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Ships and marine technology — Gasketed mechanical couplings for use in piping systems — Performance specification

Navires et technologie maritime — Accouplements mécaniques avec joints pour systèmes de tuyauteries — Spécification des performances

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Foreword

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The main task of technical committees is to prepare International Standards. 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.

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ISO 15837 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

Ships and marine technology — Gasketed mechanical couplings for use in piping systems — Performance specification

1 Scope

This International Standard provides the performance characteristics and qualification tests required for gasketed mechanical couplings, including grooved-type mechanical couplings for grooved-end pipe, mechanical restraint couplings for plain-end pipe and mechanical compression couplings for plain-end pipe. These couplings are for use at temperatures within the recommended temperature range of their respective gaskets.

2 Terms and definitions

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

2.1
class
differentiates joint characteristics such as rigid, flexible, restrained and unrestrained

2.2
failure
any leakage or joint separation, unless otherwise determined to be due to a pipe or fitting defect

2.3
fitting
a device used to change pipe direction, size or adapt to other joining methods

NOTE This device is used with pipe or other fittings to create a working system. Shapes such as elbows, tees, crosses, reducers and special shapes are used as needed to fulfil system design specifications.

2.4
flexible
characteristic of a joint wherein there is available limited angular and axial pipe movement

2.5
gasketed mechanical coupling
GMC
a device used to join pipe-to-pipe, pipe-to-fitting, or fitting-to-fitting wherein an elastomeric (gasket) is used to seal the joint

NOTE A coupling may or may not provide mechanical restraint of the pipe or fitting.

2.6
working pressure grade
joint working pressure as established by tests using representative pipe or tube and the gasketed mechanical coupling (GMC)

2.7
grooved mechanical coupling (Type 1)
a device which consists of two or more housings, closure members such as sets of bolts and nuts or pins, and a pressure-responsive gasket

NOTE It is used to mechanically join and seal grooved pipe and/or fittings, forming a joint.

See Figure 1.

2.8
grooved mechanical coupling housing
structural parts of a grooved mechanical coupling which mechanically fit into pipe or fitting grooves providing mechanical pipe or fitting restraint and enclosure of the gasket

2.9
plain-end mechanical coupling
plain-end GMCs consisting of Type II Classes 1, 2 and 3

2.9.1
Type II Classes 1 and 2
device consisting of gasket(s), housing(s), sleeve(s), end rings, threaded fasteners, pipe or fitting anchoring (gripping) features and seal retainers as applicable

NOTE These devices are used to create a seal and restrain plain-end pipe or fittings. See Figures 2 and 3.

2.9.2
Type II Class 3
device consisting of gasket(s), housing(s), sleeve, end rings and threaded fasteners as applicable

NOTE Tightening of the fasteners compresses the gasket(s), creating a seal on the outside of the plain-end pipe. See Figure 4.

2.10
joint
interface formed between pipe and pipe, pipe and fitting, or fitting and fitting where a GMC is used to seal this interface within a specified working pressure and, where applicable, provide mechanical holding strength

2.11
joint pressure rating
working pressure for the joint on the pipe or fitting material and thickness to be used in the actual piping application

2.12
leakage
escape of fluid (gaseous or liquid) from any point of the specimen

2.13
penalty run
a penalty run is performed with penalty-run specimens when the original test specimen leaks or separates during testing as a result of any cause which is not related to the design of the GMC being qualified

2.14
penalty-run specimens
additional specimen(s) which are tested in the place of the original specimen(s)

NOTE These additional specimen(s) are assembled using the same methods, along with additional GMCs of the same type, working pressure, class and configuration; and additional pipes or fittings with the same sizes, nominal wall thickness, material and material condition as the original test specimen.

2.15
pressure-responsive gasket
gasket design such that application of a pressure load to the gasket enhances its sealing capabilities; that is, additional pressure results in additional force between the gasket and the surface which it is sealing

2.16

restrained

characteristic of the joint wherein thrust loads generated by internal pressure or external means are absorbed within the joint

2.17

rigid

characteristic of a joint where there is essentially no available free angular or axial pipe movement

2.18

specimen

a prepared assembly consisting of the test joint including a GMC and pipes or fittings

NOTE The specimen is placed in a controlled environment and tested to determine if the joint performs according to the standards established by the test.

2.19

type

differentiation of kind of pipe or fitting which gasketed mechanical couplings are used to join (that is, grooved or plain end)

2.20

unrestrained

characteristic of a joint wherein thrust generated by internal pressure or external means is not absorbed by the joint

2.21

size

dimensions of the piping system or component, primarily nominal diameter and wall thickness

2.22

life cycle

complete series and stages of events in the development and manufacture of a product, from the initial conceptualization through to production, modifications and maintenance

3 Classification

3.1 Design types

Gasketed mechanical couplings (GMCs) are classified into the following design types:

— Type I, grooved mechanical couplings;

— Type II, plain-end mechanical couplings.

3.2 Working pressures

Gasketed mechanical couplings (GMCs) are classified into various working pressures, or grades, based on successful completion of testing defined herein. Working pressures range from approximately 0,7 MPa to 30 MPa and vary by GMC manufacturer. The GMC manufacturer should be consulted for specific working pressures available.

3.3 Joint characteristics

Gasketed mechanical couplings (GMCs) are classified by the following joint characteristics:

— Class 1: rigid and restrained;

— Class 2: flexible and restrained;

— Class 3: flexible and unrestrained.

4 Ordering information

Orders for GMCs (Gasketed Mechanical Couplings) in accordance with this International Standard shall include the following characteristics:

— quantity (number of gasketed mechanical couplings);

— size;

— type (I, II);

— working pressure (consult GMC manufacturer);

— class (joint characteristic);

— housing material and finish;

— gasket material, including operating temperature limitations;

— bolt (stud) and nut material and finish;

— other requirements agreed to between purchaser and GMC manufacturer.

5 Materials

The materials used for construction of GMCs shall be as agreed upon by the manufacturer and the purchaser, provided that such materials have been used to qualify the joint's performance in accordance with this International Standard.

6 Workmanship, finish and appearance

6.1 GMC machined surfaces

Machined surfaces shall be free from burrs, cracks, laps and seams which would affect the suitability for the intended service. Machined surface finishes shall be as specified by the manufacturer.

6.2 Unmachined surfaces

Unmachined surfaces, such as forging or casting surfaces, shall be free from scale, blisters, fins, folds, seams, laps, segregations and cracks which would affect suitability for the intended service.

7 Other requirements

7.1 Testing requirements

GMCs shall be subjected to the tests described in Annex A for the purpose of qualifying the GMC design. These tests shall be repeated when changes are made in the design, material, or manufacturing process that degrade the performance of the GMC. Degradation determination is to be made by the manufacturer or upon agreement between the manufacturer and purchaser.

7.2 Qualification requirements

7.2.1 General

GMCs shall be qualified using specimens of the same type, working pressure and class. Each type, working pressure, and class shall be tested in order to qualify the design. Qualification of the GMC requires successful completion of required testing. Each GMC design is only qualified for use on the pipe or fitting material and wall thickness on which it was tested.

7.2.2 Sizing

All GMCs tested shall be comprised of an equal number of specimens from the smallest, intermediate, and largest sizes within the size range of the GMC being qualified. Through reasonable interpolations between the GMC sizes tested, other sizes of GMCs within the same type, working pressure and class will be considered qualified if the specimens pass the testing requirements. Extrapolation shall not be used for qualification purposes.

7.3 Qualification test report

Upon completion of testing, a qualification test report shall be written and maintained on file during the life cycle of the design. A copy of this report shall be made available for inspection at the manufacturer's facility. Any failure during qualification testing shall be analysed and the failure analysis and corrective action shall be included in the qualification test report.

7.4 Retest

A retest as specified in Clause 8 may be allowed when failure of the original joint occurs during qualification testing. When retesting is permitted, the failure analysis and corrective action shall be included in the qualification test report specified in 7.3.

7.5 Test equipment and inspection facilities

7.5.1 General

Test equipment and inspection facilities shall be of sufficient accuracy and quality to permit performance of required inspections and tests.

7.5.2 Calibration system requirements

Testing and inspection facilities shall maintain a calibration system for Measuring and Test Equipment in accordance with the national standards of the country in which the testing is conducted.

7.6 Test conditions

Test conditions shall be as follows.

— Test pressures as specified within each test shall be used.

— Fluid used in the testing of GMCs shall be water, air or nitrogen (N_2), as specified.

— Unless otherwise specified, GMCs shall be tested within the temperature range stated by the type of test being performed. When no temperature is specified within a test, the test shall be conducted at ambient conditions.

7.7 Performance requirements

Pass criteria for each test shall require meeting or exceeding the performance requirements specified in each test.

8 Number of tests and retests for qualification testing

8.1 General

Each test shall be performed on specimens as denoted in Table A.1.

8.2 Penalty runs

8.2.1 General

In the event of not passing a test, the manufacturer shall proceed with one of the following options.

a) If the leak or separation is determined to be design related, the manufacturer shall redesign the GMC and start all tests from the beginning.

b) If the leak or separation is determined to be unrelated to the design, the test specimen shall be run again with a replacement test specimen.

c) If the leak or separation cannot be shown to be either design related or non-design related, the manufacturer shall test three additional penalty-run specimens. The requirements specified in 8.2.2 shall apply.

8.2.2 Penalty-run specimens

Penalty-run specimens shall meet the following requirements.

— Penalty-run specimens shall be prepared when a GMC has failed any of the tests specified in Annex A.

— GMCs used for penalty run(s) shall be of the same type, working pressure and class as the failed GMC being replaced.

— The pipe or fitting used in penalty runs shall be of the same material, outside diameter and wall thickness as the pipe or fitting being replaced. Preparation of the penalty-run specimens shall be in accordance with Clause 9.

— Penalty-run specimens shall be identified in accordance with 9.3.

— In addition to the part number and test specimen number, a designator shall be placed after the test specimen number which allows the specimen to be identified as a penalty-run specimen. The method used to identify penalty-run specimens shall be at the manufacturer's option.

9 Specimen preparation and installation

9.1 General

Specimen preparation and installation on appropriate testing apparatus shall be in accordance with the manufacturer's recommended procedures.

9.2 Assembly of specimens for test

9.2.1 General

The following are general test requirements:

— GMCs qualified under the requirements of this International Standard shall be tested and qualified as a completed assembly; that is, a joint;

— test specimens used in testing shall be assembled using a GMC of a single type, working pressure and class;

— the wall thickness and outside diameter. size of the pipe or fitting shall be as specified by the manufacturer for the GMC joint being qualified.

9.2.2 Prohibited assemblies

The intermixing of sub-components of the same type, working pressure and class, but of different brands or trade names, constitutes non-conformance with this standard and is prohibited.

9.3 Identification of test specimens

Test specimens shall be identified in accordance with the following requirements.

— Each test specimen shall be identified with a unique number to provide traceability back to the test records.

— Identification of test specimens shall be permanent. In those cases where size or design does not permit permanent markings, tagging or bagging may be used.

— When, as a result of testing, a test specimen is sectioned into two or more pieces, each piece shall be marked with the original unique identification number.

9.4 Disposal

Test specimens may be disposed of following approval of the qualification test report by the GMC manufacturer.

10 Test methods

10.1 General

Standard qualification tests for GMC are specified in Annex A. The following tests described are required for GMC qualification as applicable to the type, working pressure and class.

10.2 Certification of test results

When specified in the purchase order or the contract, the purchaser shall be furnished certification that samples representing the GMC have been tested as directed in this International Standard and the requirements have been met. When specified in the purchase order or contract, a report of the results shall be available for inspection at the manufacturer's facility.

10.3 In-process material tests

In-process material tests shall be performed in accordance with manufacturer's standard in-process test procedures.