



**STANDARD FOR CERTIFICATION**

**No. 2.9**

**Approval Programme No. 302B**

## **CLAD STEEL PLATES**

OCTOBER 2008

**DET NORSKE VERITAS**

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# FOREWORD

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## 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. 302 of July 1999 has been divided into two new programs:

- Rolled Stainless Steel Plates, Sections and Bars - Type Approval Programme No. 302A, and
- Clad Steel Plates - Type Approval Programme No. 302B.

This new programme for "Clad Steel Plates", is applicable to rolled clad steel products according to DNV Rule requirements Pt.2 Ch.2 Sec.3.

The program is more or less brand new, as the Type Approval Programs Nos. 301 and 302 mainly dealt with rolled ferritic and rolled stainless steel plates, and not the combined product "clad steel plates".

Comments may be sent by e-mail to [rules@dnv.com](mailto: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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## 1. General

### 1.1 Scope

This programme gives the procedure to be followed to obtain the Society's approval for:

- clad steel plates,

in accordance with the requirements given in:

- DNV Rules for Classification of Ships
- DNV Rules for Classification of High Speed, Light Craft and Naval Surface Craft
- DNV Offshore Codes.

### 1.2 Range of Approval

Approval is required for each applicable:

- cladding process
- combination of clad plate material type and base plate material steel group (see approval of manufacturer programs Nos. 301B and 302A for definition of steel types and groups)
- condition of supply
- maximum thickness of clad plate and base material plate.

The manufacturers of the plates for cladding and plates for base material plates intended for the composition plate shall be approved according to the relevant approval programmes.

### 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 clad plate material type, base plate material group, or new material combinations; full approval testing according to section 4 is required.

For extension of maximum thickness of clad plate and/or base plate of already approved grades, full approval testing according to section 4 is required. However, the test material may be reduced to one plate, where the product for testing represents the maximum thickness for approval.

## 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

- a list of equipment used for chemical analysis, mechanical testing, metallographic examination, non-destructive testing and thickness measurements
- description of the qualifications of personnel engaged in testing and inspection, including level of certification of non-destructive testing personnel
- procedure for product identification and traceability (including test samples).
- documentation showing that purchased semi-finished products are obtained from approved manufacturers.

### 3.2 Product Information

A list or table specifying:

- name of plate material manufacturers
- range of applicable product sizes (width, length, thickness)
- cladding process
- applicable clad metal type(s) and base material steel group(s) combinations.

Product statistics of tension tests, shear tests and bond bend tests for the applicable grades. The statistics are intended to demonstrate the capability to manufacture the products in accordance with the requirements.

### 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 Cladding Procedure

All relevant details for the cladding operation procedure shall be submitted, for instance for cladding by rolling; reheating temperature and time, descaling treatment, rolling temperatures, etc.

#### 3.4.2 Heat Treatment

If the cladding process is followed by heat treatment, the following information is requested:

- 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
- method of cleaning after heat treatment.

#### 3.4.3 Surface Cleaning

Methods of cleaning and pickling to be stated.

## 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 appropriate requirements of the Rules Pt.2.

In case of newly built works, newly developed types of steel or manufacturing processes; an increased scope and extent of 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 rules, retesting 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

The selected heats for approval testing shall be representative for the typical products to be approved, particularly with respect to chemical composition.

Unless otherwise specified in the following, the testing shall be carried out on at least two different heats of clad steel plate and base material plate (i.e. two plates for testing), for each material combination to be covered by the approval (see section 1.2):

- for one heat, the product for approval testing shall represent the maximum thickness of both the clad plate and the base material plate for approval.
- for the other heat, the product should represent the average thickness, unless otherwise agreed.

### 4.3 Chemical composition

For all materials, the chemical composition as required in the DNV rules shall be given. The plate manufacturers' mill certificate will be accepted. In case no DNV rule requirements are applicable, the chemical composition shall be according to a relevant recognised standard.

### 4.4 Tensile testing

- Tensile tests shall be made from both ends of each composite plate. Yield (or proof) stress, tensile strength and elongation shall be reported.
- For each composite plate with total thickness less than or equal to 50mm, and if feasible by the testing machine; the full thickness of the plate shall be tested.
- Otherwise, machined test specimens representing the same ratio of cladding metal to base steel as in the composite plate will be accepted, however, the cladding metal need not to be reduced to less than 3mm in thickness.

### 4.5 Impact testing

- Longitudinal and transverse Charpy V-notch impact tests shall be made from both ends of each sample product (i.e. from the finished composite plate), for material representing the base material plate. The test piece orientation, test temperature and absorbed energy (average and single values) shall be according to the DNV rules.
- The products shall be tested at the temperature prescribed in the DNV Rules for the base material plate, or as specified in "Approval of Manufacturers" program No. 301B or 302A in the absence of DNV rule requirements.
- The requirement for the tests is that the energy values comply with those specified in the Rules at the prescribed test temperature, as well as the values specified in a relevant recognised standard (if applicable).

### 4.6 Corrosion testing of austenitic steels cladding material

- The resistance of austenitic steels cladding metal against inter-granular corrosion shall be carried out according to

ASTM A262, Practice E (Copper – Copper Sulphate – Sulphuric Acid Test) or another recognised standard.

- Testing method and test results to be reported.

#### 4.7 Corrosion testing of duplex steels cladding material

- Corrosion test in accordance with ASTM G48 Method A or an equivalent standard is required for the cladding material, from one heat at one end of the product. The clad-steel specimens for testing shall be removed from the composite plate by a process not introducing heating or deformation of the sample material.
- the test temperature shall be +20°C for type 22Cr duplex and +50°C for type 25Cr duplex, respectively. The exposure time shall be 24 hours.
- test specimen surfaces shall have a finish representative of the material's supply condition.
- no pitting on specimen (plate) surfaces is allowed when viewed at 20x magnification. The specimen mass loss shall be less than 4.0 g/m<sup>2</sup>.

#### 4.8 Bond strength bend test

Bond strength bend testing is required from both heats for testing, at one end of the product. Bond strength bend testing to be performed according to DNV rules (Pt.2, Ch.3). Testing according to other recognised standards may be accepted if agreed in advance (e.g. ASTM A264-03). Test results to be reported.

#### 4.9 Shear strength test

Shear strength testing is required from both heats for testing, at one end of the product. Shear strength testing to be performed according to ASTM A264-03. Test results to be reported.

#### 4.10 Ultrasonic inspection

Ultrasonic inspection shall be performed according to the requirements given in the Rules, Pt.2, Ch.3. The ultrasonic inspection report shall be submitted.

#### 4.11 Visual and dimensional inspection

Visual and dimensional inspection shall be performed according to the requirements given in the Rules, Pt.2, Ch.3. The inspection reports shall be submitted.

## 5. 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
- 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.

## 6. 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 Rules.

## 7. References

- 1) ISO 10474. Steel and steel products – Inspection documents.
- 2) ASTM A262, Practice E. Copper – Copper Sulphate – Sulphuric Acid Test
- 3) ASTM G 48. Test Methods for Pitting and Crevice Corrosion Resistance of Stainless Steels and Related Alloys by Use of Ferric Chloride Solution.
- 4) ASTM A264-03. Specification for Stainless Chromium-Nickel Steel-Clad Plate.