to Resistance Thermometers for industrial use.

1.2 The purpose of this standard is to establish uniformity of terminology, (including symbols) definitions and dimensions for Resistance Thermometers.

1.3 A further purpose is to promote interchangeability of Resistance Thermometers by establishing a series of preferred bulb dimensions. These dimensions will permit interchangeability of Resistance Thermometers with Bimetallic Thermometers, Filled System Thermometers and Thermocouple Thermometers in Bushings and Wells defined in Bushings and Wells for Temperature Sensitive Elements.

Note: Resistance Thermometer Bulbs unlike Thermocouples do not follow a universal calibration curve. A Resistance Thermometer Bulb of a given manufacturer is not therefore interchangeable with one of a different manufacturer without replacement or major recalibration of the associated instrument. Only dimensions sufficient to make Bulbs compatible with Bulbs and Wells of are included. Individual parts of specific assemblies are not intended to be interchangeable.

1.4 The listing of a size does not imply that it is suitable for all purposes. Consult manufacturers for available sizes and for limitations on immersion length.

2. Terminology and General Definitions

2.1 Resistance Thermometer. A Resistance Thermometer is a temperature measuring instrument comprising a resistance measuring device, a sensing means called a Resistance Thermometer Bulb and electrical conductors for operatively connecting the two.

2.2 Resistance Thermometer Bulb. A Resistance Thermometer Bulb is the sensing means of a Resistance Thermometer comprising a Resistance Thermometer Element and a protective shell (See Fig. 1) with or without mounting means, Connection Head, leads, or other fittings. Three commonly used types of Resistance Thermometer Bulbs are the Plain Resistance Thermometer Bulb, Fixed Thread Resistance Thermometer Bulb and Union Connected Resistance Thermometer Bulb (See Figs. 5, 6 & 8).

2.2.1 Resistance Thermometer Element. A Resistance Thermometer Element is the temperature sensitive unit of a Resistance Thermometer Bulb comprising a material whose electrical resistance changes with temperature, its supporting structure and means for attachment of conductors. The Element is designed to be used as part of an assembly such as a Resistance Thermometer Bulb or a Resistance Thermometer Element with Well. (See Fig. 1)

2.2.2 Resistance Thermometer Bulb Sensitive Portion. A Resistance Thermometer Bulb Sensitive Portion is that portion of a Resistance Thermometer Bulb enclosing the temperature sensitive material. (See Fig. 1)

2.2.2.1 Resistance Thermometer Element Sensitive Portion. A Resistance Thermometer Element Sensitive Portion is that portion of a Resistance Thermometer Element comprising the temperature sensitive material. (See Fig. 1)

2.2.3 Extension. An Extension is that portion of the protective shell of a Resistance Thermometer Bulb other than the Sensitive Portion. (See Fig. 1)

2.2.3.1 Bendable Extension. A Bendable Extension is an Extension designed to be bent incident to installation.

2.2.3.2 Rigid Extension. A Rigid Extension is an Extension not designed to be bent incident to installation.

2.2.4 Connection Head. A Connection Head is a protecting housing containing a terminal block and usually provided with threaded openings for mounting on a Resistance Thermometer Bulb or Connection Head Extension and for the attachment of a conduit. (See Fig. 2)
2.2.4.1 Connection Head Extension. A Connection Head Extension is a threaded fitting, usually a pipe nipple, or an assembly of fittings extending between a Well and a Connection Head. (See Fig. 2)

2.2.4.2 Connection Head Extension Length. Connection Head Extension Length (Symbol N) is the overall length of the Connection Head Extension. (See Fig. 2)

2.2.5 Bulb Length. The Bulb Length (Symbol A) of a Plain Bulb is the overall length of the Bulb. If the Bulb includes a Threaded Connection for installation or includes a Connection Head, the Bulb Length (Symbol A) is the length from the free end of the Bulb to the Threaded Connection or Connection Head. The Bulb Length of a Union Connected Bulb is the length from the free end of the Bulb to the underside of the seating part. (See Figs. 3, 5, 6 and 8)

2.2.6 Sensitive Portion Length. The Sensitive Portion Length (Symbol X) is the length of the Sensitive Portion. (See Fig. 3)

2.2.7 Bulb Diameter. The Bulb Diameter (Symbol Y) is the outside diameter of the Sensitive Portion or the maximum cross sectional dimension if the section is not circular. (See Fig. 3)

2.2.8 Extension Length. The Extension Length (Symbol J) is the length of the Extension. (See Fig. 3)

2.2.9 Immersion Length. The Immersion Length (Symbol R) is the length from the free end of the Bulb, Well or Element to the point of immersion in the medium, the temperature of which is being measured. (Physically this point may be indistinguishable but is important for proper accuracy.) (See Fig. 4)

2.2.10 Insertion Length. The Insertion Length (Symbol U) is the length from the free end of the Bulb, Well or Element to, but not including, the external threads or other means of attachment to a vessel. (See Fig. 4)

2.3 Plain Resistance Thermometer Bulb. A Plain Resistance Thermometer Bulb is a Resistance Thermometer Bulb not provided with a Union Connection or other means for attachment to a vessel. (See Fig. 5)

2.4 Fixed Thread Resistance Thermometer Bulb. A Fixed Thread Resistance Thermometer Bulb is a Resistance Thermometer Bulb provided with a Threaded Connection for pressure-tight attachment to a vessel. (See Fig. 6)

2.4.1 Threaded Connection. A Threaded Connection is a threaded fitting rigidly attached to the Extension of a Fixed Thread Resistance Thermometer Bulb. (See Fig. 6)

2.5 Union Connected Resistance Thermometer Bulb Assembly. A Union Connected Resistance Thermometer Bulb Assembly is a Union Connected Resistance Thermometer Bulb and means such as a Bushing, Flange or Well for pressure-tight attachment to a vessel. (See Fig. 7)
2.5.1 Union Connected Resistance Thermometer Bulb. A Union Connected Resistance Thermometer Bulb is a Resistance Thermometer Bulb provided with a Union Connection for installation. (See Fig. 8)

2.5.1.1 Union Connection. A Union Connection is that portion of a Union Connected Bulb which comprises a seating part either rigidly attached to or adjustable along the Extension and a jam nut for attachment to a Bushing, Flange or Well. (See Fig. 8)

2.6 Bushing. A Bushing is a fitting provided with external threads for attachment to a vessel and with internal threads and seating means for mounting a temperature sensing element therein. A Bushing does not have a pressure-tight sheath below the external threads. (See Fig. 7)

2.7 Well. A Well is a pressure-tight receptacle adapted to receive a temperature sensing element and provided with external threads or other means for pressure-tight attachment to a vessel. (See Fig. 9)

2.7.1 Lagging Extension. A Lagging Extension is that portion of a Threaded Connection, Bushing, or Well above the external threads intended to extend through the lagging of a vessel. (See Fig. 9)

2.7.2 Lagging Extension Length. The Lagging Extension Length (Symbol T) is the length from the lower end of the external threads of a threaded connection, bushing, or well to the upper end of the portion intended to extend through the lagging of a vessel, less one inch allowance for threads. (See Fig. 9)

Note: For purposes of uniform dimensioning, the allowance for thread length is one inch, regardless of pipe thread size.

2.7.3 External Threads for Bushings or Wells. External threads for Bushings or Wells shall be American Standard Taper Pipe Threads (NPT) of the American Standards Association.

2.8 Flange. A Flange is a fitting provided with a flanged surface for attachment to a vessel and with internal threads and seating means for mounting a temperature sensing element therein. A Flange does not have a pressure-tight sheath below flanged surface.

3. Dimensions

3.1 Insertion Lengths of Union Connected Bulbs. The Insertion Lengths (Symbol U) of Union Connected Bulbs shall be 2-1/2, 4-1/2, 7-1/2, 10-1/2, 16 or 24 inches with tolerances as shown in Fig. 10.

Note: A Bulb designed for a given Insertion Length, when used with a Bushing of a given Lagging Extension Length, will fit a Well of the same nominal diameter, the same Insertion Length and Lagging Extension Length. Also, two Bulbs designed for the same total of T and U will be physically inter-changeable and usually identical, i.e., a Bulb designed for 4-1/2 inch U Length and 3 inch Lagging Length will fit a Well of 7-1/2 inch U Length and no Lagging. Caution is advised in the reverse operation to be sure that immersion is adequate. See Table 1.

3.2 Bulb Lengths of Fixed Thread Bulbs. The Bulb Lengths (Symbol A) of Fixed Thread Bulbs shall be 3-1/2, 5-1/2, 8-1/2, 11-1/2, 17 and 25 inches with tolerances as shown in Fig. 10.

3.3 Bulb Diameter. The Bulb Diameter (Symbol Y) shall be 1/4' and 3/8" with tolerances as shown in Fig. 10.
3.4 Lagging Extension Length. The Lagging Extension Length (Symbol T) if used, shall be 3 inches, except 2 inch Lagging Extension Length shall be used with 2-1/2 inch Insertion Length.

**Note:** Ordinarily, no Lagging Extension Length is used, i.e., T equals zero.

3.5 Connection Head Extension Length. The Connection Head Extension Length (Symbol N) shall be 4 or 7 inches.

**Note:** In cases where the Connection Head Extension Length is of the union type of construction, for an N dimension of 4 inches, the assembly may consist of two short nipples and one union. For an N dimension of 7 inches, the assembly may consist of two three-inch long nipples and a union.

3.6 Jam Nuts and Seating Parts. Dimensions of Jam Nuts and Seating Parts shall be as shown in Fig. 10. Dimensions not specified above nor shown in Fig. 10 are not essential for interchangeability and are at manufacturer's option subject to ordinary engineering considerations, such as strength and suitability for purpose.

3.7 Bushings and Wells. Dimensions for Bushings and Wells for use with Resistance Thermometer Bulbs and with other types of temperature sensing elements are given in SAMA RC 17.

3.8 Dimensions of Plain Bulbs. Dimensions of Plain Bulbs and Elements intended for use in the Assemblies shown in Fig. 2 shall be dimensioned to suit the Wells of SAMA RC 17.
RESISTANCE THERMOMETER BULBS
(1/4 & 3/8 DIAMETER)

A = T + U + 3/4
BULB LENGTH (FIXED THD)

1/2 NPT

A = T + U + 1/2
BULB LENGTH (UNION CONNECTED)

T LAGGING EXTENSION LENGTH

I THREAD ALLOWANCE

NOTE - FIXED THD OR UNION CONNECTED BULBS ARE INTERCHANGEABLE IN SAME BUSHING OR WELL.

A = T + U + 3/4
BULB LENGTH (FIXED THD)

1/2 NPT

A = T + U + 1/2
BULB LENGTH (UNION CONNECTED)

T LAGGING EXTENSION LENGTH

I THREAD ALLOWANCE

45° CHAMFER FIRST THD. BOTH ENDS

1/8 HEX

1/2 STRAIGHT PIPE THD AS A NPSM

NOTE THE OPTIONAL SEATING MEANS

NOTE 1. BULB TO PASS THROUGH RING GAGE 10 INCHES LONG OF 252 OR 377 ID.

NOTE 2. FOR BUSHING AND WELL DIMENSIONS SEE SAMA RC 17.

NOTE 3. ALL DIMENSIONS ARE IN INCHES.

FIG. 10

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# Table 1

**Usable Combinations of Bulbs and Wells**

**1/4 & 3/8 Nominal Bulb Diameter**

**Dimensions in Inches**

<table>
<thead>
<tr>
<th>Dimensions for Ordering</th>
<th>Dimensions for Reference Only</th>
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<tbody>
<tr>
<td>Insertion Length 'U'</td>
<td>Bulb Length 'A' Union Connected Bulbs</td>
</tr>
<tr>
<td>Lagging Extension Length 'T'</td>
<td></td>
</tr>
<tr>
<td>2 1/2</td>
<td>3</td>
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<td>24</td>
<td>27 1/2</td>
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**Note 1.** Bulb Length (Symbol A) for Union Connected Bulbs is listed to indicate interchangeability, not as a dimension for ordering. Specify Well, or Bulb to be used with Bushing or Well, by Insertion Length (Symbol U) and Lagging Extension Length (Symbol T).

**Note 2.** Bulb Length (Symbol A) for Fixed Thread Bulbs is listed to indicate interchangeability not as a dimension for ordering except for Bulbs to be installed without Well or Bushing. For Fixed Thread Bulbs to be used with Well or Bushing, order by Insertion Length (Symbol U) and Lagging Extension Length (Symbol T).