



STANDARD FOR CERTIFICATION

No. 2.9

TYPE APPROVAL PROGRAMME

4 - 732.10 - 1

Gas Turbines

OCTOBER 2011

The electronic pdf version of this document found through <http://www.dnv.com> is the officially binding version

The content of this service document is the subject of intellectual property rights reserved by Det Norske Veritas AS (DNV). The user accepts that it is prohibited by anyone else but DNV and/or its licensees to offer and/or perform classification, certification and/or verification services, including the issuance of certificates and/or declarations of conformity, wholly or partly, on the basis of and/or pursuant to this document whether free of charge or chargeable, without DNV's prior written consent. DNV is not responsible for the consequences arising from any use of this document by others.

FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

Standards for Certification

Standards for Certification (previously Certification Notes) are publications that contain principles, acceptance criteria and practical information related to the Society's consideration of objects, personnel, organisations, services and operations. Standards for Certification also apply as the basis for the issue of certificates and/or declarations that may not necessarily be related to classification.

© Det Norske Veritas AS October 2011

Any comments may be sent by e-mail to rules@dnv.com
For subscription orders or information about subscription terms, please use distribution@dnv.com
Computer Typesetting (Adobe Frame Maker) by Det Norske Veritas

This service document has been prepared based on available knowledge, technology and/or information at the time of issuance of this document, and is believed to reflect the best of contemporary technology. The use of this document by others than DNV is at the user's sole risk. DNV does not accept any liability or responsibility for loss or damages resulting from any use of this document.

CHANGES

General

This issue supersedes Approval Programme No. 4 - 732.10 - 1 of June 1997.

Text affected by the main changes is highlighted in red colour. However, where the changes involve a whole section or sub-section, only the title may be in red colour.

Main Changes:

— Updated rule references and some minor editorial changes.

CONTENTS

1.	Scope.....	5
2.	Conformity Assessment of Design of Product Type	5
2.1	Procedure	5
2.2	Conditions	5
2.3	Document to be submitted	5
2.4	Design requirements	5
2.5	Requirements to Identification of product type with certificate	5
2.6	Elements of Type Approval	5
3.	Conformity Assessment of Manufactured Products (Production).....	6
3.1	Product Certificates.....	6
3.2	Inspection and testing in the certification process	6

1. Scope

Type Approval is a procedure for certifying that the design of a product type is in conformity with a set of predetermined requirements.

This Type Approval Programme contains the requirements on which Det Norske Veritas normally bases its Type Approval of gas turbines used in propulsion or auxiliary plants on board ships, and on offshore installations or in industrial plants as generator or compressor driver.

The requirements are based on the DNV Rules for Classification of Ships (the Rules).

The procedure for assessment of conformity of manufactured products (production) is not part of the scope for the Type Approval Programme.

2. Conformity Assessment of Design of Product Type

2.1 Procedure

The type approval procedure consists mainly of the following steps:

- design assessment
- type testing
- certificate retention survey.

2.2 Conditions

A manufacturer applying for type approval of a gas turbine model is to have a quality system (QS) according to ISO 9001. Equivalent systems will be specially considered.

2.3 Document to be submitted

Documentation shall be submitted in triplicate in connection with the design assessment. For a complete list of the documentation that are to be submitted, reference is made to the Rules Pt.4 Ch.3. The extract below indicates the most important issues.

- plans showing the general arrangement and description of the design features
- drawings of the rotating parts as well as other highly stressed parts
- schematic drawing of the lube oil and fuel oil systems
- particulars regarding stress- and temperature levels of critical components, by means of finite element analysis
- results of vibrational analysis of the gas turbine, giving both rotor dynamics and blade natural frequencies
- design specification for the control system superior to the gas turbine control system.

2.4 Design requirements

The design will be evaluated with respect to the applicable DNV requirements as given in the Rules Pt.4 Ch.3.

2.5 Requirements to Identification of product type with certificate

The product is to be provided with visible marking, giving at least the following information:

- manufacturer's name or trade mark
- technical data necessary for the application
- type designation under which the product is type approved.

The marking is to be carried out in such a way that it is visible, legible and indelible throughout the anticipated life of the product, and that the marks can be traced back to the Type Approval Certificate.

2.6 Elements of Type Approval

2.6.1 Design assessment

The design assessment is carried out to assess that the design of the product type is in conformity with given design requirements stated in 2.5.

2.6.2 Type testing

The scope of a type test is to verify the ability of a product to meet specified requirements.

In particular, the main objective of the Type Testing of gas turbines is to verify the products performance, and to verify calculated properties, e.g. natural frequencies and vibration levels. The type testing will to the extent possible be conducted in conjunction with the manufacturers own testing.

The testing shall be performed in accordance with the Rules Pt.4 Ch.3.

2.6.3 Type Approval Certificate

When the design assessment and the type testing are successfully completed a Type Approval Certificate will be issued to the manufacturer stating conformity of the design of the product type.

The Certificate is given a validity period of normally 4 years.

2.6.4 Certificate retention survey

The scope of the certificate retention survey is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

If regular DNV product certification of gas turbines takes place during the validity period of the Type Approval Certificate, the retention survey can be combined with the product certification survey.

The main elements of the certificate retention survey are:

- witnessing of tests or inspection of the product, selected at random from the production line and examination of the recording given in the internal quality system documentation
- review of type approval documentation
- review of possible changes in design, materials and performance
- ensure traceability between manufacturer's marking and Type Approval Certificate.

2.6.5 Renewal of Type Approval Certificate

At least three months before the period of validity expires, the certificate-holder has to apply for renewal of the certificate.

Upon receipt of the request for renewal, Det Norske Veritas will perform a renewal survey which has the same content as the certificate retention survey stated in 2.6.4.

The survey report will constitute the basis for renewal of the Type Approval and the issuance of a new certificate.

3. Conformity Assessment of Manufactured Products (Production)

3.1 Product Certificates

Each gas turbines is to be delivered with a product certificate when intended for use on board a DNV classed vessel.

For the first Gas Turbine to be delivered, the product certification will consequently coincide with the issue of the type approval certificate. The consecutive delivered Gas Turbines will normally be certified on a less extensive basis than what is described in this type programme (The certification process will include inspection and testing through the manufacturing process, combined with workshop testing at completion. This product certification, and its extent, is to be agreed upon in a Manufacturing Survey Arrangement (MSA) as described below).

Manufacturing Survey Arrangement:

A Manufacturing Survey Arrangement (MSA) shall be set up by the manufacturer and the local DNV station.

An MSA is a signed agreement between DNV and the manufacturer with the objective to clarify:

- a) The extent of the required inspection and testing for specific range of material, components and systems, and the respective acceptance criteria.
- b) To which extent and under which conditions the manufacturer may perform all or part of the required inspection and testing without the presence of a DNV surveyor.

The content of an MSA should reflect the complexity of the product and the quality system implemented by the manufacturer to ensure the consistency in quality during production.

3.2 Inspection and testing in the certification process

The essential testing during the fabrication phase is as follows. The presence of a DNV surveyor in all or some of the mentioned tests, shall - as noted above - be agreed upon in the MSA.

- test of material properties
- pressure testing of pressurised equipment.
- surface crack detection, by means of NDT is required for the following:
 - shafts (in way of stress raisers)
 - hubs (in way of stress raisers)
 - shrink fit surfaces

- welds in power transmitting parts
- welds in casing of bearings (min. 10% to be tested)
- balancing of rotating elements, both separately and assembled
- spin test of compressor and turbine rotors
- certification testing of gas turbine (or gas generator separately). This test will be based on the manufacturers Factory Acceptance Test.

Reference document:

The following document constitutes the formal basis on which this type approval programme has been issued:
Standard for Certification 1.2.