



# Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel<sup>1</sup>

This standard is issued under the fixed designation C 795; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

<sup>ε1</sup> NOTE—Editorial changes were made in September 1998.

## 1. Scope

1.1 This specification covers non-metallic thermal insulation for use in contact with austenitic stainless steel piping and equipment. In addition to meeting the requirements specified in their individual material specifications, issued under the jurisdiction of ASTM Committee C-16, these insulations must pass the preproduction test requirements of Test Method C 692, for stress corrosion effects on austenitic stainless steel, and the confirming quality control, chemical requirements, when tested in accordance with the Test Methods C 871. These thermal insulations may be either homogeneous or non-homogeneous and either organic or inorganic.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

- C 168 Terminology Relating to Thermal Insulating Materials<sup>2</sup>
- C 692 Test Method for Evaluating the Influence of Thermal Insulations on the External Stress Corrosion Cracking Tendency of Austenitic Steel<sup>2</sup>
- C 871 Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions<sup>2</sup>

## 3. Terminology

3.1 *Definitions*—Terminology C 168 should be considered as applying to the terms used in this specification.

### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *basic material specification*—any of the material specifications for homogeneous insulation covered in any of

the pertinent *Annual Book of ASTM Standards*.

3.2.2 *lot*—a lot shall be defined in accordance with Criteria C 390 by agreement between the purchaser and the manufacturer.

3.2.3 *stress corrosion cracking*—the failure of metal, taking the form of cracks that may occur under the combined influence of certain corrosive environments and applied or residual stresses.

3.2.4 *wicking-type insulation*—insulation material that, by virtue of its physical characteristics, permits a wetting liquid to infiltrate it by capillary attraction.

## 4. Significance and Use

4.1 Stress corrosion cracking of austenitic stainless steel is a metallurgical phenomenon. One cause of stress corrosion cracking is the presence of contaminants in water solution, which can be concentrated at the stressed surface by evaporation of the water.

4.2 There is an apparent correlation between stress corrosion cracking of austenitic stainless steel and the use of insulation which either contains water-leachable chloride or, by reason of its water absorptivity, may act as a vehicle through which chlorides from outside the system may be concentrated at the surface of the stainless steel.<sup>3,4,5</sup>

4.3 Studies have shown that insulation containing certain water-soluble compounds may retard or prevent chloride-induced stress corrosion. Numerous materials thought to inhibit stress corrosion cracking have been tried with varying degrees of success. An inhibiting compound commonly used is sodium silicate. Present knowledge indicates that the sodium silicate dissociates in the presence of water, leaving the silicate ion to form a protective mechanism that inhibits or prevents the chloride ion from attacking the stainless steel. Under adverse

<sup>3</sup> Schaffer, L. D., and Klapper, J. A., "Investigation of the Effects of Wet, Chloride-Bearing, Thermal Insulation on Austenitic Stainless Steel," *Report No. ESI-25-(a)-1*, Oak Ridge National Laboratory, and Ebasco Services Inc., November 1, 1961.

<sup>4</sup> Dana, A. W., Jr., "Stress-Corrosion Cracking of Insulated Austenitic Stainless Steel," *ASTM Bulletin*, October 1957.

<sup>5</sup> Louthan, M. R., Jr., "Initial Stages of Stress Corrosion Cracking in Austenitic Stainless Steels," *Corrosion*, NACE, September 1965.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-16 on Thermal Insulation and is the direct responsibility of Subcommittee C16.20 on Homogeneous Inorganic Thermal Insulations.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.06.

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environmental conditions, this protective agent may be leached from the product with time and permanent protection may not be afforded.

4.4 Test Method C 692 contains a procedure for determining whether or not chloride-induced stress corrosion cracking will occur with a given thermal insulation. The procedure is used to evaluate insulation materials that may in themselves be passive, or actively contribute to stress corrosion cracking of austenitic stainless steels.

## 5. Ordering Information

5.1 The requirements of this specification shall be stated by the purchaser for the particular insulation and material application specified. The purchaser shall specify the type, grade, class, dimensions, quantity, and other requirements as may be available in the basic material specification for a particular insulation.

## 6. Composition

6.1 The material shall conform to the established requirements of the basic material specification.

## 7. Physical and Chemical Requirements

7.1 The physical requirements shall conform to the requirements of the basic material specification. The chemical requirements shall conform to the requirements of Section 13 of this specification.

## 8. Dimensions and Permissible Variations

8.1 The dimensions and permissible variations shall conform to the requirements of the basic material specification.

## 9. Workmanship, Finish, and Appearance

9.1 The workmanship, finish, and appearance shall conform to the requirements of the basic material specification.

## 10. Sampling

10.1 The unit sample shall be of sufficient size to perform the preproduction corrosion test and chemical analysis tests specified in this specification. The samples shall be of sufficient size to ensure an acceptable level of confidence that the test results represent the characteristics of the product being purchased. Sample size shall be in accordance with Criteria C 390.

## 11. Acceptance and Retests

11.1 *Acceptance*—All specimens in a lot sampling shall meet the chemical requirements of this specification. If the average analysis of the two specimens taken from any sample fails to conform to the requirements of this specification, the lot represented by that sample shall be rejected.

11.2 *Retest*—At the option of the supplier, each individual unit of supply (that is, carton, bag, roll, sheet, drum, etc.) in rejected lots may be retested, in accordance with Test Methods C 871, at the supplier's expense, by testing samples taken at random from the unit of supply in accordance with this specification. Unless otherwise agreed upon between the purchaser and the manufacturer, the resubmittal material shall require the same number of samples to be tested as required for

the initial submittal. If the average analysis of the two specimens taken from each sample fails to conform to the requirements of this specification, the unit of supply represented by that sample shall be rejected. For other than chemical analysis or stress corrosion tests, the number of tests and retests shall be as specified in the basic material specification.

## 12. Preproduction Corrosion Test

12.1 A corrosion test shall be performed as a preproduction test by each manufacturer. The production lot from which the sample is taken shall be of the same formulation, made by the same production processes and from the same kind, nature, and quality of ingredients as those that will be employed for production of thermal insulation under this specification.

12.2 The corrosion test shall be conducted in accordance with the method presented in Test Method C 692. At the end of the test time, none of the prepared coupons of stainless steel shall show a crack when examined in accordance with Test Method C 692.

12.3 The test procedure need not be repeated for subsequent orders using the same production process and the same kind, nature, and quality of ingredients unless so required. The manufacturer shall keep records of actual numerical results of the tests available for review on request by those concerned.

## 13. Chemical Analysis

13.1 A chemical analysis shall be performed on the insulation material in accordance with Test Methods C 871 and, in addition, the manufacturer shall demonstrate that his current product has passed the preproduction corrosion test in accordance with Test Method C 692.

13.1.1 An acceptable proportion of sodium plus silicate ions to the chloride ions as found by leaching from the insulation is shown in Fig. 1 and was arrived at empirically. Other insulation compositions, whose chemical analysis falls outside of the acceptance area shown in Fig. 1, may also be acceptable; however, their efficacy shall be determined in accordance with Test Method C 692 and subsequently monitored in accordance with Test Methods C 871.

13.2 *pH*—The pH of the leach water shall be measured, in accordance with Test Methods C 871, from the specific material supplied, and shall be greater than 7.0 but not greater than 11.7 at 77°F (25°C), except for insulating or finishing cement, or both, which may have a pH no greater than 12.5.

13.3 The specific material supplied shall be analyzed in accordance with Test Methods C 871 for the following leachable ions: chloride, sodium, and silicate. The “plot point” of these analyses shall fall in the acceptable area of Fig. 1.

13.4 The minimum allowable value of sodium plus silicate shall be 50 ppm, unless otherwise previously determined acceptable when tested in accordance with Test Method C 692.

## 14. Handling and Application

14.1 See applicable ASTM specifications for handling and application.

## 15. Keywords

15.1 austenitic stainless steel; chloride; fluoride; pH; silicate; sodium; stress corrosion cracking; thermal insulation

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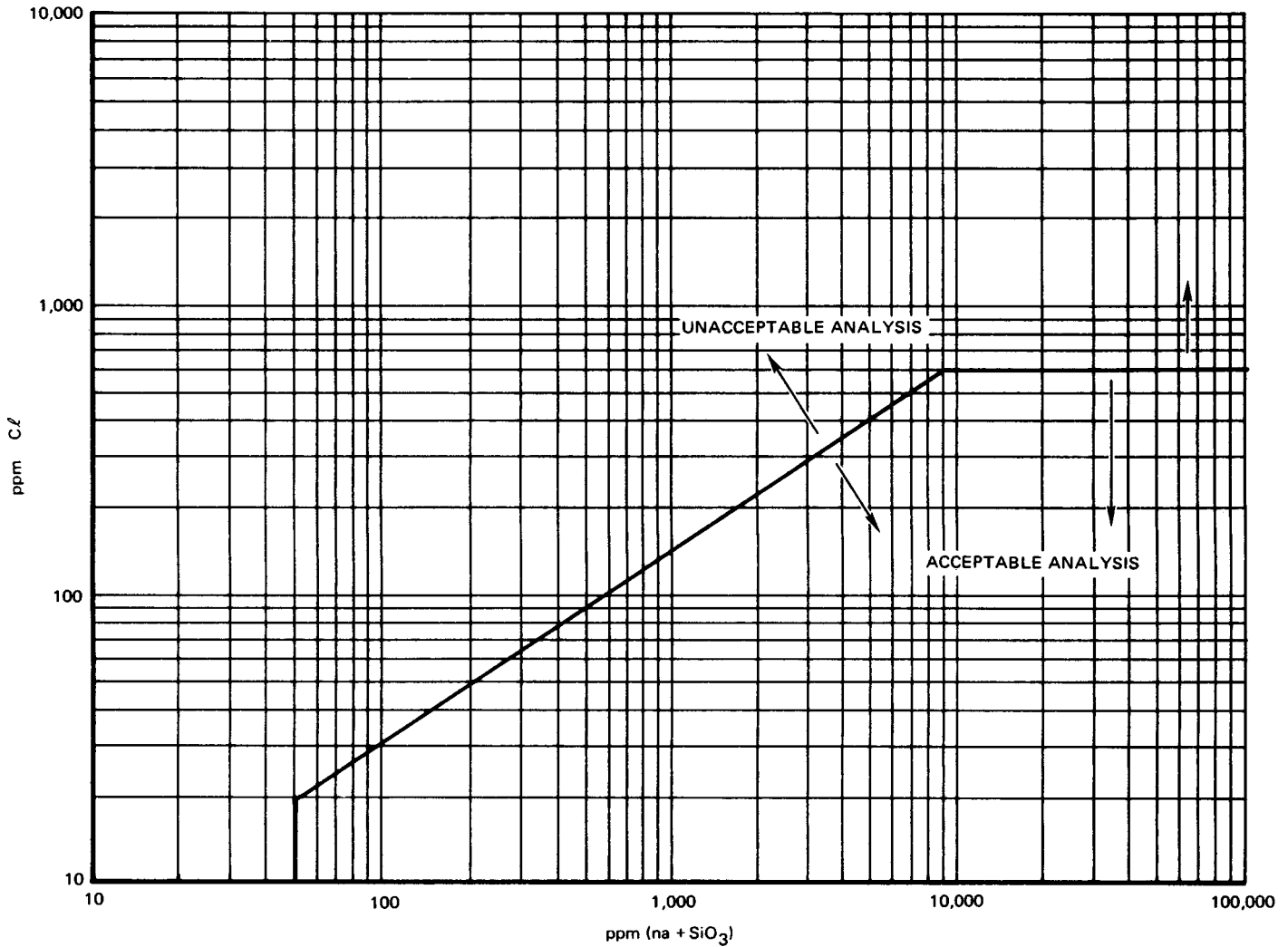


FIG. 1 Acceptability of Insulation Material on the Basis of the Plot Points of the Cl and the (Na + SiO<sub>3</sub>) Analyses.

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