NEWBUILDINGS
MATERIALS AND WELDING

General Requirements for Materials

JANUARY 2014

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FOREWORD

DNV is a global provider of knowledge for managing risk. Today, safe and responsible business conduct is both a license to operate and a competitive advantage. Our core competence is to identify, assess, and advise on risk management. From our leading position in certification, classification, verification, and training, we develop and apply standards and best practices. This helps our customers safely and responsibly improve their business performance. DNV is an independent organisation with dedicated risk professionals in more than 100 countries, with the purpose of safeguarding life, property and the environment.

The Rules lay down technical and procedural requirements related to obtaining and retaining a Class Certificate. It is used as a contractual document and includes both requirements and acceptance criteria.
CHANGES – CURRENT

General
This document supersedes the January 2011 edition.

Text affected by the main changes in this edition is highlighted in red colour. However, if the changes involve a whole chapter, section or sub-section, normally only the title will be in red colour.

Main changes January 2014, entering into force 1 July 2014

• Sec.1 Manufacture, survey and certification
  — B302: New text has been added.
  — C204: Guidance note has been added.

• Sec.2 Testing procedures
  — B101: Symbol list has been amended.
  — B105 and B106: Symbol lists have been deleted.
  — B106: Fig.1 has been amended.
  — B111 has been deleted.
  — New item B204 has been added.
  — B600: New text has been added.
  — New sub-section element B700 has been added.

Editorial Corrections
In addition to the above stated main changes, editorial corrections may have been made.
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SECTION 1 MANUFACTURE, SURVEY AND CERTIFICATION

A. General

A 100 Scope

101 This Section specifies general requirements for manufacture, survey and certification of materials used for the construction or repair of hulls, equipment, boilers and pressure vessels and machinery of vessels classed or intended for classification by the Society.

Appropriate specific requirements are given in Ch.2.

102 Materials which shall comply with these requirements are defined in the relevant design and construction parts of the rules.

103 Materials which comply with national or proprietary specifications may be accepted provided such specifications give reasonable equivalence to the requirements of Ch.2 or are otherwise specially approved.

A 200 Information to be supplied by the purchaser

201 The purchaser shall supply the manufacturer with all information necessary to ensure that survey and certification can be carried out in accordance with these rules. This applies particularly where optional or additional conditions are specified in the relevant construction rules.

A 300 Approval of manufacturers

301 Materials delivered with NV or works certificate shall be manufactured at works which have been approved by the Society. Approved manufacturers are published on DNV Exchange on the Internet.

302 In order to be approved, the manufacturer is required to demonstrate and submit documentation to the effect that the necessary manufacturing, testing and inspection facilities are available and are supervised by qualified personnel. The manufacturer is also to carry out a test programme and submit the results.

303 Detailed programmes for approval testing are given in DNV Standard for Certification No. 2.9.

304 When a manufacturer has more than one works, the approval is only valid for the works which carried out the test programme.

B. Testing and inspection

B 100 Survey during manufacture

101 The surveyor shall be given the opportunity to inspect and check at any time all plants and equipment used in the manufacture and testing.

The manufacturer shall assist the surveyor to enable him to verify that approved processes are adhered to and to witness the selection and testing as required by the rules.

102 Prior to the testing and inspection, the manufacturer shall provide the surveyor with the technical specifications of the order and any conditions additional to the rule requirements.

B 200 Chemical composition

201 The chemical composition of samples taken from each ladle of each cast shall be determined by the manufacturer in an adequately equipped and competently staffed laboratory and shall comply with the appropriate requirements of Ch.2.

202 The manufacturer's declared analysis will be accepted subject to occasional checks if required by the surveyor.

B 300 Heat treatment

301 All materials shall be supplied in a condition complying with the appropriate requirements of Ch.2.

302 Heat treatment shall be carried out in properly constructed furnaces which are efficiently maintained and have adequate means for control and recording of temperature. The furnace dimensions shall be such as to allow the material to be uniformly heated to the specified temperature.

Sufficient thermocouples shall be connected to the furnace charge to measure and record that its temperature is adequately uniform unless the temperature uniformity of the furnace is verified according to a recognized standard (e.g. ASTM A991, JB/T 6049, GB/T 9452) at regular intervals as agreed with the Society.

303 In the case of very large castings or forgings alternative methods for heat treatment will be specially considered.
B 400  Selection of test material

401  Test material sufficient for the required tests and preferably also for possible retest purposes shall be provided. The test material shall be representative of the test unit or sample product and shall not be separated until all the specified heat treatment has been completed, unless otherwise stated in Ch.2.

402  Where the Society's certification is required, all the test material shall be selected and marked by the surveyor, unless otherwise agreed.

B 500  Definitions relevant to testing

The following definitions apply:

501  **Test Unit:** The number of pieces or the tonnage of products to be accepted or rejected together, on the basis of the tests to be carried out on sample products.

502  **Sample Product:** A single forging, casting, plate, tube or other wrought product selected from a test unit.

503  **Sample:** A sufficient quantity of material taken from the sample product for the purpose of producing one or more test pieces.

504  **Test Piece:** Part of the sample, with specified dimensions, machined or unmachined, brought to a required condition for submission to a given test.

B 600  Testing

601  The appropriate tests specified in Ch.2 and 3 shall be carried out at the place of manufacture before materials are dispatched. If the necessary facilities are not available at the manufacturer's works, the testing shall be carried out at a recognized testing laboratory.

   **Where the Society's certification is required, all the testing (except for chemical composition analysis) shall be witnessed by the surveyor, unless otherwise agreed.**

602  In the event of any material proving unsatisfactory during subsequent processing or fabrication, such material shall be rejected, notwithstanding any previous certification.

   The surveyor may require further tests of materials from affected test units.

B 700  Retesting

701  When the result of any test, other than impact test, fails to meet the requirements, two further tests may be made from the same sample. If both of these additional tests are satisfactory, the test unit may be accepted.

702  When the results from a set of three impact test pieces fail to meet the requirements, three additional test pieces from the same sample may be tested and the results added to those previously obtained to form a new average. If this new average complies with the requirements and if not more than two individual results are lower than the required average and, of these, not more than one result is below 70% of the specified average value, the test unit may be accepted.

703  If unsatisfactory results are obtained from retests representative of a test unit, the sample product from which the tests were made shall be rejected. The remaining material in the test unit may be accepted provided that two further sample products are tested with satisfactory result.

704  When a test unit is rejected, the remaining sample products in the test unit may be resubmitted individually for test, and those which give satisfactory results may be accepted.

705  At the option of the manufacturer, rejected material may be resubmitted after heat treatment or re-heat treatment, or may be resubmitted as another grade and may then be accepted provided the required tests are satisfactory.

706  If any test piece fails because of faulty preparation, visible defects or (in the case of tensile test) because of fracturing outside the range permitted for the appropriate gauge length, the defective test piece may be disregarded and replaced by an additional test piece of the same type.

B 800  Visual and non-destructive examination

801  All finished material shall have a workmanlike finish and shall be free from internal and surface defects prejudicial to the use of the material for the intended application. Otherwise the material shall comply with the appropriate specific requirements of the subsequent rule chapters.

B 900  Correction of defects

901  When unacceptable defects are found, these shall be removed by appropriate methods and rectified in accordance with the applicable requirements of Ch.2.
C. Identification and certification

C 100 Identification of materials

101 The manufacturer shall adopt a system of identification which enable all finished material to be traced to the original cast, including the documentation of all important production steps. The surveyor shall be given full facilities for tracing the materials when required.

102 Before acceptance, all materials which have been tested and inspected with satisfactory results shall be clearly marked by the manufacturer in at least one place with the Society's brand, as furnished by the surveyor, and the following particulars:

a) Manufacturer's name or trade mark.

b) Material grade.

c) Identification number, cast number or other marking which will enable the full history of the product to be traced.

d) If required by the purchaser, his order number or other identification mark.

103 Where a number of light materials are securely fastened together in bundles the manufacturer may brand only the top piece of each bundle, or alternatively, a firmly fastened durable label containing the brand may be attached to each bundle.

104 The marking is normally made by hard stamping, however, other methods may be accepted.

105 In the event of any material bearing the Society's brand failing to comply with the test requirements, the brand shall be unmistakably defaced by the manufacturer.

C 200 Certification of materials

201 Certification of materials will be based on compliance with all specified tests and inspection. Unless otherwise specially approved, certification shall take place at the manufacturer's works and the surveyor shall attend and witness testing and inspection in accordance with the appropriate requirements of Ch.2.

202 As an alternative to 201, certification may be based on a Manufacturing Survey Arrangement (MSA), subject to approval by the Society. See also Rules for Classification of Ships Pt.1 Ch.1 Sec.4 B500.

203 Normally, separate inspection certificates are issued for each grade of material and each product form. The inspection certificate shall include the following particulars:

a) Purchaser's name and order number and if known the vessel identification for which the material is intended.

b) Manufacturer's name.

c) Description of the product, dimensions, weight etc.

d) Identification of specification or grade of material.

e) Identification of the cast and product.

f) Ladle analysis for specified elements.

g) Results of all specified inspections and mechanical tests.

h) Condition of supply and where appropriate, details of heat treatment.

204 Where applicable, the manufacturer shall provide the surveyor with inspection certificates or shipping statements for all accepted materials giving at least the particulars detailed in 203. Before the inspection certificates or shipping statements are signed by the surveyor, the manufacturer is required to furnish him with a written declaration stating that the material has been made by an approved process and that it has been subjected to and has withstood satisfactorily the required tests. The following form of declaration will be accepted if stamped or printed on each inspection certificate or shipping statement with the name of the works and signed by an authorized representative of the manufacturer:

“We hereby certify that the material has been made by an approved process and has been satisfactorily tested in accordance with relevant DNV Rules and/or Offshore Standards for Classification.”

Guidance note:

The wording “relevant DNV Rules and/or Offshore Standards for Classification” may be replaced with a rule reference as relevant, e.g. “DNV Rules for Ships Pt.2 and DNV OS-B101”.

When a material is not produced at the works at which it is rolled or forged, a certificate shall be supplied by the maker stating the process of manufacture, the cast number and the chemical composition of ladle samples. The works at which the material was produced must be approved.

205 Regarding electronic certificates reference is made to Rules for Classification of Ships Pt.1 Ch.1 Sec.4.
SECTION 2 TESTING PROCEDURES

A. General

A 100 Scope

This section specifies the requirements for testing machines, test pieces and testing procedures when testing ferrous and nonferrous metals.

102 Alternative test pieces, such as those complying with recognized national and international standards, may be accepted subject to approval by the Society. The same applies to the given testing procedures.

A 200 Testing machines

201 All tests shall be carried out by competent personnel on machines of accepted type. The machines shall be maintained in satisfactory and accurate condition and shall be recalibrated at approximately annual intervals by a qualified organization. A record of such calibrations shall be kept available in the test laboratory.

202 Tensile testing machine load cells shall be calibrated ±1% in accordance with ISO 7500-1 or another recognised standard.

203 Impact testing shall be carried out on Charpy V-notch machines calibrated to ISO 148, EN 10045 or ASTM E23 dependent on the testing machine type.

A 300 Preparation of test pieces

301 The preparation of test pieces shall be done in such a manner that test pieces are not subjected to any significant cold straining or heating.

302 If samples are cut from material by flame cutting or shearing, a reasonable margin is required to enable sufficient material to be removed from the cut edges during final machining.

303 Where possible, test pieces from rolled materials shall retain their rolled surface on both sides.

304 Tolerances on tensile specimen dimensions shall be in accordance with ISO 6892 or another recognised standard.

B. Test methods

B 100 Tensile testing at ambient temperature

101 Symbols related to tensile testing.

a = thickness
A = percentage elongation after fracture
A_0 = required non-proportional elongation
A_s = elongation in % for test piece with proportional gauge length
b = width
d = test specimen diameter
D = external pipe diameter
L_o = gauge length
L_c = parallel test length
R = transition radius
R_m = tensile strength
R_c = yield stress (yield point)
R_{cl} = lower yield stress (yield point)
R_{ch} = upper yield stress (yield point)
R_p = yield strength (proof stress)
R_{0.2} = yield strength at 0.2% non-proportional elongation
R_t = yield strength (proof stress), total elongation
R_{0.5} = yield strength at 0.5% total elongation
t = thickness
S_o = the cross-sectional area of the test piece in question
Z = percentage reduction of area.
Upper yield stress ($R_{\text{eff}}$) is the highest value of stress measured at the commencement of plastic deformation at yield; often this value is represented by a pronounced peak stress. For steels and copper the test shall be carried out with an elastic stress rate between 6 and 60 MPa per sec. and between 2 and 20 MPa per second for aluminum.

When no well-defined yield phenomena exists, either the yield strength at 0.2% non-proportional elongation ($R_{p0.2}$) or the yield strength at 0.5% total elongation ($R_{t0.5}$) shall be determined according to the applicable specification.

After reaching the yield stress or yield strength, the machine speed for determination of the tensile strength, is not to exceed that corresponding to a strain rate of 0.008s$^{-1}$. For cast iron the elastic stress rate shall not exceed 10 N/mm$^2$ per sec.

The elongation generally means elongation determined on a proportional gauge length $5.65\sqrt{S_0}$, or 5 \(d\) and has the designation $A_5$.

If the material is a ferritic steel of low or medium strength and not cold worked, the elongation may also be measured on a non-proportional gauge length $L_0$ after agreement with the Society. In that case the required elongation $A_{o5}$ is calculated from the following formula:

$$A_{o5} = 2A_5 \left( \frac{S_0}{L_0} \right)^{0.40}$$

The elongation value is valid if the fracture occurs at least the following distance from the end marks of the gauge length:

- Round test piece: 1.25 \(d\)
- Flat test piece: \(b + a\)

For the purpose of determining the different designations related to tensile testing, two different types of test pieces may be used: Round and flat, see Fig. 1.

The applied gauge length ($L_0$) may be rounded off to the nearest 5 mm, provided that the difference between the applied gauge length and the calculated gauge length (from B108) is less than 10% of calculated gauge length.

For plates, wide flats and sections with thickness 3 mm or more, flat test pieces of full product thickness according to alternatives A and B shall generally be used. When the capacity of the available testing machine is insufficient to allow the use of test piece of full thickness, this may be reduced in thickness by machining one of the rolled surfaces. Alternatively, for materials over 40 mm thickness, proportional round test piece according to alternative C may be used. When round test piece is used it shall be positioned with its axis at one-quarter of the thickness from a rolled surface.

*Alternative A*, proportional flat test piece:

- \(a = t\)
- \(b = 25 \text{ mm}\)
- \(L_0 = 5.65\sqrt{S_0}\)
For sheet and strips with thickness \( t \) less than 3 mm, flat test piece with the following dimensions shall be used:

- \( a = t \)
- \( b = 12.5 \text{ mm} \)
- \( L_o = 50 \text{ mm} \)
- \( L_c \approx 75 \text{ mm} \)
- \( R = 25 \text{ mm} \)

For forgings, bars, cast steel and nodular cast iron, proportional round test piece according to alternative C in 108 shall be used. The test piece for materials with a specified minimum elongation \( A_5 \leq 10\% \) shall have transition radius \( R \geq 1.5d \).  

For grey cast iron the test piece shall have dimensions as stipulated in Fig. 2.

For pipes, test piece according to alternative A or B below shall be used. 

**Alternative A**, full cross-section test pieces with plugged ends.

\[
L_o = 5.65 \sqrt{S_0}
\]

\[
L_c \equiv L_o + D
\]

\( L_c \) is the distance between the grips or the plugs, whichever is the smallest.

**Alternative B**, strip

\[
a = \text{wall thickness of the tube}
\]

\[
b = 12 \text{ mm}
\]

\[
L_o = 5.65 \sqrt{S_0}
\]

\[
L_c \equiv L_o + 2b
\]
B 200 Bend testing

201 Flat bend test piece as given in Fig. 3 shall be used. Edges on tension side to be rounded to a radius of 1 to 2 mm.

202 For plates, structural sections and sheets, test piece with the following dimensions shall be used:

\[ a = \text{as rolled thickness } t \text{ of material} \]
\[ b = 30 \text{ mm} \]

If the as rolled thickness \( t \) is greater than 25 mm, it may be reduced to 25 mm by machining on the compression side of the bend test piece.

203 For forgings, castings and semi-finished products, test piece with the following dimensions shall be used:

\[ a = 20 \text{ mm} \]
\[ b = 25 \text{ mm} \]

204 Unless otherwise detailed in the respective rules or standard, the mandrel diameter shall be \( 4 \cdot a \) (four times specimen thickness) for materials with \( \text{SMYS} < 550 \text{ MPa} \) (\( \text{SMYS} = \text{specified minimum yield strength} \)), and \( 5 \cdot a \) for materials with \( \text{SMYS} \geq 550 \text{ MPa} \), and the bending angle shall be \( 180^\circ \).

B 300 Impact testing

301 Impact testing shall be carried out as Charpy V-notch test according to the specification in question. The average value of three test pieces shall be determined and meet the specified minimum requirement. One individual value may be below the specified value, provided that it is not less than 70% of that value.

302 The Charpy V-notch impact toughness is the absorbed energy, expressed in Joule (J), the symbol being KV.

303 The Charpy impact test machine shall be of a type acceptable to the Society having a gap of 40 mm, a striking velocity between 4.5 and 7 m/sec. and a striking energy of not less than 150 J. The angle between the striking edges of the pendulum shall be \( 30^\circ \) with the edge rounded to a radius 2 to 2.5 mm. (Pendulum according to ASTM E 23 will also be accepted.)

The point of impact of the hammer shall be in the centre line of the notch.

304 Samples may be flame-cut but the notch shall not be closer to a flame-cut edge than 25 mm. The notch shall be made in a single cut by a special milling cutter. The cutter shall be kept sharp so that the shape of the notch is correct and cold working at the base is avoided as far as possible. The cutter shall be systematically checked at intervals not exceeding 100 test pieces.

305 Dimensions and tolerances for Charpy V-notch test pieces shall be as given in Table B1.

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Nominal</th>
<th>Tolerances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>55 mm</td>
<td>± 0.60 mm</td>
</tr>
<tr>
<td>Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- standard test piece</td>
<td>10 mm</td>
<td>± 0.11 mm</td>
</tr>
<tr>
<td>- subsize test piece</td>
<td>7.5 mm</td>
<td>± 0.11 mm</td>
</tr>
<tr>
<td>- subsize test piece</td>
<td>5 mm</td>
<td>± 0.06 mm</td>
</tr>
<tr>
<td>Thickness</td>
<td>10 mm</td>
<td>± 0.06 mm</td>
</tr>
<tr>
<td>Angle of notch</td>
<td>45°</td>
<td>± 2°</td>
</tr>
<tr>
<td>Depth below notch</td>
<td>8 mm</td>
<td>± 0.06 mm</td>
</tr>
<tr>
<td>Root radius</td>
<td>0.25 mm</td>
<td>± 0.025 mm</td>
</tr>
<tr>
<td>Distance of notch from ends of test piece</td>
<td>27.5 mm</td>
<td>± 0.42 mm</td>
</tr>
<tr>
<td>Angle between plane of symmetry of notch and longitudinal axis of test piece</td>
<td>90°</td>
<td>± 2°</td>
</tr>
</tbody>
</table>
Standard Charpy V-notch test pieces with width 10 mm shall be used, except when the thickness of the material does not permit this size. In such cases the largest obtainable of the subsize test pieces with width 7.5 mm or 5 mm shall be used. The required energy values are then reduced to 5/6 and 2/3 of tabulated values, respectively. Impact tests are generally not required when the material thickness is less than 6 mm.

The temperature of the test piece at the moment of breaking shall be the specified temperature within ±2°C. The temperature shall be controlled for sufficient time to ensure uniformity throughout the cross-section of the test piece.

Test temperature shall be stated in the certificate.

Guidance note:
The required temperature tolerance is usually obtainable by immersing the test piece for at least 2 minutes in an agitated liquid bath having the specified test temperature, and have the test piece broken within 5 seconds after withdrawal from the bath.

---c-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

![Charpy V-notch test piece](image)

Fig. 4
Charpy V-notch test piece

### B 400 Drop-weight testing

401 For material with thickness $t$ equal to or greater than 16 mm, drop-weight test pieces for the determination of nil ductility transition temperature shall comply with specifications given in ASTM E208, and have one of the following sizes:

- No. 1: 25 by 90 by 360 mm
- No. 2: 19 by 50 by 130 mm
- No. 3: 16 by 50 by 130 mm.

For material thicknesses below 16 mm down to and including 12 mm, a test piece machined down to 12 mm thickness shall be used. For material thicknesses below 12 mm down to and including 10 mm, the thickness of the test piece shall be that of the material. Other dimensions and requirements for test piece with thickness below 16 mm shall be as for test piece no. 3, except that a stop distance of 2.3 mm shall be used.

402 The test pieces may be cut with their axes either transverse or longitudinal to the final rolling direction of the material, but the orientation shall be the same for all test pieces.

403 The sides of the test pieces shall be saw-cut or machined. The distance from a flame-cut surface shall be min. 25 mm.

The machining of the test piece to prescribed thickness shall be on the compression side only.

404 Two test pieces shall be tested at the prescribed test temperature. Both test pieces shall exhibit a non-break performance, i.e. the nil ductility transition temperature shall be below the test temperature.

405 The drop-weight test shall be carried out and evaluated according to ASTM E208.

### B 500 Determination of grain size

501 Where the austenitic grain size is specified, it shall be determined according to methods described in recognized standards. At least one sample shall be taken from finished material from each ladle. For rolled products the sample is preferably to be taken from the thickest piece rolled. The grain size numbers refer to the ASTM scale described in ASTM E112.

### B 600 Fracture mechanics testing

601 When specified, Fracture mechanics (FM) testing of materials and weldments shall be performed. The tests shall be carried out according to ISO 15653 and ISO 12135 using 3-point bend specimens, or another recognized standard as agreed with the Society. CTOD-technique with $B \times 2B$ specimens is recommended. The test is deemed to be valid provided post-test-data analysis meets all validity criteria of the standard.

602 The test may be required for the base material or for a welded connection.

603 For welded connections, the test weld shall be made and tested for the actual combination of steel grade, manufacturer, welding process and welding consumable (brand) used.

604 The FM tests shall be carried out on a full penetration butt-weld with K- or single V-preparation. The
back of the K and one of the legs of the single V (on which the FM test will carried out) shall be perpendicular to the plane of the plate. Tests on either of these weld bevel preparations qualify for all types of bevel preparations.

605 Unless otherwise detailed in the respective rules, the test weld shall be welded with a heat input representing the maximum heat input used in the fabrication. The test weld shall be made on a plate with a thickness not smaller than 90% of the maximum plate or wall thickness for which the welding procedure shall apply. The test weld also qualifies for plate thicknesses down to 50% of the test weld plate thickness.

606 On each test weld at least three FM test specimens shall be tested in each of the positions (i) weld deposit (WM) and (ii) the grain coarsened heat affected zone (GCHAZ) (details regarding the required number of test specimens and the location of fatigue pre-cracks are given further below).

607 Metallographic sections according to ISO 15653 shall be prepared from each GCHAZ specimen. The metallographic section shall include weld metal and base metal. If necessary, in order to determine the exact location of the fatigue pre-crack, sections from both sides of the pre-crack shall be prepared. The faces of the metallographic sections shall not be taken deeper than the deepest point of the fatigue pre-crack and not more than 3 mm from the deepest point of the fatigue pre-crack.

A figure of a cross-section through the weld (of an un-fractured specimen) is shown in Fig.5.

Fig. 5
Cross-section through the weld

BM = Base Material
WM = Weld Metal or deposit
\(d_f\) = distance from the plane of the fatigue pre-crack to the fusion line (varies along the fatigue pre-crack)
\(\lambda_i\) = length (in mm) of each area with acceptable location of the fatigue pre-crack (given as SM (\(\lambda\)) = Specified Microstructure in ISO 15653)
t = plate thickness

Within the central 75% of the plate thickness the areas where \(d_f\) \(\leq\) 0.5 mm shall be identified (considered the grain coarsened HAZ, GCHAZ). The length, \(\lambda_i\) of each of these areas shall be determined. The location of the fatigue pre-crack shall satisfy the following criteria:

\[\Sigma N \lambda_i \geq \begin{cases} 3 \text{ mm for } t \leq 20 \text{ mm} \\ 0.15 t \text{ for } 20 < t \leq 80 \text{ mm} \\ 12 \text{ mm for } t > 80 \text{ mm} \end{cases} \]

N = number of areas with \(d_f\) \(\leq\) 0.5 mm

608 Results from GCHAZ specimens on which the location of the fatigue pre-crack does not satisfy the requirement above, are not valid. In addition to these requirements given for GCHAZ specimens, all the requirements specified in ISO 15653 apply for both GCAZ and weld deposit specimens.

Three or more valid tests for each of weld deposit and GCHAZ shall be carried out.

B 700 Brittle crack arrest test (ESSO test)

701 When specified, the ESSO test shall be performed. The ESSO test is used to estimate the materials ability to arrest a running brittle crack in rolled steel plates. A brittle crack arrest toughness value \(K_{ca}\) is estimated based on the test results. The test is limited to maximum plate thickness 100 mm unless otherwise approved. The test method is described in the relevant DNV approval program.

B 800 Other testing

801 Testing not described in sub-sections 100 to 700 may be required for certain products. In such cases testing shall be carried out in accordance with procedures approved by the Society.
CHANGES – HISTORIC

Note that historic changes older than the editions shown below have not been included. Older historic changes (if any) may be retrieved through http://www.dnv.com.

January 2011 edition

Amendments July 2011

- General
  - The restricted use legal clause found in Pt.1 Ch.1 Sec.5 has been added also on the front page.

Main changes coming into force 1 July 2011

- Sec.1 Manufacture, Survey and Certification
  This section has been amended with regard to correction of defects and identification of materials. Electronic certificates have been included.

- Sec.2 Testing Procedures
  This section has been amended with regard to testing of materials. Fracture Mechanics testing has been included.