



International
Standard

ISO 23936-3

**Oil and gas industries including
lower carbon energy — Non-
metallic materials in contact
with media related to oil and gas
production —**

**Part 3:
Thermosets**

*Industries du pétrole et du gaz, y compris les énergies à faible
teneur en carbone — Matériaux non métalliques en contact avec
les fluides relatifs à la production de pétrole et de gaz —*

Partie 3: Thermodurcissables

**First edition
2026-07**

Sample Document

get full document from standards.iteh.ai

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2026

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	2
3.1 Terms and definitions	2
3.2 Abbreviated terms	5
4 Technical requirements	5
4.1 General requirements	5
4.2 Cautionary remarks	6
4.3 Traceability	6
4.4 Test specimen identification	6
4.4.1 Coding overview	6
4.4.2 Moulding	7
4.4.3 Orientation	7
4.4.4 Form	7
4.4.5 Post treatment	8
4.4.6 Shaping	8
4.4.7 Test specimen fabrication for Level 2, Level 3 and Level 4 ageing experiments	8
4.5 Validation of conformity	8
5 Level 1 — Material property characterization	9
5.1 General	9
5.2 Reporting	10
5.2.1 Material data report	10
5.2.2 Certificate of conformity	10
6 Level 2 — Material stability (short-term)	10
6.1 General	10
6.2 Test criteria	10
6.2.1 General	10
6.2.2 Exposure temperature	11
6.2.3 Exposure durations	11
6.2.4 Test fluids	11
6.2.5 Property test methods	11
6.2.6 Threshold criteria	12
6.3 Preconditioning considerations	12
6.4 Reporting	12
7 Level 3 — Material stability (accelerated)	13
7.1 General	13
7.2 Exposure temperatures	13
7.3 Exposure durations	13
7.4 Exposure fluids	14
7.5 Initial swelling	14
7.6 Property test methods	14
7.7 Threshold criteria	14
7.8 Preconditioning considerations	15
7.9 Reporting	15
8 Level 4 — Material stability (long-term)	15
8.1 General requirements for Level 4 evaluation	15
8.2 Exposure temperatures	15
8.3 Exposure durations	16
8.4 Exposure fluids	16
8.5 Initial swelling	16

8.6	Property test methods.....	16
8.7	Preconditioning considerations.....	16
8.8	Threshold baseline.....	16
8.9	Threshold criteria.....	17
9	Additional test considerations.....	17
9.1	Fluid ageing.....	17
9.2	Functional tests.....	19
Annex A (normative) Test media, conditions, equipment and procedures for ageing of thermoset materials		20
Annex B (informative) Guideline for maximum long-term operating temperatures for common thermosets used in oil and gas environment.....		36
Bibliography.....		37

Sample Document

get full document from standards.iteh.ai

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*.

A list of all parts in the ISO 23936 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Non-metallic materials are used in the oil and gas industries for a wide range of components. The purpose of this document is to establish requirements and guidelines for systematic and effective planning, for non-metallic material selection to achieve cost effective technical solutions, taking into account possible constraints due to either safety or environmental issues, or both.

This document is of benefit to a broad industry group ranging from operators and suppliers to engineers and authorities. It covers relevant generic types of non-metallic material (e.g. thermosets) and includes the widest range of existing technical experience.

This information aids in material selection. It can be applied to help avoid costly degradation failures of the equipment itself, which could pose a risk to the health and safety of the public and personnel or the environment. This document complements the documents for metallic materials in sour service (the ISO 15156 series). It differs in the form of guidance provided to the user related to the potential degradation of desired properties when used in equipment for oil and gas production environments. The ISO 15156 series provides application limits and qualification requirements for metallic materials in H₂S-containing environments, which are related solely to relevant environmentally assisted cracking mechanisms.

This document recognizes that a wider range of compounds and parameters influence the degradation of non-metallic materials and thus provides guidance to permit selection of materials for hydrocarbon exploration and production applications based upon stability in appropriate test conditions.

Sample Document

get full document from standards.iteh.ai

Oil and gas industries including lower carbon energy — Non-metallic materials in contact with media related to oil and gas production —

Part 3: Thermosets

CAUTION — The non-metallic materials selected using this document are resistant to the given environments in the oil and gas industries, but not necessarily immune under all service conditions. This document allocates responsibility for suitability for the intended service in all cases to the equipment user.

1 Scope

This document provides general principles, requirements and recommendations for the assessment of the stability of thermoset materials that include short fibre filled or particle filled resins and exclude continuous fibre reinforced composites for service in equipment used in oil and gas exploration and production environments. These procedures can be adapted for application within low-carbon energy environments. This document also provides guidance for quality assurance.

This document addresses the resistance of thermosets to the deterioration in properties that can be caused by physical or chemical interaction with produced and injected oil and gas-field media, and with chemical treatment. Interaction with sunlight and ionizing radiation are excluded from the scope of this document.

This document is not necessarily applicable to equipment used in refining or downstream processes and equipment.

The equipment considered includes, but is not limited to, non-metallic pipelines, piping, liners, seals, gaskets and washers. Applications for short-term exposure include pump-down plugs, bridge plug components, line wiper plugs, balls, setting tools and fracking tools. Applications for long-term exposure include bearings and washers. This document excludes tubular products, tanks and similar items produced from continuous fibre reinforced materials.

Blistering by rapid gas decompression is not included in the scope of this document.

This document applies to the assessment of the stability of thermoset materials in simulated hydrocarbon production conditions to aid the selection of materials for equipment designed and constructed using conventional design criteria. Designs utilizing other criteria are excluded from the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 75-1, *Plastics — Determination of temperature of deflection under load — Part 1: General test method*

ISO 75-2, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite*

ISO 178, *Plastics — Determination of flexural properties*

ISO 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 604, *Plastics — Determination of compressive properties*

ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 6721-11, *Plastics — Determination of dynamic mechanical properties — Part 11: Glass transition temperature*

ISO 2039-2, *Plastics — Determination of hardness — Part 2: Rockwell hardness*

ISO 3451-1, *Plastics — Determination of ash — Part 1: General methods*

ISO 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature and step height*

ASTM D638, *Standard Test Method for Tensile Properties of Plastics*

ASTM D648, *Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position*

ASTM D695, *Standard Test Method for Compressive Properties of Rigid Plastics*

ASTM D785, *Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials*

ASTM D790, *Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*

ASTM D792, *Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement*

ASTM E1640, *Standard Test Method for Assignment of the Glass Transition Temperature By Dynamic Mechanical Analysis*

ASTM D2240, *Standard Test Method for Rubber Property Durometer Hardness*

ASTM D5630, *Standard Test Method for Ash Content in Plastics*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1.1

batch

specified quantity of raw material, packaging material or product issued from one process or series of processes so that it could be expected to be homogeneous

[SOURCE: ISO 22716:2007, 2.3, modified — The word “defined” has been changed into “specified”.]

3.1.2

certificate of conformity

document issued by the manufacturer in accordance with specific requirements

Note 1 to entry: The specific requirements shall be the requirement stated in this document or in the purchase order.

3.1.3

component

individual, finished thermoset shape

3.1.4

compound

intimate mixture of a polymer or polymers with other ingredients such as fillers, plasticizers, catalysts and colorants

[SOURCE: ISO 472:2013, 2.184]

3.1.5

conversion process

manufacturing process that converts a *compound* ([3.1.4](#)) into a plastic shape or *component* ([3.1.3](#))

3.1.6

fluid

liquid and/or gas

3.1.7

gasket

sealing *component* ([3.1.3](#)) compressed in a joint

3.1.8

glass transition temperature

temperature of a polymer material at which its mechanical properties change from elastic (glassy) to viscous (rubbery) state

3.1.9

liner

thermoplastic material for protection of medium-contacted surfaces of pipes, *pipings* ([3.1.16](#)), *pipelines* ([3.1.15](#)) or equipment

3.1.10

lot

part of a batch or part of a continuously manufactured thermoset material

3.1.11

maximum operating temperature

maximum temperature to which a *component* ([3.1.3](#)) is subjected, including deviations from normal operations, such as start-up or shutdown

3.1.12

maximum rated temperature

upper limit temperature that the material can be used regardless of the environment

3.1.13

neat resin

thermoset resin without additives

3.1.14

operating temperature

temperature to which a *component* ([3.1.3](#)) is subjected during normal operation

3.1.15
pipeline

components (3.1.3) of a pipeline system connected together to convey *fluids* (3.1.6) between stations and/or plants, including pipe, pig traps, components, appurtenances, spools, risers, isolating valves, and sectionalizing valves

[SOURCE: ISO 13623:2017, 3.1.15, modified — Note 1 to entry has been deleted.]

3.1.16
piping

pipe or system of pipes for the transport of *fluids* (3.1.6) and gases

Note 1 to entry: Interruption by different *components* (3.1.3) such as pumps, machines, vessels, does not preclude integration into one single piping system.

3.1.17
preconditioning

exposure to specified conditions in relevant *fluids* (3.1.6) prior to ageing

3.1.18
real-time ageing

matches the temperature, time, *fluid* (3.1.6) and material to the service environment

3.1.19
room temperature

temperature of $(23 \pm 2) ^\circ\text{C}$

3.1.20
seal

deformable polymeric device designed to separate different environments

3.1.21
short-term

56 days or less

3.1.22
swelling

increase in volume due to absorption of *fluids* (3.1.6)

3.1.23
thermoset

polymeric resin which, when cured by heat and/or chemical reaction, changes into a substantially infusible and insoluble material by chemical crosslinking of the polymer chains

Note 1 to entry: Typical thermosets include, but are not limited to, epoxy resins, phenolic resins, melamine-formaldehyde and urea-formaldehyde resins, unsaturated polyester resins, and vinyl ester resins.

3.1.24
washer

flat plate of a material with a centralized hole used to seat bolt heads and nuts, among others

3.2 Abbreviated terms

COC	certificate of conformity
COV	coefficient of variation
DMA	dynamic mechanical analysis
DSC	differential scanning calorimetry
HDT	heat deflection temperature
KCl	potassium chloride
QC	quality control
RGD	rapid gas decompression (rapid gas depressurization)
ST	softening temperature

4 Technical requirements

4.1 General requirements

Thermoset selection depends upon material property characteristics and fluid ageing behaviour. This document establishes four levels of testing for the purpose of comparing the properties of various thermoset materials. Material property data are generated at the four levels to allow consistent comparison of the subject materials. Generic data shall be derived per Level 1 and Level 2 including threshold criteria, solely for the purpose of producing information for preselection. Where the user requires accelerated ageing material stability data in a multi-phase H₂S containing fluid, Level 3 shall apply. Where the user requires the material stability data beyond 56 days and an attempted long-term life estimation, Level 4 shall apply.

Level 1 conformity consists of the characterization and documentation of material properties in a material data report. The material data report includes a COC for batch quality control testing. See [5.1](#) and [Table 1](#) for listing of material properties documentation requirements. Physical and mechanical properties shall be characterized on materials in an unaged condition. These standard properties assist with the selection of materials that meet a design specification. Some property tests are also used for quality assurance and control. Level 1 testing establishes a baseline for higher level testing.

Level 2 conformity pertains to 28-day material stability (ageing) behaviour and shall be accompanied by a report. [Clause 6](#) provides requirements for Level 2 conformity. The effect of the first three fluids listed in [6.2.4](#) on material properties shall be investigated with real-time ageing studies. The material's resistance to chemical, physical or mechanical change is determined.

Level 3 conformity pertains to 56-day material stability (accelerated ageing) behaviour and shall be described in a report. [Clause 7](#) provides requirements for Level 3 conformity. The effects on material properties of three temperature aging evaluations shall be investigated. The intent of Level 3 evaluations is to accelerate material property changes specifically in multi-phase H₂S-fluids.

Level 4 conformity pertains to material stability (long-term) assessment of 180 days or longer. Level 4 assessment intends to predict the material's progressive degradation, hence conformity threshold recommendations are offered for life estimation purposes. Testing shall be described in a report including a thorough account of data analysis and detailed information on the methodology of data evaluation. The report shall include an analysis utilizing a model to predict lifetimes. Users shall evaluate the threshold criteria, life estimation results and the methodologies to determine the suitability of application materials. While Arrhenius is the most well-known of the life stress models, there can be times when it does not well represent a dataset. In those situations, a different life stress model should be used.

Reports shall detail testing and analysis as well as a reference to this document, i.e. ISO 23936-3:2026.

Laboratory studies using standard test conditions may not derive data that can be used for design purposes. The user may require fit-for-purpose testing or alternative testing to simulate production conditions to allow materials selection for final application. Component functional testing is not detailed in this document.

For some highly resistant thermosets, the chemicals used for ageing in Level 3 and Level 4 have no significant thermal-chemical effect even at higher temperatures. In such cases, the first observable change in property would be related to fluid absorption or melting phase change rather than a degradation mechanism induced by the chemical.

4.2 Cautionary remarks

Designers should not assume that properties provided in a material data report as explained in [Clause 5](#) accurately represent those properties found in finished product geometries. The method of conversion is known to have an impact on these properties and that impact should be accounted for during design.

Life estimation usefulness and certainty can increase when longer term data are used to establish the degradation trend. Level 3 testing at durations up to 56 days are preferred for shorter-term (up to 1 year) life estimations and can have reduced certainty for long-term (greater than 1 year) life estimations. Level 4 testing requires up to 180 day or longer data in an effort to create higher certainty in long-term life estimation.

In some cases, progressive degradation of thermosets over long periods of time at temperatures well above the target service temperature is not observed. The data and the attempted life estimation are still valuable because they demonstrate material stability in that test environment.

4.3 Traceability

For a final component to maintain its conformity to this document, it shall be produced from a thermoset material that conforms with this document. The entire compound manufacturing process shall be fully traceable. Conformity records shall state the edition of this document used in the assessment. Reference to conformity with the ISO 23936 series shall include the part and edition (year) of the standard used, e.g. ISO 23936-3:2026.

Each compound and accompanying COC shall be traceable back to the compound manufacturer. Each company that participates in the manufacture of a compound that conforms with this document shall maintain traceability records for a minimum of 10 years that include manufacturing procedures, locations and dates.

Further requirements on conformity and traceability over the supply chain can be found in relevant product standards and agreed between interested parties.

4.4 Test specimen identification

4.4.1 Coding overview

The specimen fabrication details shall be reported using the following identification code system:

- moulding (for individual codes see [4.4.2](#));
- orientation (for individual codes see [4.4.3](#));
- form (for individual codes see [4.4.4](#));
- post treat (for individual codes see [4.4.5](#));
- shaping (for individual codes see [4.4.6](#)).

The test specimen identification shall give the following information:

- a) test standard;