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Petroleum and natural gas industries— Materials for use in H_2S-containing Environments in oil and gas production

Part 1:

General principles for selection of cracking-resistant materials

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of NACE MR0175/ISO 15156 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard NACE MR0175/ISO 15156-1 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*.

NACE MR0175/ISO 15156 consists of the following parts, under the general title *Petroleum and natural gas industries — Materials for use in H_2S-containing environments in oil and gas production*:

— *Part 1: General principles for selection of cracking-resistant materials*

— *Part 2: Cracking-resistant carbon and low alloy steels*

— *Part 3: Cracking-resistant CRAs (corrosion-resistant alloys) and other alloys*

Introduction

The consequences of sudden failures of metallic components used in the oil and gas field, and associated with their exposure to H_2S-containing production fluids, led to the preparation of the first edition of NACE Standard MR0175. This standard was published in 1975 by the National Association of Corrosion Engineers, now known as NACE International.

The original and subsequent editions of NACE Standard MR0175 established limits of H_2S partial pressure above which precautions against sulfide stress cracking (SSC) were always considered necessary. They also provided guidance for the selection and specification of SSC-resistant materials when the H_2S thresholds were exceeded. In more recent editions, NACE MR0175 has also provided application limits for some corrosion-resistant alloys, in terms of environmental composition and pH, temperature and H_2S partial pressures. NACE Standard MR0175 is complemented by NACE Standard TM0177 and NACE Standard TM0284.

In separate developments, the European Federation of Corrosion issued EFC Publication 16 in 1995 and EFC Publication 17 in 1996. These documents are generally complementary to those of NACE though they differ in scope and detail.

With the cooperation of NACE and EFC, ISO/TC 67 formed Working Group 7 to prepare ISO 15156. The Working Group are to promote the collection, review and, where appropriate, publication of field experience and laboratory test data related to the cracking resistance of metallic materials in H_2S-containing environments.

This part of NACE MR0175/ISO 15156 utilizes the above sources to provide requirements and recommendations for materials qualification and selection for safe application in environments containing wet H_2S in oil and gas production systems.

INTERNATIONAL STANDARD

Petroleum and natural gas industries—Materials for use in H_2S-containing environments in oil and gas production—

Part 1:
General principles for selection of cracking-resistant materials

1 Scope

This part of NACE MR0175/ISO 15156 describes general principles and gives requirements and recommendations for the selection and qualification of metallic materials for service in equipment used in oil and gas production and in natural gas sweetening plants in H_2S-containing environments, where the failure of such equipment could pose a risk to the health and safety of the public and personnel or to the environment. It can be applied to help to avoid costly corrosion damage to the equipment itself. It supplements, but does not replace, the material requirements given in the appropriate design codes, standards or regulations.

This part of NACE MR0175/ISO 15156 addresses all mechanisms of cracking that can be caused by H_2S, including sulfide stress cracking, stress corrosion cracking, hydrogen-induced cracking and stepwise cracking, stress-oriented hydrogen-induced cracking, soft zone cracking and galvanically induced hydrogen stress cracking.

Table 1 provides a non-exhaustive list of equipment to which this part of NACE MR0175/ISO 15156 is applicable, including permitted exclusions.

This part of NACE MR0175/ISO 15156 applies to the qualification and selection of materials for equipment designed and constructed using conventional elastic design criteria.

This part of NACE MR0175/ISO 15156 is not necessarily applicable to equipment used in refining or downstream processes and equipment.

CAUTION—Metallic materials selected or qualified using NACE MR0175/ISO 15156 are resistant to cracking in defined H_2S-containing environments in oil and gas production, but are not necessarily immune under all service conditions.