NACE Standard MR0175-2003
Item No. 21302

Standard
Material Requirements

Metals for Sulfide Stress Cracking and Stress Corrosion Cracking Resistance in Sour Oilfield Environments

Revised 2003-01-17
Approved March 1975
NACE International
1440 South Creek Dr.
Houston, Texas 77084-4906
+1 (281)228-6200

ISBN 1-57590-021-1

Foreword

This NACE standard materials requirement is one step in a series of committee studies, reports, symposia, and standards that have been sponsored by former Group Committee T-1 (Corrosion Control in Petroleum Production) relating to the general problems of sulfide stress cracking (SSC) and stress corrosion cracking (SCC) of metals. Much of this work has been directed toward the oil- and gas-production industry. This standard is a materials requirement for metals used in oil and gas service exposed to sour gas, to be used by oil and gas companies, manufacturers, engineers, and purchasing agents. Many of the guidelines and specific requirements in this standard are based on field experience with the materials listed, as used in specific components, and may be applicable to other components and equipment in the oil-production industry or to other industries, as determined by the user. Users of this standard must be cautious in extrapolating the content of this standard for use beyond its scope.

The materials, heat treatments, and metal-property requirements given in this standard represent the best judgment of Task Group 081 (formerly T-1F-1) and its administrative Specific Technology Group (STG) 32 on Oil and Gas Production—Metallurgy (formerly Unit Committee T-1F on Metallurgy of Oilfield Equipment).

This NACE standard updates and supersedes all previous editions of MR0175. The original 1975 edition of the standard superseded NACE Publication 1F166 (1973 Revision) titled "Sulfide Cracking-Resistant Metallic Materials for Valves for Production and Pipeline Service," and NACE Publication 1B163 titled "Recommendation of Materials for Sour Service" (which included Tentative Specifications 150 on valves, 51 on severe weight loss, 60 on tubular goods, and 50 on nominal weight loss).

This standard will be revised as necessary to reflect changes in technology. (See Sections 13, 14, and 15.)

Whenever possible, the recommended materials are defined by reference to accepted generic descriptors (such as UNS[1] numbers) and/or accepted standards, such as AISI,[2] API,[3] ASTM,[4] or DIN[5] standards.

In NACE standards, the terms *shall*, *must*, *should*, and *may* are used in accordance with the definitions of these terms in the *NACE Publications Style Manual*, 4th ed., Paragraph 7.4.1.9. *Shall* and *must* are used to state mandatory requirements. *Should* is used to state something considered good and is recommended but is not mandatory. *May* is used to state something considered optional.

This NACE International standard represents a consensus of those individual members who have reviewed this document, its scope, and provisions. Its acceptance does not in any respect preclude anyone, whether he has adopted the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not in conformance with this standard. Nothing contained in this NACE International standard is to be construed as granting any right, by implication or otherwise, to manufacture, sell, or use in connection with any method, apparatus, or product covered by Letters Patent, or as indemnifying or protecting anyone against liability for infringement of Letters Patent. This standard represents minimum requirements and should in no way be interpreted as a restriction on the use of better procedures or materials.

[1] Metals and Alloys in the Unified Numbering System (latest revision), a joint publication of ASTM International (ASTM) and the Society of Automotive Engineers Inc. (SAE), 400 Commonwealth Drive, Warrendale, PA 15096.
[2] American Iron and Steel Institute (AISI), 1101 17th St. NW, Suite 1300, Washington, DC 20036.
[3] American Petroleum Institute (API), 1220 L St. NW, Washington, DC 20005.
[4] ASTM International (ASTM), 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.
[5] Deutsches Institut für Normung (DIN), Burggrafenstrasse 6, D-10787 Berlin, Germany.

NACE International

Standard
Material Requirements

Metals for Sulfide Stress Cracking and Stress Corrosion Cracking Resistance in Sour Oilfield Environments

Contents

Section 1: General

1.1 Scope

This standard presents metallic material requirements to provide resistance to sulfide stress cracking (SSC) and/or stress corrosion cracking (SCC) for petroleum production, drilling, gathering and flow line equipment, and field processing facilities to be used in hydrogen sulfide (H_2S)-bearing hydrocarbon service.

This standard is applicable to the materials and/or equipment specified by the materials standards institutions listed in Table 1 (or by equivalent standards or specifications of other agencies).

This standard does not include and is not intended to include design specifications.

Other forms of corrosion and other modes of failure, although outside the scope of this standard, should also be considered in design and operation of equipment. Severely corrosive conditions may lead to failures by mechanisms other than SSC and/or SCC and should be mitigated by corrosion inhibition or materials selection, which are outside the scope of this standard. For example, some lower-strength steels used for pipelines and vessels may be subjected to failure by hydrogen-induced cracking (blistering and stepwise cracking) as a result of hydrogen damage associated with general corrosion in the presence of H_2S.[1,2]

TABLE 1
Sources of Material Standards

1. Aerospace Material Specifications (AMS): Society of Automotive Engineers Inc. (SAE), 400 Commonwealth Drive, Warrendale, PA 15096.
2. American Iron and Steel Institute (AISI), 1101 17th St. NW, Suite 1300, Washington, DC 20036.
3. American National Standards Institute (ANSI), 11 West 42nd St., New York, NY 10036.
4. American Petroleum Institute (API), 1220 L St. NW, Washington, DC 20005.
5. ASME International (ASME), Three Park Ave., New York, NY 10016-5990.
6. ASTM International (ASTM), 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.
7. American Welding Society (AWS), P.O. Box 251040, Miami, FL 33126.
8. British Standards Institution (BSI), British Standards House, 389 Chiswick High Rd., London W4 4AL, United Kingdom.
9. CSA International, 178 Rexdale Blvd., Etobicoke, Ontario, Canada M9W 1R3.
10. Deutsches Institut für Normung (DIN), Burggrafenstrasse 6, D-10787, Berlin, Germany.

1.2 Procurement

It is the responsibility of the user to determine the operating conditions and to specify when this standard applies.[(6)] A variety of candidate materials may be selected from this standard for any given component. The manufacturer is responsible for meeting metallurgical requirements. It is the user's responsibility to ensure that a material will be satisfactory in the intended environment. The user may select specific materials for use on the basis of operating conditions that include pressure, temperature, corrosiveness, fluid properties, etc. For example, when bolting components are selected, the pressure rating of flanges could be affected. The following could be specified at the user's option: (1) materials from this standard used by the manufacturer, and (2) materials from this standard proposed by the manufacturer and approved by the user. It is always the responsibility of the equipment user to convey the environmental conditions to the equipment supplier, particularly if the equipment will be used in sour service.

1.3 Applicability

This standard applies to all components of equipment exposed to sour environments, where failure by SSC or SCC would (1) prevent the equipment from being restored to an operating condition while continuing to contain pressure, (2) compromise the integrity of the pressure-containment system, and/or (3) prevent the basic function of the equipment from occurring. Materials selection for items such as atmospheric and low-pressure systems, water-handling facilities, sucker rods, and subsurface pumps are covered in greater detail in other NACE International and API documents and are outside the scope of this standard.

1.4 MR0175 Application

Sulfide stress cracking (SSC) is affected by the following factors:

(1) metallurgical condition and strength, which are affected by chemical composition, heat treatment, cold work, and microstructure;

(6) See Section 2 for the definition of *user*.