



THE CORROSION SOCIETY

NACE Standard TM0397-2012
Item No.21230

Standard Test Method

Screening Tests for Evaluating the Effectiveness of Gypsum Scale Removers

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 or she 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 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. Neither is this standard intended to apply in all cases relating to the subject. Unpredictable circumstances may negate the usefulness of this standard in specific instances. NACE assumes no responsibility for the interpretation or use of this standard by other parties and accepts responsibility for only those official NACE interpretations issued by NACE in accordance with its governing procedures and policies which preclude the issuance of interpretations by individual volunteers.

Users of this NACE standard are responsible for reviewing appropriate health, safety, environmental, and regulatory documents and for determining their applicability in relation to this standard prior to its use. This NACE standard may not necessarily address all potential health and safety problems or environmental hazards associated with the use of materials, equipment, and/or operations detailed or referred to within this standard. Users of this NACE standard are also responsible for establishing appropriate health, safety, and environmental protection practices, in consultation with appropriate regulatory authorities if necessary, to achieve compliance with any existing applicable regulatory requirements prior to the use of this standard.

CAUTIONARY NOTICE: NACE standards are subject to periodic review, and may be revised or withdrawn at any time in accordance with NACE technical committee procedures. NACE requires that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of initial publication and subsequently from the date of each reaffirmation or revision. The user is cautioned to obtain the latest edition. Purchasers of NACE standards may receive current information on all standards and other NACE publications by contacting the NACE *FirstService* Department, 1440 South Creek Dr., Houston, TX 77084-4906 (telephone +1 281-228-6200).

Reaffirmed 2012-12-13
Reaffirmed 2002-04-11
Approved 1997-10-11
NACE International
1440 South Creek Dr.
Houston, Texas 77084-4906
+1 281-228-6200

ISBN 1-57590-044-0
© 2012, NACE International

Foreword

Hydrocarbon production is often accompanied by the production of a brine. Minerals may precipitate from a brine and deposit within the production system. The scale deposits can be located both downhole and in surface equipment. Often the deposit has an adverse effect on production and must be removed.

Producers and service companies devote considerable effort to developing and marketing effective treating chemicals because of the serious impact that gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) scale formation can have on hydrocarbon production. The performance of these treating chemicals used for scale removal can be verified most effectively after an actual field trial. However, field testing can be very difficult and time-consuming, especially when many chemicals are being evaluated. Although most laboratory tests cannot exactly duplicate field conditions, the advantage of such tests is to provide the user with a comparison of the performance of one scale remover against that of another under standard laboratory conditions. The industry has not established a standard test method to evaluate gypsum scale removers. Consequently, performance tests on a scale remover or collection of scale removers yield widely differing absolute and relative results depending on the test procedure used.

NACE Unit Committee T-1D formed Task Group T-1D-32 in 1987, in response to an expressed need for a standard test method for the evaluation of chemical-based gypsum scale removers.

The initial task group assignment was to compose and publish a technical committee report. That report was issued in 1991 (NACE Publication 1D191¹). The subsequent assignment was to develop standard test methods for screening gypsum scale remover chemicals, which are addressed in this standard.

This standard presents test methods for screening the effectiveness of two types of gypsum scale removers, one for scale dissolvers, and another for scale converters. These methods are primarily intended for use by those in the petroleum industry who need to use treating chemicals to remove gypsum scale deposits.

This NACE standard was originally prepared in 1997 by Task Group T-1D-32, a component of former Unit Committee T-1D on Corrosion Monitoring and Control of Corrosion Environments in Petroleum Production Operations. It was reaffirmed in 2002 by Specific Technology Group (STG) 31 on Oil and Gas Production—Corrosion and Scale Inhibition and it was reaffirmed in 2012 by STG 31 on Oil and Gas Production—Corrosion and Scale Inhibition. It is issued by NACE International under the auspices of STG 31.

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.

**NACE International
Standard
Test Method**

**Screening Tests for Evaluating the Effectiveness
of Gypsum Scale Removers**

Contents

1. General	1
2. Gypsum Scale Dissolver Screening Test.....	1
3. Gypsum Scale Converter Screening Test.....	3
4. Calculations.....	5
References.....	6
Appendix A (Nonmandatory): Procedure for Making Compressed Gypsum Pellets	6

Section 1: General

1.1 The test methods described in this standard are static laboratory screening tests designed to measure the ability of chemicals to remove gypsum scale deposits. There are two types of scale-removal chemicals: dissolvers and converters. Scale dissolvers, generally chelating or sequestering agents, can affect the dissolution and removal of gypsum scale in one step. Converters, such as those formulations based on sodium (or potassium) glycolate and sodium (or ammonium) carbonate (or bicarbonate), are used to alter or convert the calcium sulfate to another compound which is then removed by dissolution with a dilute mineral acid (typically hydrochloric acid). Test methods for screening both gypsum scale dissolvers and converters are described.

1.2 These test methods are recommended only for ranking the performance of different scale-removal chemicals under the laboratory conditions set by these test methods.

1.3 Many factors such as reaction kinetics, fluid velocity, temperatures and pressures, scale surface area, and scale composition can significantly affect scale removal under field conditions. Detailed consideration of these parameters is outside the scope of this standard. However, field conditions, field brine composition, and others noted above should be considered at some point in the evaluation prior to final selection of a scale remover for field use.

1.4 Tests can be conducted using varying amounts of gypsum to obtain a better comparison of scale removers under the laboratory conditions set by these test methods. The actual ratio of scale remover to gypsum required for a field application may be different from that established by these test methods.

1.5 This standard lists the necessary apparatus, reagents, and procedures for conducting screening tests of both gypsum dissolvers and converters.

1.6 A reference scale dissolver, tetrasodium ethylene-diaminetetraacetate (Na_4EDTA), or a reference scale converter, potassium glycolate (the potassium salt of hydroxyacetic acid, HOCH_2COOK), is run along with the scale removers being screened. The test results obtained using a reference chemical of known scale-removal capacity provide a benchmark to verify that the screening test procedures were properly conducted.

Section 2: Gypsum Scale Dissolver Screening Test

2.1 This section lists the equipment and procedure for conducting the gypsum scale dissolver screening test.

2.2 Equipment and Solutions

2.2.1 Constant-temperature water bath or forced-draft oven capable of maintaining the specified temperature within 1 °C.

2.2.2 60 mL wide-mouth glass bottles with caps that will not react with the test solutions and that will provide an airtight seal. These bottles shall be clean of any contaminating material and shall be dry.

2.2.3 Apparatus for delivering 50.0 ± 0.5 mL, e.g., graduated cylinders or volumetric pipets.

2.2.4 Vacuum filter flask, 0.45 μm membrane filters (47 mm diameter), and filter holder assembly.

2.2.5 Laboratory balance and miscellaneous equipment to weigh, handle, and transfer solids. The balance shall be capable of measurement to 0.01 g or better.

2.2.6 ACS⁽¹⁾ reagent grade gypsum powder ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$).²

2.2.7 Undiluted and diluted (1:1 [vol] in distilled or deionized water) solutions of the scale dissolver(s).

2.2.8 A 200 g/L solution of reagent grade Na_4EDTA . This will be used as a reference scale dissolver with a known gypsum-dissolving capacity to verify that the test operator is conducting the screening test procedures properly and consistently.

⁽¹⁾ American Chemical Society (ACS), 1155 16th St. NW, Washington, DC 20036.