NACE Standard TM0296-2014
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# Standard Test Method

# Evaluating Elastomeric Materials in Sour Liquid Environments



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## Foreword

This standard test method is intended to serve as a tool in the process of evaluating elastomeric materials for use in the oil field and other energy-related areas where sour liquid environments are encountered. This standard may be used by polymer manufacturers, processors, equipment manufacturers, operating companies, or others who desire to compare resistance of various elastomeric materials to a sour liquid environment. The test method is an accelerated aging procedure similar to ASTM[(1)] D471,[1] with additional information on sour environment testing under pressures greater than atmospheric pressure. If specified test conditions are adhered to, data from separate laboratories that use this test method may be compared. Other technical organizations may have a comparable standard test method.

No attempt has been made or implied to establish any pass/fail criteria for materials tested by this method. The change in properties of an elastomeric material is indicative of its resistance to a specific environment. Use of this standard provides a measure of the resistance under the conditions of this particular test method, but does not necessarily provide results that have any direct relation to service performance. The significance of the results can be determined only by each laboratory for its particular application.

This standard was originally prepared in 1996 by NACE International Task Group T-1G-17. It was reaffirmed with significant editorial revisions in 2002 by Specific Technology Group (STG) 33, "Oil and Gas Production: Nonmetallics and Wear Coatings (Metallic)," and revised in 2008 by Task Group (TG) 087, "STG 33 Standards and Technical Committee Reports: Revision, Reaffirmation, or Withdrawal." NACE International technical committees are composed of industry representatives including consumers, producers, and interested individuals. This standard test method is issued under the auspices of STG 33.

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.* The terms *shall* and *must* are used to state a requirement and are considered mandatory. The term *should* is used to state something good and is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.

(1) ASTM International (ASTM), 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.

# NACE International
# Standard Test Method

# Evaluating Elastomeric Materials in Sour Liquid Environments

**Contents**

## Section 1: General

1.1 This standard sets forth procedures to measure the ability of elastomeric materials to withstand static exposure to sour liquid environments (e.g., hydrocarbon, water, or mixtures of each with hydrogen sulfide [$H_2S$]) at elevated pressure and temperature, and is not designed to be a functional test. It is designed for testing O-rings or specimens of elastomeric vulcanizates cut from standard sheets in accordance with ASTM D3182.[2] This standard is not applicable to the testing of cellular rubber or porous compositions.

1.2 This standard sets forth procedures for the preparation of test specimens and equipment to be used, the test procedures to be followed, and procedures for reporting results. This standard also discusses test conditions, test environment, and reagents. Specifically, this standard specifies conditions of temperature, exposure time, and pressure for the exposure of test specimens to the influence of a sour liquid environment that contains $H_2S$, carbon dioxide ($CO_2$), methane ($CH_4$), water, and liquid hydrocarbon. The test results are determined by monitoring changes in physical and mechanical properties (i.e., mass, volume, compression set, hardness, tensile strength, ultimate elongation, and modulus), as well as change in appearance after exposure to the selected test environment.

1.3 The precision of this test method and reproducibility within and among laboratories has not been established. Specimens being tested using this method may be different in performance or alike within test error. The user of this standard is encouraged to establish statistical significance of the data resulting from using this test method.

1.4 In view of the wide range of service conditions, this standard is intended only to provide a means of initial material evaluation and comparison. The test results are not intended to provide any direct correlation with service performance. This standard is useful in conducting research and development of elastomeric vulcanizates.

1.5 SAFETY PRECAUTIONS: $H_2S$ is an extremely toxic gas that must be handled with care. See Appendix A (mandatory) for safety considerations in handling $H_2S$.

## Section 2: Definitions

2.1 ASTM D1566[3] provides definitions of technical terms used in this standard.

## Section 3: Reagents

3.1 Reagent Purity

3.1.1 The gases ($H_2S$, $CO_2$, and $CH_4$) shall be reagent or a chemically pure (99.5% minimum purity) grade. The nitrogen or other inert gas used for purging (to remove oxygen from the test environment) shall be a high-purity, oxygen-free grade (i.e., less than 5 ppm oxygen).

3.1.2 The water shall conform to ASTM D 1193[4] for Type IV reagent water. Tap water shall not be used.

## Section 4: Test Environment

4.1 The test environment consists of the following: a water phase occupying 5% of the test vessel volume, a selected hydrocarbon liquid phase occupying 60% of the test vessel volume, and a selected $H_2S$-containing gas mixture occupying the remainder of the test vessel volume and used to produce the test pressure.

4.1.1 It is usually desirable to evaluate elastomers in the specific environments to which they are to be exposed in service. However, to provide a uniform basis for the evaluation and comparison of elastomer performance, the test environment should utilize the standard liquid hydrocarbon phases and gas mixtures specified below. The choice of the liquid hydrocarbon and gas phases used shall depend on the elastomers to be tested and the service conditions anticipated.