MIL-STD-735A(SHIPS)
NOTICE 1
20 April 1971

MILITARY STANDARD

TEST METHODS AND TEST EQUIPMENT

FOR THERMOMETERS USED IN

MACHINERY AND PIPING SYSTEMS

TO ALL HOLDERS OF MIL-STD-735A(SHIPS)

1. THE FOLLOWING PAGE OF MIL-STD-735A(SHIPS) HAS BEEN REVISED AND SUPERSEDES THE PAGE LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
17	20 April 1971	17	6 May 1965
18	6 May 1965		Reprinted without change

2. RETAIN THIS NOTICE AND INSERT BEFORE THE TABLE OF CONTENTS.

3. Holders of MIL-STD-735A(SHIPS) will verify that the page change indicated above has been entered. The notice page will be retained as a check sheet. This issuance, together with the appended page is a separate publication. Each notice is to be retained by stocking points until the Military Standard is completely revised or cancelled.

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or as a comparison standard, whichever may apply. Timing shall be by stop watch or other method capable of timing to 0.2 second or better. A millivolt pyrometer or potentiometer having a response time at least two times faster than the response time of the standard cylinder, (see table II), will be needed to measure the temperature rise of the cylinder.

Table II - Response time for standard cylinder.

Bath medium	Test temperature Range (°F.)	Response time (Seconds)
Glycol 1/	-20 to 140	15 ± 1
Water	32 to 212	6 ± 0.2
Oil	180 to 500	40 ± 2
Salt 2/	400 to 1500	8 ± 0.2

1/ Fifty percent glycol, 50 percent water.

2/ Noncorrosive low melting point mixture of nitrates and nitrites of sodium and potassium. The liquid shall be stable at all operating temperatures.

6.2.3 Method. The test shall be performed in a liquid bath having a variable rate of stirring. The stirring rate shall be set to give the response time of table II or as specified for the standard cylinder. The setting is determined by performing the test described in this method using the standard cylinder instead of a thermometer and adjusting the stirring rate to give the required response time.

6.2.3.1 Temperatures. The temperature listed below shall be as specified or shall be selected to give a step change of at least 25 percent of the scale span of the thermometer being tested.

(a) Bath temperature.
(b) Initial temperature; T_1 minus 10 percent of scale span.
(c) Temperature at which timing is to begin, T_1.
(d) Temperature at which timing is to stop, T_2.

6.2.3.2 Lag determination. The bath shall be adjusted to hold a constant temperature and the stirring speed set as described above. The thermometer bulb shall be immersed in the bath at the same location at which the test was performed with the standard cylinder and shall be allowed to soak until the indicator shows no further rise. The bulb shall be removed from the bath and shall be cooled in air or in a second bath to a temperature 10 percent of the dial span of the thermometer below the temperature at which timing is started. When a second bath is used, the bulb shall be held in this bath until its temperature becomes constant. The bulb shall be transferred back into the first bath where the bulb shall be immersed to its full insertion length at the same location in the bath it originally occupied. Timing shall be started when the indicator passes the T_1 mark and stopped when it passes the T_2 mark. The time lapse between T_1 and T_2 is the response time. The response time shall be the average of 4 trials. T_1 and T_2 shall be true, not indicated temperatures.

6.2.3.3 Summary. The following details shall be specified in the individual specification:

(a) The bath medium.
(b) The bath temperature.

(c) The initial temperature.
(d) The temperature at which timing is to begin, T_1.
(e) The temperature at which timing is to stop, T_2.
(f) Response time of the thermometer in the bath medium.
(g) Type of well to be used for the test if other than bare bulb.

6.3 Over temperature.

6.3.1 Purpose. In the over or excess temperature test the bulb or sensitive portion of the thermometer is subjected for a specified time to a temperature above its normal range of operation. The test is used to prove that the thermometer system can be used at the top of its operating range and that it will withstand short periods of higher temperatures without failure. Weaknesses in the system will be indicated by physical damage or loss of accuracy. The effects of over temperature include heat damage to the materials, overstressing of the pressure system, leakage of the filling medium and changes in electrical or mechanical characteristics.

6.3.2 Equipment. The test shall be performed in a bath in accordance with 5.1. The bath shall be of sufficient size for complete immersion of the insertion length of the thermometer bulb.

6.3.3 Methods. The insertion length of the bulb shall be subjected to a temperature equal or slightly greater than the maximum dial indication for 5 minutes. The bulb shall then be allowed to cool to ambient temperature in air. After cooling, the thermometer shall be calibrated for accuracy.

6.3.4 Summary. The following details shall be specified in the individual specification:

(a) The temperature if other than maximum dial indication.
(b) The time if other than 5 minutes.

6.4 Indicator and capillary compensation (filled systems type only).

6.4.1 Purpose. This test is performed to determine the effectiveness of the provisions made in the thermometer system to compensate for temperature changes around the indicator and along the capillary. Without compensation or with inadequate compensation the temperature variations around these elements may have a substantial influence on the indication.

6.4.2 Equipment. A stirred liquid bath and a cabinet or oven capable of being heated or cooled are required for this test. The first of these is for bulb temperatures. The second is for ambient temperatures around the capillary and indicator. The cabinet shall have a suitable opening for enclosing either the capillary or the indicator while the bulb is in the liquid bath. A cabinet for heating or cooling the indicator of direct connected thermometers is shown on figure 8. An alternate method for testing the capillary is to immerse it in a water bath at the specified temperature.

6.4.3 Methods. The bulb shall be immersed in a stirred liquid bath. Bulb, indicator and capillary temperature shall be obtained as shown in table III. In each test the indicator or capillary shall be held at the required temperature for not less than one hour before taking a reading. The results of the test shall be plotted as shown on figure 9 and the effectiveness of the compensation determined therefrom as illustrated.

6.4.4 Summary. The following details shall be specified in the individual specification:

(a) The base temperature or temperatures if other than 110°F. and the temperature changes from 110°F. if different from those specified in table III.
(b) The maximum change in indication allowable for the indicator and the capillary if other than one scale division each.

6.5 Thermal cycling.

6.5.1 Purpose. This test is made to determine the resistance of the thermometer system to cyclic changes in temperature and to expose weaknesses in materials or construction that may cause premature failure. Such failure may include leakage of the filling medium, clogging or plugging of the capillary, changes in operating characteristics, and physical damage or distortion.