INTERNATIONAL STANDARD

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Gas turbines — Procurement —

Part 8: Inspection, testing, installation and commissioning

Turbines à gaz — Spécifications pour l'acquisition —
Partie 8: Contrôle, essais, installation et mise en service

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Contents

Page

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.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 3977 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3977-8 was prepared by Technical Committee ISO/TC 192, *Gas turbines.*

ISO 3977 consists of the following parts, under the general title *Gas turbines — Procurement*:

— *Part 1: General and definitions*

— *Part 2: Standard reference conditions and ratings*

— *Part 3: Design requirements*

— *Part 4: Fuels and environment*

— *Part 5: Applications for petroleum and natural gas industries*

— *Part 7: Technical information*

— *Part 8: Inspection, testing, installation and commissioning*

— *Part 9: Reliability, availability, maintainability and safety*

Gas turbines — Procurement —

Part 8:
Inspection, testing, installation and commissioning

1 Scope

This part of ISO 3977 states the principles for systems and procedures to assure the integrity of a packager's product and services.

It gives guidance on the inspection, testing, installation and commissioning required for the package and packaged equipment. It outlines the responsibilities between the purchaser and packager for inspection, coordination, reporting and recording.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 3977. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 3977 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2314:1989, *Gas turbines — Acceptance tests*

ISO 3977-1:1997, *Gas turbines – Procurement — Part 1: General introduction and definitions*

ISO 3997-2:1997, *Gas turbines — Procurement — Part 2: Standard reference conditions and ratings*

ISO 3977-3:2002, *Gas turbines — Procurement — Part 3: Design requirements*

ISO 3997-4:2002, *Gas turbines — Procurement — Part 4: Fuels and environment*

ISO 4406:1999, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 6190:1988, *Acoustics — Measurement of sound pressure levels of gas turbine installations for evaluating environmental noise — Survey method*

ISO 10442:—[1)] , *Petroleum, chemical and gas service industries — Packaged, integrally geared centrifugal air compressors for general refinery service*

ISO 11042-1:1996, *Gas turbines — Exhaust gas emission — Part 1: Measurement and evaluation*

ISO 11086:1996, *Gas turbines — Vocabulary*

1) To be published.

ISO 13709:—[1)], *Centrifugal pumps for petroleum, petrochemical, and natural gas industries*

ISO 13691:2001, *Petroleum and natural gas industries — High-speed special-purpose gear units*

IEC 60034-1:1983, *Rotating electrical machines — Part 1: Rating and performance*

IEC 60034-4:1985; *Rotating electrical machines — Part 4: Methods for determining synchronous machine quantities from tests*

3 Terms and definitions

For the purposes of this part of ISO 3977, the terms and definitions given in ISO 3977-1, ISO 3977-3, ISO 3977-4 and ISO 11086 and the following apply.

3.1
inspection
process by which it is demonstrated that materials, components, assemblies or complete packages satisfy one or more particular specification requirements of the packager or purchaser

NOTE This may include verificational documentation, reports, material certificates, chemical analyses, physical or dimensional checks, build records, visual checks and/or results of documented inspections and tests including any other non-destructive evaluation (NDE) methods or techniques that may be employed.

3.2
test
process by which it is demonstrated that assemblies, completed components or packages satisfy the physical, functional and operational requirements as specified by the packager's test schedules and procedures, or the purchaser's specification

3.3
witnessed
term meaning that a hold is applied to the production schedule and that the inspection or test will be carried out with the purchaser or his representative in attendance

3.4
observed
term meaning that the purchaser will be notified of the timing of the inspection or test

NOTE However, the inspection or test should be performed as scheduled, and if the purchaser or his representative is not present, the packager should proceed to the next step.

4 General principles

The packager shall furnish the purchaser with inspection and testing plans. These define the actions required by the packager and his sub-suppliers to assure the integrity of the package.

These plans should include any specific requirements stated by the purchaser in his enquiry and any local or national regulations applicable to the package in either the country of origin or destination. The plan shall be agreed between the packager and purchaser, and any third-party inspector who may be appointed by the purchaser, prior to commencement of manufacture.

It is the purchaser's responsibility to notify the packager of any applicable local and national regulations in the country of destination.

Where inspection and testing have to be done on site, these shall be identified in the inspection and testing plans and agreed between the packager and purchaser.

The packager and purchaser shall agree to the following:

— the extent of purchaser participation in the inspection and testing, including witnessed and observed test points;

— detail running test procedures and acceptance parameters and criteria;

— notification period for hold points and witnessed tests and observed tests;

— facilities and services to be provided by the purchaser.

The packager shall keep at least the following data available for a minimum of 10 years after the date of commissioning for examination by the purchaser or his representative upon request:

— certification of materials;

— purchase specifications for all items on bills of materials;

— test data to verify that the requirements of the specification have been met;

— results of documented material inspections, including fully identified records of all heat treatment and radiography processes;

— when specified, final-assembly maintenance and as-built clearances.

In addition to the above requirements, the purchaser may specify the following:

— parts that shall be subjected to surface and subsurface examination;

— the type of non-destructive evaluation to be applied.

5 Inspection

5.1 General

Inspection activities are carried out throughout the entire manufacturing process and may cover

— materials,

— components,

— fabrications,

— sub-assemblies,

— auxillary packages, and

— finished gas turbine packages.

Where inspection activities involve pressure-containing parts, these shall not be painted until the specified inspection of the parts is completed.

5.2 Material inspection

Non-destructive evaluation (NDE) procedures and acceptance criteria used in the manufacturing and assembly procedures for the gas generator, power turbine and all other items of equipment shall be in accordance with the agreed inspection and testing plans.

5.3 Mechanical inspection

During assembly and prior to functional/operational testing, components or sub-assemblies (including cast-in passages of these components) and all piping and appurtenances shall be cleaned chemically or by another appropriate method to remove foreign materials, corrosion products and mill scale.

Any portion of the oil system furnished shall meet the cleanliness requirements of ISO 4406.

When specified, the purchaser may inspect the equipment and all piping and appurtenances furnished by or through the packager for cleanliness before heads are welded to vessels, openings in vessels or exchangers are closed, or piping is finally assembled.

When specified, the hardness of parts, welds and heat-affected zones shall be verified as being within the allowable values by testing of the parts, welds or zones. The method, extent, documentation and witnessing of the testing shall be mutually agreed upon by the purchaser and packager.

6 Testing

6.1 General

This clause deals with the minimum recommended requirements for the physical testing of components, assemblies and the complete package prior to entry into commercial service.

The purchaser and packager shall agree on the scope of testing. This may include a selection of optional tests specified by the purchaser as described in 6.4.

Figure 1 shows the desired sequence of mandatory and optional operation testing and may be used for guidance.

All test reports shall be retained for periods consistent with the requirements of ISO 3977-2.

6.2 Hydrostatic test

As a minimum, components defined by legislation or national standards as pressure vessels (excluding the casings of gas generator and power turbine) shall be tested hydrostatically according to legislation or national standards, but at least with liquid at a minimum of 1,5 times the maximum allowable working pressure but not less than 140 kPa differential pressure. Other components and systems shall be tested in accordance with the purchaser's requirements or statuatory or mandatory requirements applicable to the destination territory. The test liquid shall be at a higher temperature than the nil-ductility transition temperature of the material being tested.

If the part tested is to operate at a temperature at which the tensile strength of a material is below the tensile strength of that material at room temperature, the hydrostatic test pressure shall be multiplied by a factor obtained by dividing the allowable working stress for the material at room temperature by that at operating temperature. The data sheets shall list actual hydrostatic test pressures and temperatures.

The chloride content of liquids used to test austenitic stainless-steel materials shall not exceed 50 parts per million. To prevent deposition of chlorides as a result of evaporative drying, all residual liquid shall be removed from tested parts at the conclusion of the test.

Tests shall be maintained for a sufficient period of time to permit complete examination of parts under pressure. The hydrostatic test shall be considered satisfactory when neither leaks nor seepage through the casing or casing joint is observed for a minimum of 30 min. Large, heavy castings may require a longer testing period which is to be agreed upon by the purchaser and packager.

Seepage past internal closures required for testing of segmented cases and operation of a test pump to maintain pressure are acceptable.

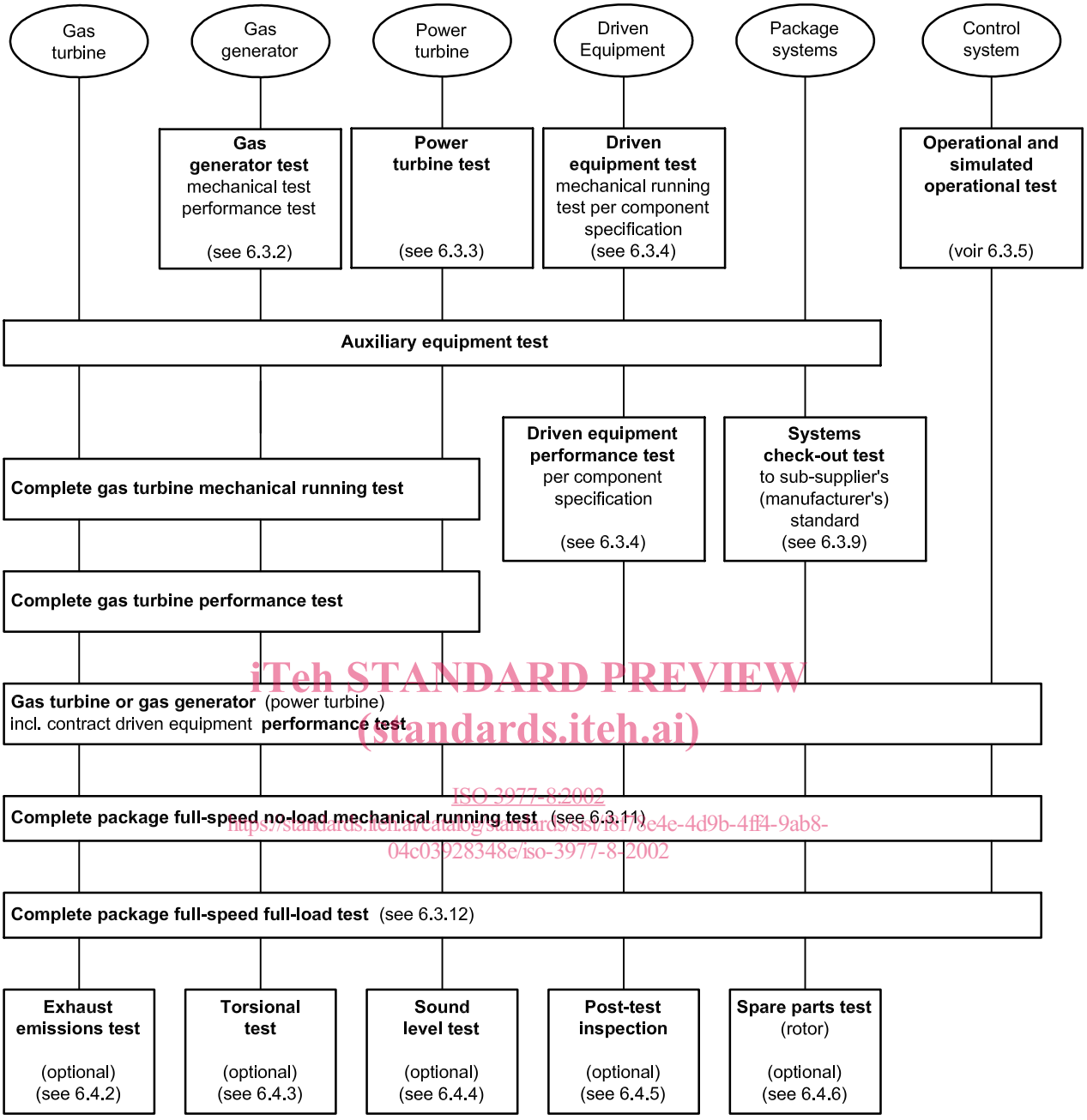

Figure 1 — Diagram of options for testing

6.3 Functional/operating tests

6.3.1 General

Figure 1 shows a visual representation of the alternative testing options.

The extent of testing possible prior to delivery to site will depend upon the design, rating and size of gas turbine and the facilities available at the packager's works. Where these factors prohibit shop testing, the package shall be tested at an alternative location or on site. In any case, site acceptance tests are usually required irrespective of the extent of works testing.