FOUNDRIES - ALUMINIUM ALLOY CASTINGS

OCTOBER 2008
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.

A list of Standards for Certification is found in the latest edition of Pt.0 Ch.1 of the "Rules for Classification of Ships" and the "Rules for Classification of High Speed, Light Craft and Naval Surface Craft".

The list of Standards for Certification is also included in the current “Classification Services – Publications” issued by the Society, which is available on request. All publications may be ordered from the Society’s Web site http://exchange.dnv.com.

The Society reserves the exclusive right to interpret, decide equivalence or make exemptions to this Standard for Certification.

Main changes

Approval Programme No. 307 of October 2000 has been rewritten, and the main changes are:

- types of aluminium alloys to be covered by an approval have been specified
- requirements for possible extension or change to the approval is described
- new structure describing requirements to approval documentation in section 3.

Comments may be sent by e-mail to rules@dnv.com

Comprehensive information about DNV and the Society's services is found at the Web site http://www.dnv.com

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In this provision "Det Norske Veritas" shall mean the Foundation Det Norske Veritas as well as all its subsidiaries, directors, officers, employees, agents and any other acting on behalf of Det Norske Veritas.
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1. General

1.1 Scope
This programme gives the procedure to be followed to obtain the Society’s approval for:

— aluminium Alloy Castings

specified in recognised national or international standards.

1.2 Range of Approval
Approval is required for the manufacture of the products:

— castings.

Approval is furthermore, required for the manufacture of each of the following grouped types of cast aluminium:

— unalloyed aluminium, 99%Al minimum
— AlCu alloys
— AlSiCu, AlSiMg and AlSiCuMg alloys
— AlSi alloys
— AlMg alloys
— AlZn alloys
— AlSi alloys
— Other aluminium alloys.

Approval is given for a maximum casting mass.

1.3 Validity and Renewal
The approval will be valid for four years. To maintain the approved status, the manufacturer must be re-inspected every four years. Application for renewal should be made not later than three months before the expiry date of the certificate.

Any significant alteration to the approved condition during the period of validity, e.g. as described in the approval documentation (section 3) shall be reported to the Society. A re-inspection and/or re-testing may be required when deemed necessary by the Society.

New requirements to the manufacturer due to revision of this programme, i.e. imposed during the period of validity, shall take effect at the next extension, change or renewal of the approval, unless otherwise required by the Society.

1.4 Extension or Change of Approval
An existing approval of manufacturer certificate may be extended with respect to the “range of approval” as given in section 1.2.

1.4.1 Approval Documentation
For extensions or changes to the approval conditions, the approval documentation specified in section 3 and already submitted during the initial approval process, need not to be re-submitted. However, the documentation related to changes to the manufacturing process shall be submitted.

1.4.2 Approval Testing
— For extensions of an existing approval to include new products or aluminium types (as defined in section 1.2), full approval testing of one heat according to section 4 is required.
— For extension of maximum mass for approval (as given on the approval of manufacturer certificate), there is usually no need for additional testing. However, if this is brought about due to alterations in the manufacturing equipment, a new works inspection would normally be required and new approval testing may be considered.

2. Approval Procedure

2.1 Application
Application for approval shall be sent to the local DNV office together with the following information:

— name and site address of the manufacturer
— a list of products for which approval is requested. The list shall include the information specified in section 1.2
— a brief description of manufacturing, testing and inspection facilities and equipment.

2.2 Works Inspection and Approval Testing
The surveyor may request additional documentation (see section 3) if deemed necessary, for his preparation for the works inspection to be performed.

After receipt and review of the requested information the DNV surveyor will carry out a works inspection to verify that the necessary manufacturing, testing, and inspection facilities are available and supervised by qualified personnel.

Approval testing shall be witnessed by DNV.

2.3 Submission of Approval Application Report
On completion of approval testing, the manufacturer shall prepare and submit a complete approval application report.

The approval report shall be organized in the same order and with the same indexing as described in this program, containing all the information requested in section 2.1, section 3 and section 4. The language of the submitted documentation shall be English.

The approval report shall be signed and dated by the manufacturer’s representative, and sent to the local DNV office.

2.4 Evaluation of the Approval Report
When received at the local DNV office, the approval report shall be endorsed, that is; conforming the completeness of the report and the correctness of the test results, by the surveyor witnessing the tests, and forwarded to DNV Høvik for evaluation, together with the applicable checklists.

2.5 Issue of Approval of Manufacturer Certificate
Manufacturers whose works has been inspected and whose approval documentation has been reviewed with satisfactory result will be granted an “Approval of manufacturer certificate” and an entry made on DNV Exchange on the internet (http://exchange.dnv.com/tari).

3. Approval Documentation
This section lists the general information to be provided in the approval application report (see section 2.3). The information relevant to the manufacturing of the products to be covered by the approval of manufacturer certificate shall be submitted. The language of the submitted documentation shall be English.

3.1 General Manufacturer Information
— an outline of the organisation structure including quality control responsibilities
— manufacturing process description, visualized in flow chart(s) indicating all process steps, and in particular the associated testing and inspection points
— a list of the manufacturers written procedures for testing and inspection. The procedures need not to be submitted, but must be available for review at the manufacturer’s works upon request
3.2 Product Information
A list or table specifying:
- type of products.
- range of applicable product sizes and mass
- applicable aluminium types and grades
- reference to recognised standards for the applicable chemical composition, mechanical properties and heat treatment.

3.3 Manufacturers’ own Certificate Form
Where certification of materials using the manufacturer’s own certificate validated by DNV is intended, a blank copy of the certificate form and a filled in certificate for a representative product shall be submitted.

3.4 Information on Manufacturing Route and Equipment

3.4.1 Moulding
- type and material of templates
- moulding process including sands for moulding
- type of die or die arrangement, if applicable
- information on equipment used for sand mixing and reclamation shall be submitted if applicable.

3.4.2 Melting and pouring
- type of furnace and capacity
- type of raw materials, furnace charge composition
- ladle capacity
- refining and alloying practice
- metal treatment, e.g. vacuum degassing, argon or nitrogen rinsing
- any special routine measure applied for treatment and prevention of re-oxidation, reduction of oxide inclusions and segregations to be stated
- pouring temperature range.

3.4.3 Cleaning and finishing
- shakeout temperature
- method of surface cleaning
- method of surplus metal removal (gates, risers).

3.4.4 Weld repairs
Procedure specification for weld repairs allowed in the finishing process to be given, including at least:
- welding process
- welding consumables
- extent and depths allowed for weld repair
- qualification of welders, welders certificates to be submitted
- qualified welding procedures
- surface preparation after welding
- heat treatment after welding
- non-destructive testing before and after welding
- reference to manufacturers procedure for the maintenance of records of weld repairs.

3.4.5 Heat Treatment (if applicable)
- type of furnace and dimensions.
- heating source
- sketch indicating the positions of thermocouples
- accuracy and calibration status of temperature control devices
- heat treatment procedures, specifying temperatures and holding times, and where applicable, information about heating and cooling rates, quenching medium and cooling medium after tempering
- any re-heat treatment procedure to be given, if applicable

4. Approval Testing

4.1 General requirements
Unless otherwise specified herein, the testing procedures, test piece shape, test piece location and orientation, and test results shall comply with the relevant standard.

In case of newly built foundries, newly developed types of aluminium or manufacturing processes; an increased number of casts and casting dimensions for testing may be deemed necessary on a case by case evaluation.

In case the test results for the approval testing fails to meet the requirements given in this program and/or the DNV Rules, re-testing of certain tests for the same heats is in general not permitted. However, the manufacturer shall do an evaluation of the cause for the failure and implement preventive actions. The evaluation report shall be submitted to DNV together with the approval report. New approval testing on new heats after implementation of preventive actions will generally be required.

Approval tests, except for determination of chemical composition and metallographic examination, shall be witnessed by DNV’s surveyor. If the testing facilities are not available at the works, the tests shall be carried out at a recognised laboratory.

4.2 Test material
- material representing castings from two different heats shall be tested. However, where two or more aluminium types shall be covered by the approval, the testing may be reduced to one heat per aluminium type
- the items for approval testing should represent typical casting mass (i.e. not necessarily maximum casting mass)
- approval testing of castings will cover approval of ingots and semis, but not vice versa
- test blocks, from which test pieces are taken, shall be either integrally cast or gated to the casting unless separately cast test blocks are permitted by the relevant standard.
- sketches, drawings or photos showing the position of test blocks, gates, risers and chills shall be submitted
- where separately cast test blocks are used, these are to receive substantially the same casting practices and heat treatment as the production castings represented.

4.3 Chemical composition
Chemical composition as determined by ladle analysis shall comprise all elements specified in the relevant standard.

4.4 Tensile testing
One tensile test shall be made from each casting. The mechanical properties are to comply with the relevant standard.

4.5 Non-destructive testing
Liquid penetrant testing (PT) shall be carried out. The castings shall be tested in the following areas:
- in way of fabrication weld preparations for a band width of 30 mm
— at all accessible fillets and abrupt changes of section
— on all machined surfaces and at positions where surplus metal has been removed
— at positions where repair welds are made.

Where required by the relevant standard (if applicable), ultrasonic testing (UT) shall be carried out.

Records of non-destructive testing shall be submitted, giving the extent of testing, methods of testing and basis for acceptance.

4.6 Other tests (if applicable)
In case other tests, e.g. corrosion tests, impact tests, hardness tests, bend tests, etc. are required by the referred standard, the test results shall be submitted.

5. Suspension or Withdrawal of Certificates
An approval of manufacturer certificate may be suspended or withdrawn if the Society finds it justified.
Directions for suspension and withdrawal of an approval of manufacturer certificate are given by the DNV Rules.