

Bristol® Thermometer Systems

Class 1 - Liquid Filled

There are two types of Liquid-Filled Thermometer Systems available. Class 1A - "Fully-compensated", and Class 1B - "Case-compensated".

Class 1A Systems are designed to correct the recorded temperature for wide changes in ambient temperature along the capillary tubing and at the pressure element. Thus, a Class 1A System may be used for applications requiring relatively long lengths of tubing and having wide temperature variations along the tubing.

Class 1B Systems are designed for applications requiring 10 feet or less of capillary tubing which will not be subjected to more than ± 25 °F change from the ambient temperature at which the system is calibrated.

In specifying a Class 1A Thermometer System, it is essential to state both the normal operating range and the span of ambient temperature changes that the system may experience in service.

It is necessary to specify the normal operating range so that the system will be compensated for maximum accuracy within its operating range, otherwise, the system will be compensated for maximum accuracy at mid-chart range. The ambient temperature must be specified to determine the maximum capillary length that may be used.

Bristol's Liquid-Filled Systems are protected for temperature changes along the tubing between 0°F and 100°F. This is necessary to protect the systems from damage during shipment; or when they are out of service and may be subjected to extreme atmospheric temperatures. The minimum range span that may be specified is therefore governed by these atmospheric temperature limits. The lower range temperature may not exceed 50% of the span above 0°F. The upper range temperature may not be less than 50% of the measured span below 100°F.

For example, a 60 °F span may be specified to measure a range of +30° to 90°F or +10° to 70°F. A 150 °F span for a range +75 ° to 225 °F or -125 ° to +25 °F, or any 150 °F range span between -125°F and +225 °F. Likewise, a 300°F span for range of +150 °F to 450°F, or -175 °F to +125 °F, or any 300 °F range span between -175 °F and +450 °F.

The upper and lower range limits stated are for standard design conditions. Higher and lower range limits are possible for some applications provided that shorter ambient temperature span compensation and short capillary lengths (less than 30 feet) can be tolerated, and little or no overrange and underrange protection is required.

The maximum span that may be specified and the filling liquid used, depends on the range as shown in Table 1.

Filling Liquids	Within Ranges	Max. Span
Nitrogen (1)	TBA	TBA
Ethyl Benzene (2)	-125 to +350° F	475° F
Tetralin (2)	0 to +500° F	500° F
(1) Class 1B and 3B case comp only (2) Typical 1A & 3A full comp but can be used in all applications		

Table 1

The maximum capillary length that may be used for a Class 1A System is a function of the overrange protection required and the ambient temperature range. See Table 2 below.

Maximum Capillary Lengths (feet)				
Overrange % of span	Ambient Temperature Ranges			
	0 - 120° F	20 - 120° F	40 - 110° F	50 - 100° F
Zero	47 feet	60 feet	92 feet	140 feet
25%	40 feet	50 feet	77 feet	112 feet
50%	30 feet	37 feet	60 feet	90 feet

Table 2

90% Response Time Class 1 Systems		
Medium	Plain Bulb	Bulb in Well
Water	18 - 30 sec.	5 - 10 min.
Air (250-850 cfm.)	13 - 16 min.	14 - 23 min.

Table 3

Bulb Sensitive Lengths (Plain Bulb)	
Range Span °F	"X" Inches
400-500	0.80
270-399	1.00
185-269	1.30
125-184	1.70
80-124	2.50
50-79	3.80

Table 4

Range Span °F	Plain Bulb
400-500	1.00
270-399	1.50
185-269	2.00
125-184	2.90
80-124	4.30
50-79	6.60

Table 5

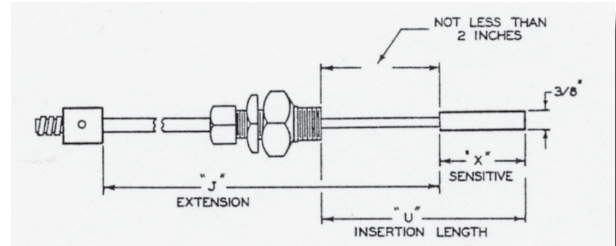


Figure 2 - (S.P.D. 6651) Plain Bulb with Union Fitting

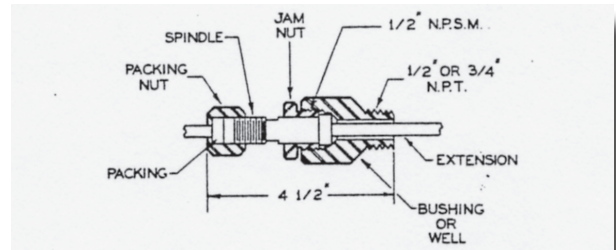


Figure 3 - (S.P.D. 6652) Union Fitting

As shown in Table 2, a standard Class 1A System may be specified to withstand overrange temperatures up to 50% of the span. However, such systems require special linkage to protect the system from damage. This linkage must also be provided if the system will be subjected to underrange temperatures. It is therefore necessary to specify both overrange and underrange conditions so that proper protection will be provided.

Standard Class 1 System bulbs are 3/8" O.D. 316 Stainless Steel. Bulb length depends on the measured temperature span, as indicated in Tables 4 and 5.

The improvement in response time is insignificant when used for gas applications or when the bulb is inserted into a well. Refer to Table 3.

The extension is an integral part of the bulb. It is a length of 1/4 inch O.D. bendable nickel-alloy or stainless steel tubing and serves two primary purposes:

- To permit complete immersion of the sensitive portion of the bulb in the measured medium.
- To minimize heat conduction between the

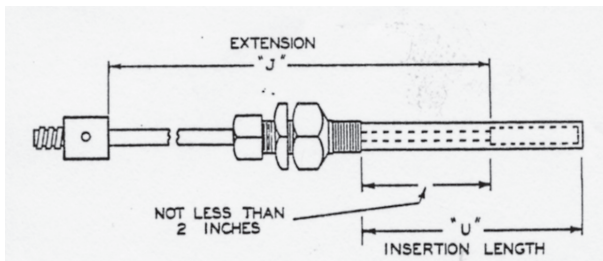
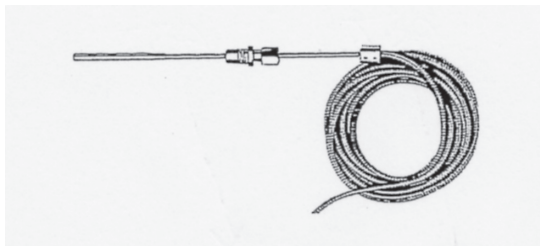


Figure 1 - (S.P.D. 6650) Bulb in Thermo-Well

sensitive portion of the bulb and the rest of the system. Standard lengths are 10 inches and 30 inches. Other lengths can be furnished for special applications.

When specified, the bulb can be furnished with a union connection fitting consisting of a packing gland, jam nut, and bushing with 1/2 or 3/4 inch male pipe thread for part of the bulb assembly, but is adjustable along the extension to provide a pressure tight means of securely mounting the bulb with the sensitive portion properly immersed in the measured fluid. The fitting should not be positioned less than 2 inches from the sensitive section.

When a well is used, the well length ("U" dimension) should be at least 2 inches plus the sensitive length of the bulb ("X" dimension) and preferably 2-1/2 to 3 inches, to insure proper bulb immersion and minimize conduction errors.



Flexible armored tubing

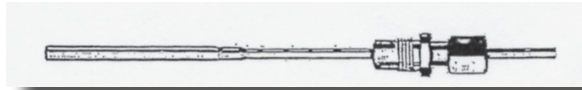
Thermometer Capillary Tubing

When ordering, specify lengths in 5 ft. increments.

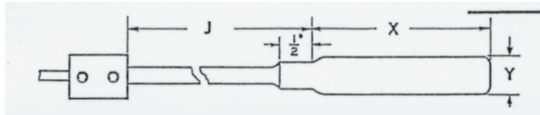
Single Armor - Single Capillary			
Armor Material	Capillary Material	Symbol	O.D. Inches
Flexible Stainless steel interlock	Stainless Steel	SSA-SST	9/32

Single Armor - Double Capillary (for Class 1A systems only)			
Armor Material	Capillary Material	Symbol	O.D. Inches
Flexible Stainless steel interlock	Stainless Steel	SSA-DSST	9/32

Class 2 Thermometer Bulbs



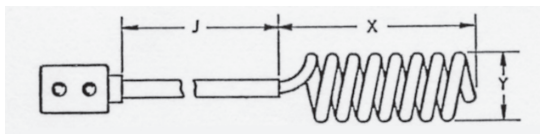
Plain Bulb with Union Fitting



Plain Bulbs

Span Limits	Bulb Specification Number	"Y" Outside Diameter	"X" Sensitive Length	"J" Extension Length
	Stainless Steel			
400-500 °F	1-020-6(+)-()*	3/8"	0.9 Max.	10" or 30"
270-399 °F	1-020-6(+)-()*		1.0 Max.	
185-269 °F	1-020-6(+)-()*		1.3 Max.	
125-184 °F	1-020-6(+)-()*		1.7 Max.	
80-124 °F	1-020-6(+)-()*		2.5 Max.	
50-79 °F	1-020-6(+)-()*		3.8 Max.	

(+) insert "J" dimension - 10" or 30" standard
 * Length determined by actual range span



Coiled Bulbs

Span Limits	Bulb Specification Number	"Y" Outside Diameter	"X" Sensitive Length	"J" Extension Length
	Stainless Steel			
400-500 °F	1-021-2(+)-()*	3/4"	0.8"	10" or 30"
270-399 °F	1-021-2(+)-()*		1.0	
185-269 °F	1-021-2(+)-()*		1.2	
125-184 °F	1-021-2(+)-()*		1.7	
80-124 °F	1-021-2(+)-()*		2.6	
50-79 °F	1-021-2(+)-()*		4.2	

(+) insert "J" dimension - 10" or 30" standard

Adjustable Union Fittings (non-removable) and Bushings

<i>Bulb Size</i>	<i>Union Fitting</i>		<i>Bushing</i>		
	<i>Material</i>	<i>Part Number</i>	<i>Material</i>	<i>N.P.T.</i>	<i>Part Number</i>
3/8"	Stainless Steel	306087-006	Stainless Steel	1/2"	306092-00-0
				3/4"	306089-00-9

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