

Rules for the Approval of Manufacturers of Materials

Effective from 1 January 2021

GENERAL CONDITIONS

Definitions:

“Administration” means the Government of the State whose flag the Ship is entitled to fly or under whose authority the Ship is authorised to operate in the specific case.

“IACS” means the International Association of Classification Societies.

“Interested Party” means the party, other than the Society, having an interest in or responsibility for the Ship, product, plant or system subject to classification or certification (such as the owner of the Ship and his representatives, the ship builder, the engine builder or the supplier of parts to be tested) who requests the Services or on whose behalf the Services are requested.

“Owner” means the registered owner, the ship owner, the manager or any other party with the responsibility, legally or contractually, to keep the ship seaworthy or in service, having particular regard to the provisions relating to the maintenance of class laid down in Part A, Chapter 2 of the Rules for the Classification of Ships or in the corresponding rules indicated in the specific Rules.

“Rules” in these General Conditions means the documents below issued by the Society:

- (i) Rules for the Classification of Ships or other special units;
- (ii) Complementary Rules containing the requirements for product, plant, system and other certification or containing the requirements for the assignment of additional class notations;
- (iii) Rules for the application of statutory rules, containing the rules to perform the duties delegated by Administrations;
- (iv) Guides to carry out particular activities connected with Services;
- (v) Any other technical document, as for example rule variations or interpretations.

“Services” means the activities described in Article 1 below, rendered by the Society upon request made by or on behalf of the Interested Party.

“Ship” means ships, boats, craft and other special units, as for example offshore structures, floating units and underwater craft.

“Society” or “TASNEEF” means Tasneef and/or all the companies in the Tasneef Group which provide the Services.

“Surveyor” means technical staff acting on behalf of the Society in performing the Services.

Article 1

1.1. The purpose of the Society is, among others, the classification and certification of ships and the certification of their parts and components. In particular, the Society:

- (i) sets forth and develops Rules;
- (ii) publishes the Register of Ships;
- (iii) issues certificates, statements and reports based on its survey activities.

1.2. The Society also takes part in the implementation of national and international rules and standards as delegated by various Governments.

1.3. The Society carries out technical assistance activities on request and provides special services outside the scope of classification, which are regulated by these general conditions, unless expressly excluded in the particular contract.

Article 2

2.1. The Rules developed by the Society reflect the level of its technical knowledge at the time they are published. Therefore, the Society, although committed also through its research and development services to continuous updating of the Rules, does not guarantee the Rules meet state-of-the-art science and technology at the time of publication or that they meet the Society's or others' subsequent technical developments.

2.2. The Interested Party is required to know the Rules on the basis of which the Services are provided. With particular reference to Classification Services, special attention is to be given to the Rules concerning class suspension, withdrawal and reinstatement. In case of doubt or inaccuracy, the Interested Party is to promptly contact the Society for clarification.

The Rules for Classification of Ships are published on the Society's website: www.tasneef.ae.

2.3. The Society exercises due care and skill:

- (i) in the selection of its Surveyors
- (ii) in the performance of its Services, taking into account the level of its technical knowledge at the time the Services are performed.

2.4. Surveys conducted by the Society include, but are not limited to, visual inspection and non-destructive testing. Unless otherwise required, surveys are conducted through sampling techniques and do not consist of comprehensive verification or monitoring of the Ship or of the items subject to certification. The surveys and checks made by the Society on board ship do not necessarily require the constant and continuous presence of the Surveyor. The Society may also commission laboratory testing, underwater inspection and other checks carried out by and under the responsibility of qualified service suppliers. Survey practices and procedures are selected by the Society based on its experience and knowledge and according to generally accepted technical standards in the sector.

Article 3

3.1. The class assigned to a Ship, like the reports, statements, certificates or any other document or information issued by the Society, reflects the opinion of the Society concerning compliance, at the time the Service is provided, of the Ship or product subject to certification, with the applicable Rules (given the intended use and within the relevant time frame).

The Society is under no obligation to make statements or provide information about elements or facts which are not part of the specific scope of the Service requested by the Interested Party or on its behalf.

3.2. No report, statement, notation on a plan, review, Certificate of Classification, document or information issued or given as part of the Services provided by the Society shall have any legal effect or implication other than a representation that, on the basis of the checks made by the Society, the Ship, structure, materials, equipment, machinery or any other item covered by such document or information meet the Rules. Any such document is issued solely for the use of the Society, its committees and clients or other duly authorised bodies and for no other purpose. Therefore, the Society cannot be held liable for any act made or document issued by other parties on the basis of the statements or information given by the Society. The validity, application, meaning and interpretation of a Certificate of Classification, or any other document or information issued by the Society in connection with its Services, is governed by the Rules of the Society, which is the sole subject entitled to make such interpretation. Any disagreement on technical matters between the Interested Party and the Surveyor in the carrying out of his functions shall be raised in writing as soon as possible with the Society, which will settle any divergence of opinion or dispute.

3.3. The classification of a Ship, or the issuance of a certificate or other document connected with classification or certification and in general with the performance of Services by the Society shall have the validity conferred upon it by the Rules of the Society at the time of the assignment of class or issuance of the certificate; in no case shall it amount to a statement or warranty of seaworthiness,

structural integrity, quality or fitness for a particular purpose or service of any Ship, structure, material, equipment or machinery inspected or tested by the Society.

3.4. Any document issued by the Society in relation to its activities reflects the condition of the Ship or the subject of certification or other activity at the time of the check.

3.5. The Rules, surveys and activities performed by the Society, reports, certificates and other documents issued by the Society are in no way intended to replace the duties and responsibilities of other parties such as Governments, designers, ship builders, manufacturers, repairers, suppliers, contractors or sub-contractors, Owners, operators, charterers, underwriters, sellers or intended buyers of a Ship or other product or system surveyed.

These documents and activities do not relieve such parties from any fulfilment, warranty, responsibility, duty or obligation (also of a contractual nature) expressed or implied or in any case incumbent on them, nor do they confer on such parties any right, claim or cause of action against the Society. With particular regard to the duties of the ship Owner, the Services undertaken by the Society do not relieve the Owner of his duty to ensure proper maintenance of the Ship and ensure seaworthiness at all times. Likewise, the Rules, surveys performed, reports, certificates and other documents issued by the Society are intended neither to guarantee the buyers of the Ship, its components or any other surveyed or certified item, nor to relieve the seller of the duties arising out of the law or the contract, regarding the quality, commercial value or characteristics of the item which is the subject of transaction.

In no case, therefore, shall the Society assume the obligations incumbent upon the above-mentioned parties, even when it is consulted in connection with matters not covered by its Rules or other documents.

In consideration of the above, the Interested Party undertakes to relieve and hold harmless the Society from any third party claim, as well as from any liability in relation to the latter concerning the Services rendered.

Insofar as they are not expressly provided for in these General Conditions, the duties and responsibilities of the Owner and Interested Parties with respect to the services rendered by the Society are described in the Rules applicable to the specific Service rendered.

Article 4

4.1. Any request for the Society's Services shall be submitted in writing and signed by or on behalf of the Interested Party. Such a request will be considered irrevocable as soon as received by the Society and shall entail acceptance by the applicant of all relevant requirements of the Rules, including these General Conditions. Upon acceptance of the written request by the Society, a contract between the Society and the Interested Party is entered into, which is regulated by the present General Conditions.

4.2. In consideration of the Services rendered by the Society, the Interested Party and the person requesting the service shall be jointly liable for the payment of the relevant fees, even if the service is not concluded for any cause not pertaining to the Society. In the latter case, the Society shall not be held liable for non-fulfilment or partial fulfilment of the Services requested. In the event of late payment, interest at the legal current rate increased by 1.5% may be demanded.

4.3. The contract for the classification of a Ship or for other Services may be terminated and any certificates revoked at the request of one of the parties, subject to at least 30 days' notice to be given in writing. Failure to pay, even in part, the fees due for Services carried out by the Society will entitle the Society to immediately terminate the contract and suspend the Services.

For every termination of the contract, the fees for the activities performed until the time of the termination shall be owed to the Society as well as the expenses incurred in view of activities already programmed; this is without prejudice to the right to compensation due to the Society as a consequence of the termination.

With particular reference to Ship classification and certification, unless decided otherwise by the Society, termination of the contract implies that the assignment of class to a Ship is withheld or, if already assigned, that it is suspended or withdrawn; any statutory certificates issued by the Society will be withdrawn in those cases where provided for by agreements between the Society and the flag State.

Article 5

5.1. In providing the Services, as well as other correlated information or advice, the Society, its Surveyors, servants or agents operate with due diligence for the proper execution of the activity. However, considering the nature of the activities performed (see art. 2.4), it is not possible to guarantee absolute accuracy, correctness and completeness of any information or advice supplied. Express and implied warranties are specifically disclaimed.

Therefore, except as provided for in paragraph 5.2 below, and also in the case of activities carried out by delegation of Governments, neither the Society nor any of its Surveyors will be liable for any loss, damage or expense of whatever nature sustained by any person, in tort or in contract, derived from carrying out the Services.

5.2. Notwithstanding the provisions in paragraph 5.1 above, should any user of the Society's Services prove that he has suffered a loss or damage due to any negligent act or omission of the Society, its Surveyors, servants or agents, then the Society will pay compensation to such person for his proved loss, up to, but not exceeding, five times the amount of the fees charged for the specific services, information or opinions from which the loss or damage derives or, if no fee has been charged, a maximum of AED5,000 (Arab Emirates Dirhams Five Thousand only). Where the fees charged are related to a number of Services, the amount of the fees will be apportioned for the purpose of the calculation of the maximum compensation, by reference to the estimated time involved in the performance of the Service from which the damage or loss derives. Any liability for indirect or consequential loss, damage or expense is specifically excluded. In any case, irrespective of the amount of the fees charged, the maximum damages payable by the Society will not be more than AED5,000,000 (Arab Emirates Dirhams Five Millions only). Payment of compensation under this paragraph will not entail any admission of responsibility and/or liability by the Society and will be made without prejudice to the disclaimer clause contained in paragraph 5.1 above.

5.3. Any claim for loss or damage of whatever nature by virtue of the provisions set forth herein shall be made to the Society in writing, within the shorter of the following periods: (i) THREE (3) MONTHS from the date on which the Services were performed, or (ii) THREE (3) MONTHS from the date on which the damage was discovered. Failure to comply with the above deadline will constitute an absolute bar to the pursuit of such a claim against the Society.

Article 6

6.1. These General Conditions shall be governed by and construed in accordance with United Arab Emirates (UAE) law, and any dispute arising from or in connection with the Rules or with the Services of the Society, including any issues concerning responsibility, liability or limitations of liability of the Society, shall be determined in accordance with UAE law. The courts of the Dubai International Financial Centre (DIFC) shall have exclusive jurisdiction in relation to any claim or dispute which may arise out of or in connection with the Rules or with the Services of the Society.

6.2. However,

- (i) In cases where neither the claim nor any counterclaim exceeds the sum of AED300,000 (Arab Emirates Dirhams Three Hundred Thousand) the dispute shall be referred to the jurisdiction of the DIFC Small Claims Tribunal; and
- (ii) for disputes concerning non-payment of the fees and/or expenses due to the Society for services, the Society shall have the

right to submit any claim to the jurisdiction of the Courts of the place where the registered or operating office of the Interested Party or of the applicant who requested the Service is located.

In the case of actions taken against the Society by a third party before a public Court, the Society shall also have the right to summon the Interested Party or the subject who requested the Service before that Court, in order to be relieved and held harmless according to art. 3.5 above.

Article 7

7.1. All plans, specifications, documents and information provided by, issued by, or made known to the Society, in connection with the performance of its Services, will be treated as confidential and will not be made available to any other party other than the Owner without authorisation of the Interested Party, except as provided for or required by any applicable international, European or domestic legislation, Charter or other IACS resolutions, or order from a competent authority. Information about the status and validity of class and statutory certificates, including transfers, changes, suspensions, withdrawals of class, recommendations/conditions of class, operating conditions or restrictions issued against classed ships and other related information, as may be required, may be published on the website or released by other means, without the prior consent of the Interested Party.

Information about the status and validity of other certificates and statements may also be published on the website or released by other means, without the prior consent of the Interested Party.

7.2. Notwithstanding the general duty of confidentiality owed by the Society to its clients in clause 7.1 above, the Society's clients hereby accept that the Society may participate in the IACS Early Warning System which requires each Classification Society to provide other involved Classification Societies with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and used to facilitate the proper working of the IACS Early Warning System. The Society will provide its clients with written details of such information sent to the involved Classification Societies.

7.3. In the event of transfer of class, addition of a second class or withdrawal from a double/dual class, the Interested Party undertakes to provide or to permit the Society to provide the other Classification Society with all building plans and drawings, certificates, documents and information relevant to the classed unit, including its history file, as the other Classification Society may require for the purpose of classification in compliance with the applicable legislation and relative IACS Procedure. It is the Owner's duty to ensure that, whenever required, the consent of the builder is obtained with regard to the provision of plans and drawings to the new Society, either by way of appropriate stipulation in the building contract or by other agreement.

In the event that the ownership of the ship, product or system subject to certification is transferred to a new subject, the latter shall have the right to access all pertinent drawings, specifications, documents or information issued by the Society or which has come to the knowledge of the Society while carrying out its Services, even if related to a period prior to transfer of ownership.

Article 8

8.1. Should any part of these General Conditions be declared invalid, this will not affect the validity of the remaining provisions.

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GENERAL REQUIREMENTS FOR APPROVAL

SECTION 1 GENERAL REQUIREMENTS FOR APPROVAL

SECTION 1

GENERAL REQUIREMENTS FOR APPROVAL

1 General

1.1 Application

1.1.1 These Rules apply to the approval of Manufacturers and associated manufacturing processes of products and equipment which, in accordance with the requirements of Part D of the Rules for the Classification of Ships, are to be produced by approved Manufacturers.

1.2 Abbreviation

1.2.1 "Rules" means the Rules for the Classification of Ships.

1.3 Requirements

1.3.1 In order to be approved the Manufacturer is required to:

- a) demonstrate that the works has the necessary manufacturing and testing facilities and qualified personnel to supervise quality control activities
- b) carry out approval tests with satisfactory results, according to a specified program agreed with Tasneef.

The condition under a) is deemed satisfied if the Manufacturer has instituted and maintained an approved quality assurance system conforming to ISO 9001 or ISO 9002 standards.

1.4 Request for approval

1.4.1 The request for approval is to be submitted directly to the Tasneef Head Office or through the relevant area branch office.

In addition to the general information required in [1.5.1] as applicable, the specific information required for the various products is to be submitted together with the request for approval.

1.4.2 Where approval is requested for several factories belonging to the same group, a complete set of approval tests is generally carried out in one factory, considered as the main factory, while reduced tests are conducted in the others.

1.5 General information to be submitted for approval

1.5.1 Preliminary general information is to be submitted to Tasneef in connection with the request for approval and is to include, as applicable, particulars relevant to:

- a) the name and site address of the Manufacturer, the location of the workshops, the background and size of the

works, the estimated total annual production of finished products for ship building construction and for other applications, as deemed useful

- b) the organisation and quality:
 - organisation chart
 - staff employed
 - organisation of the quality control department
 - qualification of the personnel involved in activities related to the quality of the products
 - certification of conformity of quality system to ISO 9001 or 9002, if any
- c) the manufacturing facilities
 - flow chart of the manufacturing process
 - origin and storage of raw materials
 - storage of finished products
 - equipment for systematic control during fabrication
- d) details of inspections and quality control facilities
 - details of system used for identification of materials at the different stages of manufacturing
 - equipment for mechanical tests, chemical analysis and metallography and relevant calibration procedures
 - equipment for non-destructive examinations
 - list of quality control procedures
- e) approval already granted by other IACS (International Association of Classification Societies) Classification Societies and relevant documentation inclusive of the approval tests performed, if any.

1.6 Approval procedure

1.6.1 Visit to the Manufacturer's plant and tests

On the basis of the information submitted, the approval program is prepared by Tasneef and communicated to the Manufacturer. Approval programs typical of the various products are indicated in the relevant items of these rules.

A visit to the manufacturing facilities is generally performed by the Tasneef Surveyor beforehand or in connection with the initial testing of the products.

The approval tests are, in general, to be witnessed by a Tasneef Surveyor.

If testing facilities are not available at the works, the tests are to be carried out at recognised laboratories.

1.6.2 Extent of approval tests

The extent of the test program specified in the various items of these rules, may be modified on the basis of preliminary information submitted by the Manufacturer.

1.7 Certification

1.7.1 Approval certificate

Upon satisfactory completion of the approval procedure, a certificate of approval, is issued by Tasneef.

1.7.2 List of approved Manufacturers

The approved Manufacturers are added to a list containing the main conditions of the approval.

1.8 Renewal of approval

1.8.1 The maximum validity of the approval is five years; application for renewal is to be submitted prior to expiry.

Where, for operational reasons agreed by Tasneef, the renewal audit falls outside the period of approval, the Manufacturer will still be considered as approved if agreement on this audit date is made within the original period of approval; subject to the satisfactory outcome, the extension of approval will be backdated to the original renewal date.

Manufacturers who have not produced the approved products during the period between renewals may either be required to carry out new approval tests or, on the basis of results of production of similar products, at the discretion of Tasneef, be re-approved.

1.9 Reconsideration of the approval

1.9.1

During the period of validity the approval may be reconsidered in the following cases:

a) in-service failures, traceable to product quality

- b) non-conformity of the product revealed during fabrication and construction
- c) failure of the Manufacturer's quality system discovered
- d) changes made by the Manufacturer to the extent of the approval defined at the time of the approval, without the prior agreement of Tasneef
- e) evidence of major non-conformities during routine testing of the products.

1.10 Responsibilities of the Manufacturer

1.10.1 After the approval is obtained, irrespective of the periodical tests and checks performed by Tasneef, the Manufacturer is responsible for the consistency of the quality of the finished product as verified at the time of approval.

1.10.2 The manufacture is to be carried out with the same procedures verified in the samples for the approval tests.

1.10.3 The Manufacturer is to give prior warning to Tasneef of any significant modifications to the fabrication and control procedure. Tasneef may, at its discretion, require tests and inspections deemed necessary to extend the approval to the new fabrication conditions.

1.10.4 The Manufacturer is to keep up-to-date records covering the manufacture, quality control and tests of the products; the records are to permit the identification of the various productions, heat treatments and test and examination results. The Tasneef Surveyor is to have ready access to these records at all times.

STEEL AND IRON PRODUCTS

SECTION 1 ROLLED STEEL PLATES AND SECTIONS

SECTION 2 PIPES

SECTION 3 FORGINGS

SECTION 4 CASTINGS

SECTION 1

ROLLED STEEL PLATES AND SECTIONS

1 General

1.1 Application

1.1.1 This Section specifies the procedure for the approval of manufacturing processes of plates and sections intended for hull and other structural applications and pressure systems.

In addition to the provisions given in the specific items [2] to [8], the requirements in Ch 1 are also to be complied with as appropriate.

2 Normal and higher strength steel for hull and other structural applications

2.1 Application

2.1.1 Items [2.2] to [2.7] give provisions for the approval of the manufacture of normal and higher strength rolled steel plates and sections for hull and other structural applications.

This procedure also applies to semi-finished products such as slabs, blooms and billets.

2.1.2 Item [2.8] gives a specific confirmation scheme for approval of hull structural steels intended for welding with high heat input over 50 kJ/cm.

2.2 Information to be submitted for approval

2.2.1 The Manufacturer is to submit to Tasneef, together with the request for approval and the general information specified in Ch 1, Sec 1, [1.5.1], particulars relevant to:

- a) the types of products (plates, sections, coils), grades of steel, range of thickness and material properties as follows:
 - range of chemical composition including grain refining, micro alloying and residual elements for the various grades of steel; if the range of chemical composition depends on thickness and supply condition, the different ranges are to be specified, as appropriate
 - aim carbon equivalent according to IIW formula
 - aim Pcm content for higher strength grades with low carbon content $C < 0,13\%$
 - production statistics data of the chemical composition and mechanical properties (R_{eH} , R_{m} , A% and KV). The statistics are intended to demonstrate the capability to manufacture the steel products in accordance with these rules.

b) Steel making process

- steel making process and capacity of furnace/s or converter/s
- raw material used
- deoxidation and alloying practice
- desulphurisation and vacuum degassing installations
- casting methods : ingot or continuous casting. In the case of continuous casting, information is to be provided as appropriate regarding the type of casting machine, teeming practice, methods to prevent re-oxidation, inclusion and segregation control, presence of electromagnetic stirring, criteria for sequential casting in the case of different grades of steels
- ingot or slab size and weight
- ingot or slab treatment : scarfing and discarding procedures, hydrogen diffusion processes, if any, sulphur print checks of slabs for quality control purposes, if any

c) Reheating and rolling

- type of furnace and treatment parameters
- rolling: reduction ratio of slab/bloom/billet to finished product thickness, rolling and finishing temperatures
- descaling treatment during rolling
- capacity of the rolling stands

d) Heat treatment

- type of furnaces, heat treatment parameters and their associated records
- accuracy and calibration of temperature control devices

e) Programmed rolling

For products delivered with normalising rolling (NR) or thermo mechanical rolling (TM) condition, the following additional information is to be given:

- description of the rolling process
- normalising temperature, re-crystallisation temperature and Ar3 temperature and the methods to determine them
- control standards for typical rolling parameters used for the different thicknesses and grades of steel (temperatures and thickness at the beginning and at the end of the passes, interval between passes, reduction ratio, temperature range and cooling speed of accelerated cooling, if any) and relevant methods of control
- calibration of the control equipment
- influence on mechanical properties (impact and strength) of heating and flame straightening under

conditions representative of the usual working practice

- transition curve and scattering of impact tests values.
- f) Recommendations for working and welding in particular for products delivered in the CR or TM condition
- cold and hot working recommendations if needed in addition to the normal practice used in the shipyards and workshops
 - minimum and maximum heat input if different from those usually used in the shipyards and workshops (15 - 50kJ/cm)
- g) Where any part of the manufacturing process is subcontracted to other companies or other manufacturing plants, the relevant information is to be included
- h) If the approval is restricted only to semi-finished products such as slabs, blooms and billets, the information as per a) and b) above is required.

Where the approval includes plates with through thickness properties the following information is also to be given:

- typical properties
- maximum thickness and steel grades for which approval is required and relevant delivery conditions
- modifications introduced in the process to obtain the required properties (method for inclusion shape control, low sulphur content, rolling etc.)
- procedures for ultrasonic examination on the line and acceptance criteria
- statistical results of reduction of area values

2.3 Documents to be submitted to change the approval conditions

2.3.1

The Manufacturer is to submit the documents required in [2.2.1] together with the request for changing the approval conditions, in the case of important modifications such as one or more of the following a) to e):

- a) change in the manufacturing process (steel making, casting, rolling and heat treatment)
- b) change of the maximum thickness (dimension)
- c) change of the chemical composition, added element, etc.
- d) subcontracting the rolling, heat treatment, etc
- e) use of slabs, blooms and billets manufactured by other companies which are not approved.

However, where the documents are duplicates of those at the previous approval for the same type of product, some or all of the documents may be omitted.

2.4 Approval tests

2.4.1 Extension of the approval tests

The extension of the test program, specified in [2.6] and [2.7], may be modified on the basis of preliminary information submitted by the Manufacturer.

Specifically, a reduction in the number of casts, steel plate thicknesses and grades to be tested or complete suppression of approval tests may be decided by Tasneef taking into account the following cases:

- a) approval already granted by another IACS (International Association of Classification Societies) Classification Society and documentation of approval tests performed
- b) grades of steel to be approved and availability of long-term statistical results of chemical and mechanical properties
- c) the requested change only regards the approval conditions
- d) approval is intended only for semi-finished products such as slabs, blooms and billets
- e) approval of any grade of steel also covers approval of any lower grade in the same strength level, provided that the aim analyses, method of manufacture and condition of supply are similar
- f) for higher tensile steels, approval of one strength level covers the approval of the strength level immediately below, provided the steel making process, deoxidation and fine grain practice, casting method and condition of supply are the same.

On the other hand, an increase in the number of casts and thicknesses to be tested may be required in the case of newly developed types of steel or manufacturing processes.

2.5 Test program

2.5.1 Selection of material

The selection is to be agreed with Tasneef. In general for each grade of steel and for each manufacturing process (e.g. steel making, casting, rolling and condition of supply), one test sample with the maximum thickness (dimension) to be approved is to be selected for each kind of product.

In addition, for initial approval, Tasneef requires selection of one test product of average thickness.

The selection of the casts from which the test samples are taken is to be based on the typical chemical composition, with particular regard to the specified Ceq or Pcm values and grain refining micro-alloying additions.

2.5.2 Position of test samples

Unless otherwise agreed, the test samples are to be taken from the product (plate, flat, section, bar) corresponding to the top of the ingot; in the case of continuous casting, samples are taken at random.

The position of the samples to be taken in the length of the rolled product, the "piece" defined in Part D, Ch 2, Sec 1, [2.7.3] of the Rules (top and/or bottom of the piece) and the direction of the test specimens with respect to the final direction of rolling of the material are indicated in Table 1.

The position of the samples in the width of the product is to be in compliance with Part D, Ch 2, Sec 1, [1.8.2] of the Rules.

2.6 Tests on base material

2.6.1 Type of tests

The tests to be carried out are indicated in Table 1.

Table 1 : Tests on base material

Type of test	Position of the samples and direction of the test specimens (1)	Remarks			
Tensile test	Top and bottom transverse (2)	R _{eH} , R _m , A ₅ (%), R _A (%) are to be reported			
Tensile test (stress relieved) only for TM steels	Top and bottom transverse (2)	Stress relieving at 600 °C (2 min/mm with minimum 1 hour)			
Impact tests (3) on non-aged specimens for grades:		Testing temperature (°C)			
A, B, AH32, AH36, AH40	Top and bottom - longitudinal	+20	0	-20	
D, DH32, DH36, DH40		0	-20	-40	
E, EH32, EH36, EH40		0	-20	-40	-60
FH32, FH36, FH40		-20	-40	-60	-80
A, B, AH32, AH36, AH40	Top - transverse (3)	+20	0	-20	
D, DH32, DH36, DH40		0	-20	-40	
E, EH32, EH36, EH40		-20	-40	-60	
FH32, FH36, FH40		-40	-60	-80	
Impact test (4) on strain aged specimens (5) for grades		Testing temperature (°C)			
AH32, AH36, AH40	Top - longitudinal	+20	0	-20	
D, DH32, DH36, DH40		0	-20	-40	
E, EH32, EH36, EH40		-20	-40	-60	
FH32, FH36, FH40		-40	-60	-80	
Chemical composition (6)	Top	Complete analysis including micro alloying elements			
Sulphur prints	Top				
Micro examination	Top				
Grain size determination	Top	Only for fine grain steels			
Drop weight test (3)	Top	For grades E, EH32, EH36, EH40, FH32, FH36, FH40.			
Through thickness tensile tests	Top and bottom	Only for grades with improved through thickness properties			
(1) For hot rolled strips see [2.6.2].					
(2) Longitudinal direction for sections and plates having width less than 600 mm.					
(3) Not required for sections and plates having width less than 600 mm.					
(4) One set of 3 Charpy V-notch impact specimens is required for each impact test.					
(5) Deformation 5% + 1 hour at 250° C.					
(6) In addition to product analyses, ladle analyses are required.					

2.6.2 Test specimens and testing procedures

The test specimens and testing procedures are, as a rule, to be in accordance with Part D, Ch 1, Sec 2 of the Rules.

In particular the following applies:

a) Tensile test

- on plates made from a hot rolled strip, one additional tensile specimen is to be taken from the middle of the strip constituting the coil
- for plates having thickness greater than 40 mm, when the capacity of the available testing machine is insufficient to allow the use of test specimens of full thickness, multiple flat specimens collectively representing the full thickness can be used. Alternatively,

two round specimens with the axis located at one quarter and at mid-thickness can be taken.

b) Impact test

- for plates made from a hot rolled strip, one additional set of impact specimens is to be taken from the middle of the strip constituting the coil
- for plates having thickness greater than 40 mm, one additional set of impact specimens is to be taken with the axis located at mid-thickness. In addition to the determination of the energy value, the lateral expansion and the percentage crystallinity are also to be reported.

c) Chemical composition

In general the content of the following elements is to be checked: C, Mn, Si, P, S, Ni, Cr, Mo, Al, N, Nb, V, Cu, As, Sn. Ti and, for steel manufactured by an electric or open-hearth furnace, Sb and B.

d) The material for the analysis is to be taken from the tensile test specimen.

Sulphur prints are to be taken from plate edges which are perpendicular to the longitudinal axis of the ingot or slab. These sulphur prints are to be approximately 600 mm long taken from the centre of the edge selected, i.e. on the ingot centreline, and are to include the full plate thickness.

e) Micrographic examination: the micrographs are to be representative of the full thickness. For thick products at least three examinations are generally to be made at the surface, one quarter and mid-thickness of the product.

All photomicrographs are to be taken at x100 magnification and, where ferrite grain size exceeds ASTM 10, additionally at x500 magnification. Ferrite grain size is to be determined for each photomicrograph.

f) Drop weight test : the test is to be performed in accordance with ASTM E208. The NDTT is to be determined and photographs of the tested specimens are to be taken and enclosed with the test report.

g) Through thickness tensile test: the test is to be performed in accordance with the requirements of [8].

2.6.3 Other tests

Additional tests such as a CTOD test and, large scale brittle fracture tests may be required in the case of newly developed types of steel or when deemed necessary by Tasneef.

2.7 Weldability tests

2.7.1 General

Weldability tests are required for plates and are generally to be carried out on samples of the thickest plate.

Tests are required for normal strength grade E and for higher strength steels.

They are required to the extent deemed necessary by Tasneef considering the actual material properties and the conditions of the approval.

2.7.2 Preparation and welding of the test assemblies

The following tests are, in general, required:

- a) 1 butt weld test assembly welded with a heat input approximately 15 kJ/cm
- b) 1 butt weld test assembly welded with a heat input approximately 50 kJ/cm.

The butt weld test assemblies are to be prepared with the weld seam transverse to the plate rolling direction, so that impact specimens will be in the longitudinal direction.

The bevel preparation should be preferably 1/2V or K.

The welding procedure should be as far as possible in accordance with the normal welding practice used at the yards for the type of steel and thicknesses in question.

The welding parameters including consumables designation and diameter, pre-heating temperatures, interpass temperatures, heat input, number of passes, etc. are to be reported.

2.7.3 Type of tests

The following tests are to be carried out on the test assemblies:

- a) 1 cross weld tensile test
- b) a set of 3 Charpy V-notch impact specimens transverse to the weld with the notch located at the fusion line and at a distance 2 mm, 5 mm and a minimum of 20 mm from the fusion line. The fusion boundary is to be identified by etching the specimens with a suitable reagent. The test temperature is to be as prescribed for the testing of the steel grade in question.
- c) Hardness tests HV 5 across the weldment. The indentations are to be made along a 1 mm transverse line beneath the plate surface on both the face side and the root side of the weld as follows:
 - Fusion line
 - HAZ: at every 0,7 mm from fusion line into unaffected base material (6 to 7 minimum measurements for each HAZ).

The maximum hardness value is to be not greater than 350 HV.

A sketch of the weld joint depicting groove dimensions, number of passes and hardness indentations is to be attached to the test report together with photomicrographs of the weld cross section.

2.7.4 Other tests

Additional tests such as cold cracking tests (CTS, cruciform, implant, Tekken, bead-on plate), CTO, or other tests may be required in the case of newly developed types of steel, or when deemed necessary by Tasneef.

2.8 Approval scheme for Manufacturers of hull structural steels intended for welding with high heat input

2.8.1 General

This item [2.8] specifies the weldability confirmation scheme for normal and higher strength hull structural steels intended for welding with high heat input over 50 kJ/cm.

The weldability confirmation scheme is to be generally applied at the Manufacturer's option and is valid for certifying that the steel has satisfactory weldability for the high heat input welding concerned under test conditions.

Demonstration of conformance to the requirements of these requirement approves a particular steel mill for the manufacture of the grade of steel to the specific chemical composition range, melting practice, and processing practice for which conformance was established. The approval scheme does not apply to qualification of welding procedures to be undertaken by shipyards.

2.8.2 Application of certification

The Manufacturer is to submit to Tasneef a request for certification, the proposed weldability test program and technical documents relevant to:

- a) Outline of steel plate to be certified
 - grade
 - thickness range
 - deoxidation practice
 - fine grain practice
 - aim range of chemical composition
 - aim maximum Ceq and Pcm
 - production statistics of mechanical properties (tensile and Charpy V-notch impact tests), if any
- b) Manufacturing control points to prevent toughness deterioration in the heat-affected zone when welded with high heat input, relevant to chemical elements, steel making, casting, rolling, heat treatment, etc.
- c) Welding control points to improve joint properties on strength and toughness, if any.

2.8.3 Confirmation tests

- a) Range of certification

The range of certification for steel grades is to be the following 1) through 5), unless otherwise agreed by Tasneef:

- 1) Approval tests on the lowest and highest toughness levels cover the intermediate toughness level.
- 2) Approval tests on the normal strength level cover that strength level only.
- 3) For high tensile steels, approval tests on one strength level cover the strength level immediately below.
- 4) Tests may be carried out separately subject to the same manufacturing process.
- 5) Certification and documentation of confirmation tests performed by another IACS Classification Society may be accepted at the discretion of Tasneef.

- b) Weldability test program

The extent of the test program is specified in e) but it may be modified according to the contents of certification. In particular, additional test assemblies and/or test items may be required in the case of a newly developed type of steel, welding consumable and welding method, or when deemed necessary by Tasneef.

Where the content of tests differs from that specified in e), the program is to be confirmed by Tasneef before the tests are carried out.

- c) Test plate

The test plate is to be manufactured by a process approved by Tasneef in accordance with the requirements of items [2.2] to [2.7].

For each manufacturing process route, two test plates with different thickness are to be selected. The thicker plate (t) and thinner plate (less than or equal to $t/2$) are to be proposed by the Manufacturer.

Small changes in manufacturing processing (e.g. within the TMCP process) may be considered for acceptance without testing, at the discretion of Tasneef.

- d) Test assembly

One butt weld assembly welded with heat input over 50 kJ/cm is to be generally prepared with the weld axis transverse to the plate rolling direction.

The dimensions of the test assembly are to be amply sufficient to take all the required test specimens specified in e).

The welding procedures are to be as far as possible in accordance with the normal practices applied at shipyards for the test plate concerned.

The welding process, welding position, welding consumables (Manufacturer, brand, grade, diameter and shield gas) and welding parameters including bevel preparation, heat input, preheating temperatures, inter-pass temperatures, number of passes etc. are to be reported.

- e) Examinations and tests for the test assembly

The test assembly is to be examined and tested in accordance with the following 1) through 8), unless otherwise agreed by Tasneef.

- 1) Visual examination

The overall welded surface is to be uniform and free from injurious defects such as cracks, undercuts, overlaps etc.

- 2) Macroscopic test

One macroscopic photograph is to be representative of the transverse section of the welded joint and is to show absence of cracks, lack of penetration, lack of fusion and other injurious defects.

- 3) Microscopic test

Along the mid-thickness line across the transverse section of the weld, one micrograph with $\times 100$ magnification is to be taken at each position of the weld metal centreline, the fusion line and at a distance 2, 5, 10 and a minimum of 20 mm from the fusion line. The test result is provided for information purpose only.

- 4) Hardness test

Along two lines across the transverse weld section 1 mm beneath the plate surface on both the face and root side of the weld, indentations by HV5 are to be made at the weld metal centreline, the fusion line and each 0,7 mm position from the fusion line to the unaffected base metal (minimum 6 to 7 measurements for each heat-affected zone).

The maximum hardness value is to not be higher than 350 HV.

- 5) Transverse tensile test

Two transverse (cross weld) tensile specimens are to be taken from the test assembly. Test specimens and testing procedures are to comply with the requirements of Part D, Ch 5, Sec 2 of the Rules.

The tensile strength is to be not less than the minimum required value for the grade of base metal.

- 6) Bend test

Two transverse (cross weld) test specimens are to be taken from the test assembly and bent on a mandrel with diameter of quadruple specimen thickness. The bending angle is to be at least 120° . Test specimens

are to comply with the requirements of Part D, Ch 5, Sec 2 of the Rules.

For plate thickness up to 20 mm, one face-bend and one root-bend specimen or two side-bend specimens are to be taken. For plate thickness over 20 mm, two side-bend specimens are to be taken.

After testing, the test specimens are not to reveal any crack or other open defect in any direction greater than 3 mm.

7) Impact test

Charpy V-notch impact specimens (three specimens for one set) are to be taken within 2 mm below the plate surface on the face side of the weld with the notch perpendicular to the plate surface.

One set of specimens transverse to the weld is to be taken with the notch located at the fusion line and at a distance 2, 5 and a minimum of 20 mm from the fusion line. The fusion boundary is to be identified by etching the specimens with a suitable reagent. The test temperature is to be that prescribed for the testing of the steel grade in question.

For steel plates with thickness greater than 50 mm or one side welding for plate thickness greater than 20 mm, one additional set of specimens is to be taken from the root side of the weld with the notch located at each of the same positions as for the face side.

The average impact energy at the specified test temperature is to comply with Tables 4 or 7 of Part D, Ch 2, Sec 1 of the Rules depending on the steel grade and thickness. Only one individual value may be below the specified average value, provided it is not less than 70% of that value.

Additional tests at the different testing temperatures may be required for evaluating the transition temperature curve of absorbed energy and percentage crystallinity, at the discretion of Tasneef.

8) Other tests

Additional tests such as wide-width tensile tests, HAZ tensile tests, cold cracking tests (CTS, Cruciform, Implant, Tekken and Bead-on plate), CTOD or other tests may be required at the discretion of Tasneef (see item b)).

2.8.4 Certification

Subject to the satisfactory result of the approval test, Tasneef issues the Approval Certificate, where the following information is generally included:

- a) Manufacturer
- b) Grade designation with notation of heat input (see [2.8.5])
- c) Deoxidation practice
- d) Fine grain practice
- e) Condition of supply
- f) Plate thickness tested
- g) Welding process
- h) Welding consumables (Manufacturer, brand, grade), if desired
- i) Actual heat input applied.

2.8.5 Grade designation

Upon issuance of the certificate, the notation indicating the value of heat input applied in the confirmation test may be added to the grade designation of the test plate, e.g. "E36-W300" (where the heat input applied is 300 kJ/cm). The value of this notation is to be not less than 50 and rounded to the nearest multiple of 10.

2.9 Results

2.9.1 All the results, which are in any case to comply with the requirements of the Rules, are evaluated by Tasneef as a whole for the scope of approval; depending on the outcome, particular limitations or testing conditions, as deemed appropriate, may be specified in the approval document.

All the information required under [2], applicable to the products submitted to the tests, is to be collected by the Manufacturer and enclosed in the approval dossier jointly with all the test results and manufacturing records relevant to steel making, casting, rolling and heat treatment of the test product from which the samples were taken.

For steel grades submitted to the confirmation scheme for high heat input welding, the specific information required under [2.8.2] and [2.8.4] is to be included in the dossier.

3 High Strength Steels for Welded Structures

3.1 Scope of application

3.1.1 This Article specifies the procedure for the approval of the manufacturing process of high strength steels for welded structures.

All materials are to be manufactured at works which have been approved by Tasneef for the type, delivery condition, grade and thickness of steel which is being supplied. The suitability of each grade of steel for forming and welding is to be demonstrated during the initial approval tests at the steelworks.

The manufacturing approval scheme is valid for verifying the manufacturer's capability to provide satisfactory products stably under effective process and production controls in operation including programmed rolling, which is required in Pt D, Ch 2, Sec 1, [3.4].

3.2 Approval application

3.2.1

a) Information to be submitted for approval

The Manufacturer is to submit to Tasneef, together with the request for approval and the general information specified in Ch 1, Sec 1, [1.5.1], particulars relevant to:

- 1) Material to be approved, including type of products (plates, sections, bars and tubular), delivery condition, grades of steel, range of thickness and aim material properties as follows:
 - range of chemical composition, aim analyses and associated control limits, including grain refining, nitrogen binding, micro alloying and

residual elements, for the various grades of steel; if the range of chemical composition depends on thickness and delivery condition, the different ranges are to be specified, as appropriate.

- in addition, where zirconium, calcium and rare earth metals have been used during steelmaking for grain refinement and, or inclusion modification, the contents of these elements shall be specified in the manufacturing specification.
- aim carbon equivalent C_{eq} according to IIW formula or CET formula and/or aim P_{cm} content and associated control limits.
- production statistics of the chemical composition and mechanical properties (R_{eH} , R_m , A% and CVN).

The statistics are intended to demonstrate the capability to manufacture the steel products.

- 2) The statistics are intended to demonstrate the capability to manufacture the steel products.
 - steel making process and capacity of furnace/s or converter/s
 - raw material used
 - deoxidation, grain refining, nitrogen binding and alloying practice
 - desulphurisation, dehydrogenation, sulphide treatment, ladle refining and vacuum degassing installations, if any
 - casting methods: ingot or continuous casting. In the case of continuous casting, information relevant to type of casting machine, teeming practice, methods to prevent re-oxidation, inclusions and segregation control, presence of electromagnetic stirring, soft reduction, etc., is to be provided as appropriate
 - casting/solidification cooling rate control
 - ingot or slab size and weight
 - ingot or slab treatment: scarfing and discarding procedures
- 3) Reheating and rolling
 - type of furnace and treatment parameters
 - rolling: reduction ratio of ingot/slab/bloom/billet to finished product, rolling and finishing temperatures for each grade/thickness combination
 - descaling treatment during rolling
 - capacity of the rolling stands
- 4) Heat treatment
 - type of furnaces, heat treatment parameters for products to be approved
 - accuracy and calibration of temperature control devices
 - the methods used to determine austenitizing temperature, re-crystallization temperature and Ar₃ temperature
 - description of quenching and tempering process, if applicable
- 5) Programmed rolling

For products delivered in the Normalised rolling (NR) or thermo-mechanical rolling (TM) condition, the following additional information on the programmed rolling schedules is to be given:

- description of the rolling process
 - the methods used to determine austenitizing temperature, re-crystallization temperature and Ar₃ temperature
 - control standards for typical rolling parameters used for the different thickness and grades of steel (temperature and thickness at the beginning and at the end of the passes, interval between passes, reduction ratio, temperature range and cooling speed of accelerated cooling, if any) and relevant method of control
 - calibration of the control equipment
- 6) Recommendations for fabrication and welding in particular for products delivered in the NR or TM condition:
 - cold and hot working recommendations if needed in addition to the normal practice used in the shipyards and workshops
 - minimum and maximum heat input and recommended pre-heat/interpass temperature
 - 7) Where any part of the manufacturing process is assigned to other companies or other manufacturing plants, additional information required by Tasneef is to be included.
 - 8) Approval already granted by other Classification Societies and documentation of approval tests performed.
- b) Documents to be submitted for changing the approval conditions
- The manufacturer has to submit to Tasneef the documents required in Ch 1, Sec 1, [1.5] together with the request of changing the approval conditions, in the case of the following 1) through 5) as applicable:
- 1) Change of the manufacturing process (steel making, casting, rolling and heat treatment).
 - 2) Change of the maximum thickness (dimension).
 - 3) Change of the chemical composition, added element, etc.
 - 4) Subcontracting the rolling, heat treatment, etc.
 - 5) Use of the ingots, slabs, blooms and billets manufactured by companies other than the ones verified in the approval tests.

However, where the documents are duplicated by the ones at the previous approval for the same type of product, part or all of the documents may be omitted except the approval test program (see 3.3.1).

3.3 Approval tests

3.3.1 Extent of the approval tests

The extent of the test program is specified in 3.3.6 and 3.3.7; it may be modified on the basis of the preliminary information submitted by the manufacturer.

In particular a reduction of the indicated number of casts, steel plate thicknesses and grades to be tested or complete suppression of the approval tests may be accepted by Tasneef taking into account:

- a) Approval already granted by other Classification Societies and documentation of approval tests performed
- b) Grades of steel to be approved and where available the long term statistical results of chemical and mechanical properties.

An increase of the number of casts and thicknesses to be tested may be required in the case of newly developed types of steel or manufacturing processes.

In case of multi-source slabs or changing of slab manufacturer, the rolled steel manufacturer is required to obtain the approval of the manufacturing process of rolled steels using the slabs from each slab manufacturer and to conduct approval tests in accordance with 3.3.6 and 3.3.7.

A reduction or complete suppression of the approval tests may be considered by Tasneef taking into account previous approval as follows

- the rolled steel manufacturer has already been approved for the rolling process and heat treatment using approved other semi finished products characterized by the same thickness range, steel grade, grain refining and micro-alloying elements, steel making(deoxidation) and casting process.
- the semi finished products have been approved for the complete manufacturing process with the same conditions (steelmaking, casting, rolling and heat treatment) for the same steel types.

3.3.2 Approval test program

Where the number of tests differs from those shown in 3.3.6 and 3.3.7, the program is to be confirmed by Tasneef before the tests are carried out.

3.3.3 Approval survey

The approval tests are to be witnessed by the Surveyor at the manufacturer's plant and the execution of the plant inspection in operation may be required by the Surveyor during the visit for the approval.

If the testing facilities are not available at the works, the tests are to be carried out at accredited laboratories.

3.3.4 Selection of the test product

For each grade of steel and for each manufacturing process (e.g. steel making, casting, rolling and condition of supply), one test product with the maximum thickness (dimension) to be approved is in general to be selected for each kind of product.

In addition, for initial approval, Tasneef will require selection of one test product of representative thickness.

The selection of the casts for the test product is to be based on the typical chemical composition, with particular regard to the aimed Ceq, CET or Pcm values and grain refining micro-alloying additions.

3.3.5 Position of the test samples and specimens

The test samples are to be taken, unless otherwise agreed, from the product (plate, flat, section, bar and tubular) corresponding to the top and bottom of the ingot as indicated in Table A1, or, in the case of continuous casting, a random sample.

The position of the samples to be taken in the length of the rolled product, (top and bottom of the rolled unit, as defined in Pt D, Ch 1, Sec 1, [3.3.3]) and the direction of the test specimens with respect to the final rolling direction of the material are indicated in Table A1.

The position of the samples in the width of the product is to be in accordance with Pt D, Ch 2, Sec 1, [2].

The position of the tensile and Charpy impact test samples with respect to the plate thickness is to be in accordance with the following additional requirements:

a) Tensile test:

- for plates made from hot rolled strip one additional tensile specimen is to be taken from the middle of the strip constituting the coil.
- for plates having thickness higher than 40 mm, when the capacity of the available testing machine is insufficient to allow the use of test specimens of full thickness, multiple flat specimens, representing collectively the full thickness, can be used. Alternatively two round specimens with the axis located at one quarter and at midthickness can be taken.

b) impact test:

- for plates made from hot rolled strip one additional set of impact specimens is to be taken from the middle of the strip constituting the coil.
- for plates having thickness higher than 40 mm one additional set of impact specimens is to be taken with the axis located at mid-thickness.
- in addition to the determination of the energy value, also the lateral expansion and the percentage crystallinity are to be reported.

3.3.6 Tests on base material

The tests to be carried out are indicated in the following Tab 2.

Table 2

No.	Type of test	Position and direction of test specimens	Remarks
1	Chemical analysis (ladle and product) (1)	Top	a) Contents of C, Mn, Si, P, S, Ni, Cr, Mo, Al, N, Nb, V, Ti, B, Zr, Cu, As, Sn, Bi, Pb, Ca, Sb, O, H are to be reported. b) Carbon equivalent calculation, and/or c) Pcm calculation, as applicable.
2	Segregation examination	Top	Sulphur prints (2) are to be taken from plate edges which are perpendicular to the axis of the ingot or slab. These sulphur prints are to be approximately 600 mm long taken from the centre of the edge selected, i.e. on the ingot centre-line, and are to include the full plate thickness.
3	Micrographic examination (3)	Top	a) Grain size determination. Ferrite and/or prior austenite grain size should be determined. b) All photomicrographs are to be taken at x 100 and 500 magnification. c) Non-metallic inclusion contents/Cleanliness The level of non-metallic inclusions and impurities in term of amount, size, shape and distribution shall be controlled by the manufacturer. The standards of the micrographic examination methods ISO 4967 or equivalent standards are applicable. Alternative methods for demonstrating the non-metallic inclusions and impurities may be used by the manufacturer.
4	Tensile test	Top and bottom - longitudinal and transverse direction	Yield strength (R_{eH}), Tensile strength (R_m), Elongation (A5), Reduction in Area (RA) and Y/T ratio are to be reported.
5a	Charpy Impact tests on unstrained specimens for grades (4)	Top and bottom	Testing temperature ($^{\circ}\text{C}$)
	AH	Longitudinal and transverse direction	+20 0 -20
	DH		0 -20 -40
	EH		0 -20 -40 -60
	FH		-20 -40 -60 -80
<p>(1) The product analyses should be taken from the tensile specimen. The deviation of the product analysis from the ladle analysis shall be permissible in accordance with the limits given in the manufacturing specification.</p> <p>(2) Other tests than Sulphur prints for segregation examination may be applied and subject to acceptance by the Classification Society.</p> <p>(3) The micrographs are to be representative of the full thickness. For thick products in general at least three examinations are to be made at surface, 1/4t and 1/2t of the product</p> <p>(4) In addition to the determination of the absorbed energy value, also the lateral expansion and the percentage crystallinity are to be reported.</p> <p>(5) Strain ageing test is to be carried out on the thickest plate.</p> <p>(6) Weldability test is to be carried out on the thickest plate.</p>			

No.	Type of test	Position and direction of test specimens	Remarks
5b	Charpy Impact tests on strain aged specimens for grades (4) (5)	Top	Deformation of 5% + 1 hour at 250°C
	AH	Either longitudinal or transverse	+20 0 -20
	DH		0 -20 -40
	EH		0 -20 -40 -60
	FH		-20 -40 -60 -80
6	Drop weight test	Top	The test is to be performed only on plates in accordance with ASTM E208. The NDTT is to be determined and photographs of the tested specimens are to be taken and enclosed with the test report.
7	Through thickness tensile tests	Top and bottom	Optional for grades with improved through thickness properties, testing in accordance with Pt D, Ch 2, Sec 1, [9].
8	Weldability test (6)		
	a) Butt Weld Assembly as-welded	Top	Cross weld tensile, Charpy impact test on WM, FL, FL+2, FL+5, FL+20 Macro examination and hardness survey, CTOD at -10°C on Grain-coarsened HAZ.
	b) Butt Weld Assembly (PWHT), if applicable	Top	Cross weld tensile, Charpy impact test on WM, FL, FL+2, FL+5, FL+20 Macro examination and hardness survey, CTOD at -10°C on Grain-coarsened HAZ.
	c) Y-shape weld crack test (Hydrogen crack test)	Top	
<p>(1) The product analyses should be taken from the tensile specimen. The deviation of the product analysis from the ladle analysis shall be permissible in accordance with the limits given in the manufacturing specification.</p> <p>(2) Other tests than Sulphur prints for segregation examination may be applied and subject to acceptance by the Classification Society.</p> <p>(3) The micrographs are to be representative of the full thickness. For thick products in general at least three examinations are to be made at surface, 1/4t and 1/2t of the product</p> <p>(4) In addition to the determination of the absorbed energy value, also the lateral expansion and the percentage crystallinity are to be reported.</p> <p>(5) Strain ageing test is to be carried out on the thickest plate.</p> <p>(6) Weldability test is to be carried out on the thickest plate.</p>			

The test specimens and testing procedures are to be in accordance with Pt D, Ch 1, Sec 2, where applicable. Additional tests such as CTOD test on parent plate, large scale brittle fracture tests (Double Tension test, ESSO test, Deep Notch test, etc.) or other tests may be required in the case of newly developed type of steel, outside the scope of Pt D, Ch 2, Sec 1, [3], or when deemed necessary by Tasneef.

3.3.7 Weldability tests - Butt weld test

a) Steel grades H420 to H500:

Weldability tests are to be carried out on samples of the thickest plate. Testing on higher grades can cover the lower strength and toughness grades.

- 1) one butt weld test assembly welded with a heat input 15±2 kJ/cm is to be tested as-welded.
- 2) one butt weld test assembly welded with a heat input 50±5 kJ/cm for N/NR and TM and 35±3.5 kJ/cm for QT steels is to be tested as-welded.

- 3) one butt weld test assembly welded with the same heat input as given in 2) is to be post-weld heat treated (PWHT) prior to testing.

Option: Steels intended to be designated as steels for high heat input welding are to be tested with one butt weld test assembly in the as-welded condition and one test assembly in the PWHT condition, both welded with the maximum heat input being approved.

b) Steel grades H550 to H960:

In general, the thickest plate with the highest toughness grade for each strength grade is to be tested. Provided the chemical composition of the higher grade is representative to the lower grade, testing requirements on the lower grades may be reduced at the discretion of Tasneef.

- 1) one butt weld test assembly welded with a heat input 10±2 kJ/cm is to be tested as-welded.
- 2) one butt weld test assembly welded with a maximum heat input as proposed by the manufacturer is

to be tested as-welded. The approved maximum heat input shall be stated on the manufacturer approval certificate.

Option: If the manufacturer requests to include the approval for Post Weld Heat Treated (PWHT) condition, one additional butt weld test assembly welded with a maximum heat input proposed by the manufacturer for the approval same as test assembly 2) is to be post-weld heat treated (PWHT) prior to testing.

c) Butt weld test assembly

The butt weld test assemblies of N/NR plates are to be prepared with the weld seam transverse to the final plate rolling direction.

The butt weld test assemblies of TM/TM+AcC/TM+DQ and QT plates are to be prepared with the weld seam parallel to the final plate rolling direction. The butt weld test assemblies of long products, sections and seamless tubular in any delivery condition are to be prepared with the weld seam transverse to the rolling direction.

d) Bevel preparation

The bevel preparation should be preferably 1/2V or K related to thickness.

The welding procedure should be as far as possible in accordance with the normal welding practice used for the type of steel in question.

The welding procedure and welding record are to be submitted to Tasneef for review.

e) Post-weld heat treatment procedures

Post-weld heat treatment is to be carried out according to the following procedures:

- 1) Steels delivered in N/NR or TM/TM+AcC/TM+DQ condition are to be heat treated for a minimum time of 1 hour per 25 mm thickness (but not less than 30 minutes and not more than 150 minutes) at a maximum holding temperature of 580°C, unless otherwise approved at the time of approval.
- 2) Steels delivered in QT condition are to be heat treated for a minimum time of 1 hour per 25 mm thickness (but not less than 30 minutes and not more than 150 minutes) at a maximum holding temperature of 550°C, with the maximum holding temperature of at least 30°C below the previous tempering temperature, unless otherwise approved at the time of approval.
- 3) Heating and cooling above 300°C are to be carried out in a controlled manner in order to heat/cool the material uniformly. The cooling rate from the maximum holding temperature to 300°C is not to be slower than 55°C/hr.

f) Type of tests

From the test assemblies the following test specimens are to be taken:

- 1) one cross weld tensile test - one full thickness test sample or sub-sized samples which cover the full thickness cross section.
- 2) one set of 3 Charpy V-notch impact specimens transverse to the weld seam and 1-2 mm below the surface with the notch located at the fusion line and at

a distance 2, 5 and 20 mm from the straight fusion line. An additional set of 3 Charpy test specimens at root is required for each aforementioned position for plate thickness $t = 50$ mm. The fusion boundary is to be identified by etching the specimens with a suitable reagent. The test temperature is to be the one prescribed for the testing of the steel grade.

- 3) Hardness tests HV10 across the weldment. The indentations are to be made along a 1-2 mm transverse line beneath the plate surface on both the face side and the root side of the weld as follows:

- fusion line
- HAZ: at each 0.7 mm from fusion line into unaffected base material (6 to 7 minimum measurements for each HAZ)

The maximum hardness value should not be higher than 350HV for grade steels H420 to H460; not be higher than 420HV for H500 to H690; and not be higher than 450HV for H890 and H960.

A sketch of the weld joint depicting groove dimensions, number of passes, hardness indentations are to be attached to the test report together with photomicrographs of the weld cross section.

- 4) CTOD test - CTOD test specimens are to be taken from butt weld test assembly specified in 3.3.7 a) 2) or 3.3.7 b) 2). CTOD test is to be carried out in accordance with EN ISO 15653 or equivalent.

- the specimen geometry ($B = W$) is permitted for plate thickness up to 50 mm. For plate thicker than 50 mm, subsidiary specimen geometry (50x50 mm) is permitted, which is to be taken 50 mm in depth through thickness from the subsurface and 50 mm in width. See Fig 1 and Fig 2 for more details
- the specimens are to be notched in through thickness direction
- grain-coarsened HAZ (GCHAZ) is to be targeted for the sampling position of the crack tip
- the test specimens is to be in as-welded and post-weld heat treated, if applicable
- three tests are to be performed at -10°C on each butt weld test assembly

For grades H690 and above, dehydrogenation of as-welded test pieces may be carried out by a low temperature heat treatment, prior to CTOD testing. Heat treatment conditions of 200°C for 4 h are recommended, and the exact parameters are to be notified with the CTOD test results.

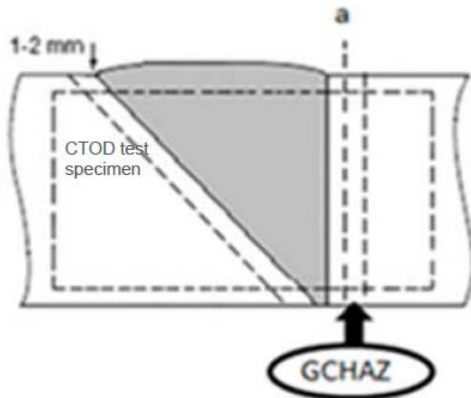
g) Crack susceptibility weld test (Hydrogen crack test)

Testing in accordance with national and international recognised standards such as GB/T4675.1 and JIS Z 3158 for Y-groove weld crack test. Minimum preheat temperature is to be determined and the relationship of minimum preheat temperature with thickness is to be derived.

h) Other tests

Additional tests may be required in the case of newly developed types of steel, outside the scope of this Article, or when deemed necessary by Tasneef.

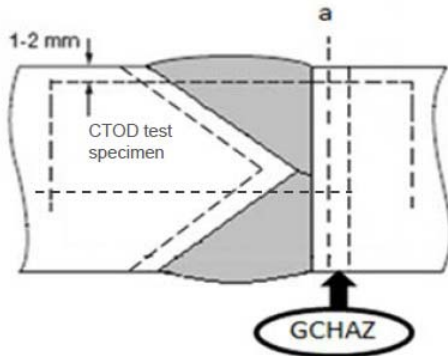
Figure 1 : For plate thickness $t = 50$ mm, CTOD test specimen is to be sampled in full thickness



Notch location:

a : in GHAZ

Figure 2 : For plate thickness $t > 50$ mm, subsidiary test specimen with a thickness of maximum 50 mm in subsurface area is to be sampled



Notch location:

a : in GHAZ

3.4 Results

3.4.1 All the results are to comply with the requirements of the scheme of initial approval.

The manufacturer is to submit all the test results together with the manufacturing specification containing all the information required under [3.2], and manufacturing records relevant to steel making, casting, rolling and heat treatment, applicable to the product submitted to the tests.

4 Steel plates for boilers and pressure vessels

4.1 Application

4.1.1 All the provisions in [2] unless hereunder modified and the additional particular requirements specified here apply to the approval of steel plates and sections intended for boilers and pressure vessels.

4.1.2 For steel grades already covered by recognised national and international standards, the visit for approval is generally based on the examination of the manufacturing conditions, inspection procedures and production statistics of the steel concerned.

4.2 Test program

4.2.1 Test on base material

The program is to be based on the requirements in [2.6] and to include the following:

- tensile tests at ambient temperature at both ends of the plates
- impact tests in the longitudinal and transverse directions (test temperature $T, T-20^{\circ}\text{C}$), where T is the required temperature for the acceptance test of the steel
- impact tests of artificially aged conditions in the transverse direction at the required testing temperature T
- tensile tests at elevated temperatures at the top of the plates; the test temperature is to be agreed with Tasneef. Where the steels are produced in accordance with recognised national or international standards and the Manufacturer requests approval with proof stress $R_{p0.2}$ values higher than those given in the Rules, the approval program is to cover at least 3 casts for each type of steel grade representative of the range of thickness proposed for approval. When approval is required to cover a whole temperature range, tensile tests are to be carried out at three different temperature in addition to the ambient temperature as follows:

- carbon and carbon manganese steels: minimum temperature, intermediate and maximum 400°C
- alloy steels: minimum temperature, intermediate and maximum temperature proposed.

Each test is to include the determination of $R_{p0.2}$ and tensile strength.

When the approval is requested for a single temperature, the test is to be carried out at that temperature.

4.2.2 Weldability test

Reference is made to the requirements specified in [2.7] as applicable.

The butt weld test assemblies are to be prepared with the weld seam parallel to the plate rolling direction, so that impact specimens will be in the transverse direction.

5 Ferritic steel plates and sections for low temperature service

5.1 Application

5.1.1 All the provisions in [2] unless hereunder modified and the additional particular requirements specified here apply to the approval of steel plates and sections intended for low temperature service.

5.2 Additional information to be submitted for approval

5.2.1 General

Due to the particular influence of the heat treatment on the mechanical properties, detailed procedures for heat treatment are to be included in the documentation and verification of correct execution may be required by the Surveyor on the plates submitted for approval, in particular for Nickel steels.

In general, the following is to be verified:

- heat treatment parameters (heating and cooling rate, temperature and holding time)
- calibration procedures of measuring devices (pyrometers, thermocouples)
- recording of heat treatment parameters
- procedure for quenching

The ultrasonic examination procedure of current production is to be submitted for examination; the procedure may refer to a national or international standard and is to be verified during the approval tests with examination of 100% of the surface in order to verify the reliability of the grid system checks performed on the current production.

5.2.2 Test program

The program is to be based on the requirements indicated in [2.6] and on the following:

- the impact tests indicated in Table 1 are to be performed in the transverse (longitudinal for profiles) direction at the following temperatures:
 - LE grades: 0,-20,-40,-60 °C
 - LF grades: -20,-40,-60,-80 °C
 - 1,5 Ni grade: -40,-60,-80,-100 °C
 - 3,5 Ni grade: -60,-80,-100, -120 °C
 - 5,0 Ni grade: -80,-100,-120,-165,-196 °C
 - 9,0 Ni grade: -80,-100,-165,-196 °C
- impact tests of artificially aged conditions to be performed in the transverse direction at the required testing temperature of the steel
- the NDTT verified with a drop weight test is to be at least 10 ° lower than the standard service temperature of the steel considered (or 5 °C lower than the required impact test temperature)
- micrographic examinations are to be carried out to check the inclusion contents.

The JERN KONTORET method may be applied with determination of the quantity of inclusions: sulphide, aluminate,

silicate and oxide. The checks is to be made on each cast top end, top and bottom plate.

5.2.3 Weldability test

Reference is made to the requirements specified in [2.7] as applicable.

The butt weld test assemblies are to be prepared with the weld seam parallel to the plate rolling direction, so that impact specimens will be in the transverse direction.

6 Stainless steel plates and sections

6.1 Application

6.1.1 Provision is made in this article for the approval of austenitic and austenitic ferritic (duplex) stainless steels plates and sections intended for chemical carriers.

For other applications the approval procedure will be established on a case-by-case basis.

6.2 Specific information to be submitted for approval

6.2.1 The Manufacturer is to submit to Tasneef, together with the request of approval and the general information specified in Ch 1, Sec 1, [1.5.1], particulars relevant to:

- the type of products (plates, sections, coils) and range of thickness for which approval is required and material properties as follows:
 - range of chemical composition C, Mn, Si, P, S, Ni, Cr Mo, N₂, Ti, Nb, B and residual elements if specific limits are specified
 - maximum ferrite content for austenitic grades and ferrite/austenite ratio for duplex steels
 - surface condition with reference to the applicable standard
 - internal soundness condition, applicable ultrasonic procedure or reference to a recognised standard
 - tolerances on the thickness
 - list of permitted cargoes and specific requirements for transportation if any
 - corrosion resistance and applicable standardised corrosion tests
 - production statistics of the chemical composition and mechanical properties (R_{eH} , R_m , A% and K_v). The statistics may also be used in the preparation of the test program in order to reduce the required approval tests.
- steel making process, rolling and heat treatment
- heat treatment devices
 - type of furnaces, heat treatment parameters and their associated records, quenching methods
 - accuracy and calibration of temperature control devices
 - control of atmosphere
- surface finishing : pickling or other methods
- inspections performed on current production
- repair procedure for surface defects if any

- g) recommendations for working, welding and surface cleaning
- cold and hot working recommendations, in particular to avoid intergranular corrosion
 - minimum and maximum welding heat input, recommended filler metals
 - cleaning, pickling and passivating recommendations (initial and in service)
 - surface condition according to recognised standards

Where the approval includes plates with through thickness properties the following information is also to be given:

- maximum thickness and steel grades for which approval is required and relevant delivery conditions
- modifications introduced in the process to obtain the required properties (method for inclusion shape control, low sulphur content, rolling etc.)
- procedures for ultrasonic examination and acceptance criteria
- statistical results of reduction of area values.

6.3 Test program

6.3.1 Selection of material

In general approval tests carried out on one Mo alloyed grade and on one non-Mo alloyed grade may qualify all grades.

For each grade, in principle two plates (sections) originating from two different casts are to be tested.

The thickness of the selected plates is to represent the minimum and the maximum thickness to be approved.

Some relaxation of the above requirements may be allowed for the most common grades on the basis of the documentation submitted and of the intended application.

6.3.2 Position of samples

In the case of ingots, top and bottom position correspond to the top and bottom of the ingot.

In the case of continuous casting, the top end position corresponds to the beginning of the cast and the bottom end position to the bottom end of the cast; if specified in the program, the tests required from the second cast may be required to be taken from the bottom position.

Top and bottom plate mean the top and bottom of the plate or rolled unit, respectively.

6.4 Tests for austenitic grades

6.4.1 Steel grades

The steel grades considered for chemical carriers are: 304L 316L 316LN, 317L 317LN. Steel grades for general applications and high and/or low temperature service also include 321 and 347.

6.4.2 Tests

The tests to be carried out are indicated in Tab 3 below.

6.5 Tests for austenitic-ferritic grades

6.5.1 Steel grades

Austenitic-ferritic grades (duplex steels) have a structure containing about 50% ferrite and the following range of chemical composition (%): Cr 21-26; Ni 5-8; Mo 2,5-5 with addition of nitrogen and/or copper.

6.5.2 Tests on base metal

The tests to be carried out are indicated in Tab 4.

Table 3 : Tests on austenitic grades

Type of test	Position (see [6.3.2])	Remarks
Tensile test	Top (1); transverse for plates, longitudinal for profiles	R_{eH} , R_m , A_5 (%), Z (%) are to be reported
Tensile test at 50 °C, 75 °C, 100 °C	Top (1); top and bottom plate, transverse for plates	Only R_m and $R_{p0,2}$ to be determined
Bend test (for information)	Top (1); top plate, transverse	Bend angle 180 ° on mandrel diameter 3 t
Impact test	Top (1); top and bottom plate, transverse and longitudinal	Testing temperature: 0 -196 °C
Chemical analysis	Top and bottom (1); top plate	All elements to be determined
Micrographic examination	Top and bottom (1); top plate	100x and 500 x Surface and mid thickness
Determination of ferrite delta content Detection of detrimental phases (sigma)	Top and bottom (1); top plate	
Ultrasonic examinations	All plates	Procedure to be established
Corrosion tests	On each cast	ASTM A262 Pr. E (2)
		ASTM A 262 Pr C (3)
		In phosphoric media (4)
(1) Top : top of the ingot or beginning of the cast in the case of continuous casting (2) After sensitising treatment 700 °C for 30 min for stabilised and low carbon steels (3) Not to be carried out on Mo grades (4) To be agreed in the case of special cargoes		

Table 4 : Tests on duplex grades

Type of test	Position (see [6.3.2])	Remarks
Tensile test	Top end ; top plate transverse	R_{eH} , R_m , A_5 (%), Z (%) are to be reported
Tensile test at 50 °C, 75 °C, 100 °C	Top (1); top and bottom plate transversal	Only R_m and $R_{p0.2}$ to be determined
Bend test (for information)	Top (1); top plate transversal	Bend angle 180 ° on mandrel diameter 3t
Impact test	Top (1); top and bottom plate transverse and longitudinal	Testing temperature: 0, -20, -40, -60 °C
Chemical analysis	Top and bottom end (1); top plate	All elements to be determined
Micrographic examination	Top and bottom (1); top plate	100x and 500 x Surface and mid thickness
Determination of ferrite /austenite content Detection of detrimental phases (sigma)	Top and bottom (1); top plate	Surface and mid thickness
Ultrasonic examinations	All plates	Procedure to be established
Corrosion tests	On each cast	ASTM A 262 Pr C
		ASTM G 48 Method A
		In phosphoric media (2)
(1) Top : top of the ingot or beginning of the cast in the case of continuous casting		
(2) To be agreed in the case of special cargoes		

6.5.3 Weldability tests

Butt weld tests are generally required for one cast.

The butt weld test assemblies are to be prepared with the weld seam transverse to the plate rolling direction, so that impact specimens will be in the longitudinal direction.

Bevel preparation will be K or V.

K preparation is, in general, preferred because it allows the notch of the impact specimen to be located parallel to the fusion line (notch located on the unbevelled side).

The samples are to be welded with minimum and maximum heat input appropriate (in general 5-20 kJ/cm) for the steel grade and plate thickness.

The following tests are to be carried out on the test samples:

- 1 tensile test transverse to the weld
- two bend tests (1 root and 1 face bend)
- 1 macro examination
- 3 Charpy V-notch impact specimens with the notch perpendicular to the plate surface and located in the fusion line and at a distance 1, 2, 5 and 20 mm from the fusion line. The positions to be identified by etching the specimens are to be agreed with the Surveyor.

One set of impact tests may also be performed in the weld metal for information. Test temperature: 0 and -20° C.

e) Hardness tests Vickers HV 5 or HV10, across the weldment. When required, they are to be performed in order to determine the maximum hardness of the HAZ.

f) Determination of ferrite content (aim at 30-60%) in base metal heat affected zone and for information only in the weld metal.

6.6 Special requirements

6.6.1 Tensile tests at elevated temperature

When stainless steels are proposed for use at temperatures above ambient temperature, tensile tests at elevated temperature are to be performed in order to evaluate the yield strength properties.

6.6.2 Thickness tolerances

The manufacturing tolerances are to be specified at the approval.

6.7 Results

6.7.1 All the results, which are in any case to comply with the requirements of the Rules, are evaluated for approval by Tasneef; particular conditions, as deemed appropriate, may be specified in the approval document.

All the information required in [6.2.1] and applicable to the plates submitted to the tests is to be collected by the Manufacturer in the approval dossier, which is to include all the results of the tests carried out.

7 Stainless steel clad plates and sections

7.1 Application

7.1.1 Provision is made in this Article [7] for the approval of stainless steel clad plates and sections.

The provisions made in [2] and [4] relevant to approval of the backing material and the additional particular requirements hereunder specified apply to the approval of stainless steel clad plates.

The nominal thickness of the cladding material is to be not less than 2 mm.

7.2 Specific information to be submitted for approval

7.2.1 In addition to the information required in [2.2.1], the following particulars are to be submitted:

- a) grades of backing and cladding steels
- b) thickness range and tolerances
- c) details of manufacturing process adopted: rolling or explosive bonding
- d) flow chart of the manufacturing process and details of inspection points
- e) recommended welding procedures.

7.3 Test program

7.3.1 The test program is established by Tasneef on the basis of the information submitted and generally includes the following tests:

- a) tensile test on the backing plate
- b) impact test on a Charpy V, on the backing plate
- c) tensile test on the full clad plate
- d) tensile test after removal of cladding
- e) bend test on the full clad plate
- f) shear test on the cladding
- g) perpendicular tensile test in order to assess the tearing strength of the cladding
- h) checking of the weldability
- i) ultrasonic examination of the adhesion on plates submitted for approval.

The tests are to be carried out on grades of steel and thicknesses representative of the range to be approved as agreed with Tasneef.

7.4 Results

7.4.1 All of the results which are in any case to comply with the requirements of the Rules, are to be examined in order to define the conditions of the approval. As far as concerns the results of the tests required under [7.3.1] c), the requirements of Part D, Ch 2, Sec 1, [8.7.3] of the Rules apply. As regards the tensile test after removal of cladding, the requirements for the base metal are to be complied with.

7.4.2 All the information required in [7.2.1] and applicable to the plates submitted to the tests is to be collected by the Manufacturer in the dossier, which is to include all the results of the tests carried out.

8 Plates with specified through thickness properties

8.1 Application

8.1.1 Provision is made in this Article [8] for the specific approval of the through thickness properties.

The steel is to be preliminarily or jointly approved in a general form according to the other parts of these Rules.

The approval generally covers thicknesses not less than 15 mm and, in the case of austenitic stainless steels, only grades containing Mo.

8.2 Specific information to be submitted for approval

8.2.1 In addition to the information required in [2.2.1] the following is to be submitted together with the request for approval:

- a) maximum thickness and steel grades for which approval is required and relevant delivery conditions
- b) modifications introduced in the process to obtain the required properties (method for inclusion shape control, low sulphur content, rolling, etc.)
- c) procedures for ultrasonic examination and acceptance criteria
- d) statistical results of reduction of area values

8.3 Approval test

8.3.1 Verification of through thickness properties is carried out on one plate of thickness 30 mm or the maximum thickness to be approved.

A check of the chemical composition and ultrasonic examination are to be performed in accordance with the provisions in Part D, Ch 2, Sec 1, [9.10] of the Rules.

8.3.2 The tensile test specimens are to be taken at the top and bottom end of the plate in a position corresponding to the axis of the plate (3 samples) and halfway between the axis and the side of the plate (3 samples).

8.3.3 The reduction of area of the twelve tests (and the tensile strength for information only) is to comply with the requirements of Part D, Ch 2, Sec 1, [9] of the Rules.

9 Corrosion Resistant Steel

9.1 Application

9.1.1 Provision is made in this Article [9] for the specific approval of corrosion resistant steels based upon corrosion testing.

The corrosion testing is to be carried out in addition to the approval testing specified in Article [2] for the approval of

normal and higher strength hull structural steels. The corrosion tests and assessment criteria are to be in accordance with the Appendix of the Annex to Performance Standard for Alternative Means of Corrosion Protection for Cargo Oil Tanks of Crude Oil Tankers (MSC.289 (87)).

9.2 Specific information to be submitted for approval

9.2.1 In addition to the information required in [2.2.1] the following is to be submitted together with the request for approval:

- a) corrosion test plan and details of equipment and test environments
- b) technical data related to product assessment criteria for confirming corrosion resistance)
- c) the technical background explaining how the variation in added and controlled elements improves corrosion resistance. The manufacturer will establish a relationship of all the chemical elements which affect the corrosion resistance. The chemical elements added or controlled to achieve the required level of corrosion resistance are to be specifically verified for acceptance. Verification is to be based on the ladle analysis of the steel.
- d) the grades, the brand name and maximum thickness of corrosion resistant steel to be approved. Designations for corrosion resistant steels are given in Table 4
- e) the welding processes and the brand name of the welding consumables to be used for approval.

9.3 Approval of test plan

9.3.1 The test program submitted by the manufacturer is to be reviewed by Tasneef. If found satisfactory, it will be approved and returned to the manufacturer for acceptance prior to tests being carried out. Tests that need to be witnessed by the Tasneef Surveyor will be identified.

9.3.2 Method for selection of test samples is to satisfy the following:

- a) the numbers of test samples is to be in accordance with the requirements of the Appendix of the Annex to Performance Standard for Alternative Means of Corrosion Protection for Cargo Oil Tanks of Crude Oil Tankers (MSC.289 (87))
- b) the number of casts and test samples selected are to be sufficient to make it possible to confirm the validity of interaction effects and/or the control range (upper limit, lower limit) of the elements which are added or intentionally controlled, for improving the corrosion resistance. Where agreed, this may be supported with data submitted by the manufacturer.
- c) additional tests may be required by Tasneef based on but not limited to the following considerations:
 - 1) when Tasneef determines that the control range is set by the theoretical analysis of each element based on existing data, the number of corrosion resistance tests conducted in accordance with the Appendix of

the Annex to Performance Standard for Alternative Means of Corrosion Protection for Cargo Oil Tanks (MSC.289 (87)) is too few to adequately confirm the validity of the control range of chemical composition;

- 2) when Tasneef determines that the data of the corrosion resistance test result obtained for setting the control range of chemical composition varies too widely;
- 3) when Tasneef determines that the validity of the corrosion resistance test result for setting the control range of chemical composition is insufficient, or has some flaws; and
- 4) when Tasneef Surveyor has not attended the corrosion resistance tests for setting the control range of chemical composition, and Tasneef determines that additional testing is necessary in order to confirm the validity of the test result data.
- d) the grades, the brand name and maximum thickness of corrosion resistant steel to be approved. Designations for corrosion resistant steels are given in Table 4
- e) the welding processes and the brand name of the welding consumables to be used for approval.

9.3.3 The chemical composition of the corrosion resistant steel is to be within the range specified for rolled steel for hull. Elements to be added for improving the corrosion resistance and for which content is not specified are to be generally within 1% in total.

9.4 Approval Test

9.4.1 The manufacturer is to carry out the approval test in accordance with the approved test plan.

The Tasneef Surveyor is to be present, as a rule, when the test samples for the approval test are being identified and for approval tests, see also [9.3.1].

9.5 Test Results

9.5.1 After completion of the approval test, the manufacturer is to produce the report of the approval test and submit it to Tasneef.

9.5.2 Tasneef will give approval for corrosion resistant steel where approval tests are considered to have given satisfactory results based on the data submitted in accordance with the provisions of this Article [9].

9.5.3 The certificate is to contain the manufacturer's name, the period of validity of the certificate, the grades and thickness of the steel approved, welding methods and welding consumables approved.

9.6 Weldability tests

9.6.1 The results will be assessed by Tasneef in accordance with the acceptance criteria specified in the Appendix of the Annex to Performance Standard for Alternative Means of Corrosion Protection for Cargo Oil Tanks (MSC.289 (87)).

Table 5 : Designations for Corrosion Resistant Steels

Type of steel	Location where steel is ineffective	Corrosion Resistant Designation
Corrosion Resistant Designation	For lower surface of strength deck and surrounding structures (ullage space)	RCU
	For upper surface of inner bottom plating and surrounding structures	RCB
	For both strength deck and inner bottom plating	RCW

10 YP47 Steels

10.1 Application

10.1.1 (1/1/2021)

Provision is made in this Article [10] for the manufacturing approval scheme for YP47 steels of grade EH47.

Unless otherwise specified in this Article, provision in Article [2] is to be followed.

10.2 Approval tests

10.2.1 Extent of the approval tests (1/1/2021)

Articles [2.4.1] e) and f) are not applied to manufacturing approval of YP47 steels.

10.2.2 Type of tests (1/1/2021)

- a) Brittle fracture initiation test
Deep notch test or Crack Tip Opening Displacement (CTOD) test is to be carried out.
- b) Weldability test
 - 1) Y-groove weld cracking test (Hydrogen crack test)
The test method is to be in accordance with recognized national standards such as JIS Z 3158-2016 or CB/T 4364-2013.
 - 2) Brittle fracture initiation test
Deep notch test or CTOD test is to be carried out. Test method and results are to be considered appropriate by the Society.
- c) Other tests
In addition to the requirement specified in [10.2.1] and [10.2.2] above, the approval tests required for steels specified in Article [2] are to be carried out. Additional tests may be required when deemed necessary by the Society.

11 Brittle Crack Arrest Steels

11.1 Application

11.1.1 (1/1/2021)

Provision is made in this Article [11] for the manufacturing approval scheme for brittle crack arrest steels.

Unless otherwise specified in this Article, provision in Article [2] and/or Article [10] are to be followed.

11.2 Documents to be submitted

11.2.1 (1/1/2021)

The manufacturer is to submit to the Society the following documents together with those required in Ch 1, Sec 1, [1.5.1] and Ch 2, Sec 1, [2.2]:

- a) In-house test reports of the brittle crack arrest properties of the steels intended for approval
- b) Approval test program for the brittle crack arrest properties (see [11.3.1] below)
- c) Production test procedure for the brittle crack arrest properties.

11.3 Approval tests

11.3.1 Extent of the approval tests (1/1/2021)

The extent of the test program is specified in [11.3.2], [11.3.3] and [11.3.4].

If the manufacturing process and mechanism to ensure the brittle crack arrest properties for the steels intended for approval are same, [2.4.1] is to be followed for the extent of the approval tests.

The number of test samples and test specimens may be increased when deemed necessary by the Society, based on the in-house test reports of the brittle crack arrest properties of the steels intended for approval specified in [11.2.1] a).

11.3.2 Type of tests (1/1/2021)

Brittle crack arrest tests are to be carried out in accordance with [11.3.3] in addition to the approval tests specified in Article [2] and/or Article [10].

In the case of applying for addition of the specified brittle crack arrest properties for YP36, YP40 and YP47 steels of which, manufacturing process has been approved by the Society (i.e. the aim analyses, method of manufacture and condition of supply are similar and the steelmaking process, deoxidation and fine grain practice, casting method and condition of supply are the same), brittle crack arrest tests, chemical analyses, tensile test and Charpy V-notch impact test are to be carried out in accordance with this Article and Article [2].

11.3.3 Test specimens and testing procedure of brittle crack arrest tests (1/1/2021)

The test specimens of the brittle crack arrest tests are to be taken with their longitudinal axis parallel to the final rolling direction of the test plates.

The loading direction of brittle crack tests is to be parallel to the final rolling direction of the test plates.

The thickness of the test specimens of the brittle crack arrest tests is to be the full thickness of the test plates.

The test specimens and repeat test specimens are to be taken from the same steel plate.

The thickness of the test specimen is to be the maximum thickness of the steel plate requested for approval.

In the case where the brittle crack arrest properties are evaluated by K_{ca} , the brittle crack arrest test method is to be in accordance with Pt D, Ch 2, App 4, [8] of Tasneef Rules for the Classification of Ships. In the case where the brittle crack arrest properties are evaluated by CAT, the test method is to be in accordance with Pt D, Ch 2, App 4, [9] of Tasneef Rules for the Classification of Ships.

11.3.4 Other tests (1/1/2021)

Additional tests may be required when deemed necessary by the Society in addition to the tests specified in [11.3.3].

11.4 Results

11.4.1 (1/1/2021)

Article [2.9] is to be followed for the results.

Additionally, results of test items and the procedures are to comply with the test program approved by the Society. In the case where the brittle crack arrest properties are evaluated by K_{ca} or CAT, the manufacturer also is to submit to the Society the brittle crack arrest test reports in accordance with P Pt D, Ch 2, App 4, [8] of Tasneef Rules for the Classification of Ships for K_{ca} and Pt D, Ch 2, App 4, [9] of Tasneef Rules for the Classification of Ships for CAT.

11.5 Approval and Certification

11.5.1 (1/1/2021)

Upon satisfactory completion of the survey and tests, approval is granted by the Society with the grade designa-

tion having the suffix "BCA1" or "BCA2" (e.g. EH40-BCA1, EH47-BCA1, EH47-BCA2, etc.).

11.6 Renewal of approval

11.6.1 (1/1/2021)

The manufacturer is also to submit to the Society actual manufacturing records of the approved brittle crack arrest steels within the term of validity of the manufacturing approval certificate.

Note 1: Chemical composition, mechanical properties, brittle crack arrest properties (e.g. brittle crack arrest test results or small-scale alternative test results) and nominal thickness are to be described in the form of histogram or statistics.

SECTION 2 PIPES

1 Seamless pipes

1.1 Application

1.1.1 Provision is made in this Article [1] for the approval of Manufacturers of seamless pipes and fittings in low alloyed and alloyed steels intended for high temperatures.

1.1.2 Seamless pipes intended for other applications and already covered by the Rules or by recognised national or international standards may be accepted without specific approval tests on the basis of an examination of the manufacturing and inspection conditions, as well as of the production statistics of the steel concerned.

Such examination may be performed by the Surveyor on the occasion of the first testing of the pipes.

However, for particularly severe conditions (e.g. low temperature) the approval may be requested at Tasneef discretion.

1.1.3 The approval procedure is generally to include the following:

- a) visit to manufacturing facilities
- b) approval tests according to a program agreed with Tasneef.

In general, a sample of pipes (representative of the range to be approved) is to be subjected to the following:

- check of chemical, mechanical and technological properties
- visual, dimensional and non-destructive examination
- check of yield point at elevated temperatures; the verification is required where the steels are proposed in accordance with national or proprietary specifications, and the Manufacturer requests approval with proof stress $R_{p0.2}$ values higher than those given in the Rules.

1.2 Non-destructive examination (NDE)

1.2.1 Where, as indicated in Part D, Ch 2, Sec 2, [1.8.3] of the Rules, the Manufacturer proposes non-destructive testing during production as an alternative to the hydrostatic test, the provisions indicated in [2.6.1] apply.

2 Welded pipes

2.1 Application

2.1.1 Provision is made in this Article [2] for the approval of Manufacturers of welded pipes having an efficiency of welded joint equal to 1 and therefore considered as equivalent to seamless pipes.

The following processes are considered:

- a) electric resistance or induction welding
- b) electric-arc fusion welding; in the case of submerged-arc processes, the joints are to be back welded inside
- c) welding and further cold drawing to final dimensions or cold rolling of the weld seam

2.2 Specific information to be submitted for approval

2.2.1 The Manufacturer is to submit to Tasneef detailed information concerning the process proposed and in particular:

- a) the range of pipe sizes for which approval is requested (outside diameter and thickness)
- b) the base material type and its standard or Manufacturer's name
- c) a description of the manufacturing process
- d) the type of joint, welding procedure specification, welding material equipment
- e) the heat treatment and furnace type
- f) quality controls performed upon receipt, during production and on finished products.
- g) procedures and requirements relevant to NDE of the welded seam (for equivalence to seamless pipe) and of the whole pipe circumference when NDE is also proposed as alternative to the hydrostatic test.

2.3 Base material

2.3.1 The steels to be considered are those specified in Part D, Ch 2, Sec 1 of the Rules, with the exception of Ni, Mo and Cr-Mo steels.

Types of steel other than those indicated above may be considered by Tasneef depending on their properties, welding processes, fabrication processes, heat treatments and intended application.

2.4 Test program

2.4.1 General

The program is to be agreed with Tasneef; the approval tests required are those indicated in [2.4.2].

Examinations and tests are in relation to the type of material, fabrication process and proposed applications.

2.4.2 Selection of material

The samples for the tests are to be selected from the production selecting pipes in the final stage of fabrication, including cold expansion treatment if any.

The Tasneef Surveyor may ask to witness all or part of the welding process of the pipes submitted to the approval tests.

Alternatively, test samples may be taken from pipes selected by the Tasneef Surveyor from a sufficient quantity of pipes already fabricated or from stock.

In all cases the Manufacturer is to submit details concerning the production, treatments and internal quality controls relevant to the pipes selected for samples.

As a rule, for one or more fabrication processes to be approved and for each type of material and process, 2 or 3 samples are taken with diameters and thickness selected in the range requested for approval; in general, the minimum and maximum dimensions are to be tested.

2.5 Approval tests

2.5.1 Examinations and tests

The examinations and tests will include all or part of the following:

- a) inspections of the original pipe lengths, before cutting the samples
 - visual inspection and dimensional check; the visual inspection and dimensional check are carried out for the purpose of ascertaining the absence of surface defects, undercuts, excessive reinforcement in way of the joint (where permitted) or poor fairing with the adjacent surfaces both inside and outside. Compliance with the specified tolerance covering dimensions, out-of-roundness and linearity is also to be checked
 - radiographic and/or ultrasonic examination of the welded joint in locations selected by the Tasneef Surveyor. The ultrasonic equipment is to be previously calibrated. In all cases, the joint at the ends of the pipe for a length of approximately 450 mm is to be subjected to radiographic examination. The above examinations are to demonstrate the absence of unacceptable defects
 - hydrostatic test; the test pressure required for the specific type of pipe is to be maintained for a sufficient time (at least for 5 seconds)
- b) testing as follows on samples cut from pipes selected as indicated in [2.4.2]:
 - macrographic examination across the joint
 - micrographic examination across the joint; the structure and, with the exception of austenitic steels, HV 5 Vickers hardness on weld, HAZ and base metal are to be recorded
 - check of chemical composition; in the case of welding processes involving deposited metal, the check of chemical composition of the fusion zone, with particular reference to the contents of characteristic elements is also to be carried out
 - check of ferrite content in base material, HAZ and welded zone in the case of duplex stainless steels
 - corrosion tests according to ASTM A 262 Pr. E in the case of austenitic stainless steels and according to

ASTM G 48 method A in the case of duplex stainless steels

- flattening tests with the weld at 0° and 90° to the direction of the flattening force
- expansion test (flaring or flanging as specified by the applicable testing requirements)
- tension test
- tensile tests and bend tests transverse to the weld in the case of electric-arc welding processes with filler metal
- Charpy V-notch impact tests for austenitic steels in the case of low temperature service: 1 set of 3 impact specimens is to be taken with notch located in the positions: middle of weld, fusion line, 1,3 and 5 mm from fusion line; test temperature -196 °C
- Charpy V-notch impact tests for C-Mn steels in the case of low temperature service: the sets of impact specimens are to be taken in compliance with the above requirements and tested at the temperature appropriate to the steel grade
- Charpy V notch impact tests for duplex grades: at -20°C for thickness above 3 mm with notch located in the middle of the weld.

2.5.2 For the tensile and bend tests, the test specimens obtained from the pipe samples may be cold-flattened by means of a suitable procedure.

2.5.3 Results

All the results, which are in any case to comply with the requirements of the Rules, are evaluated for approval by Tasneef; particular conditions, as deemed appropriate, may be prescribed in the approval document.

All the information required under [2.2] and applicable to the material tested is to be collected by the Manufacturer in the approval dossier, which is include all the results of the approval tests.

2.6 Non-destructive examination

2.6.1 The procedure required in [2.2.1] g) is to contain detailed information on the following:

- a) method, type of equipment and capacity (pipe wall thickness and outside diameter range)
- b) calibration criteria, dimension and position of artificial defects
- c) frequency of calibration
- d) length of untested ends, if applicable
- e) sensitivity to detect internal/external defects
- f) evaluation of imperfections
- g) operator qualification according to SNT- TC1-A or an equivalent recognised standard (EN 10256 or EN 473); at least level 1 qualification is required.

The correct application of the procedure is to be verified during the approval tests consisting in the examination, with the method proposed, of some pipes having the maximum thickness.

SECTION 3 FORGINGS

1 Forgings

1.1 Application

1.1.1 General

Provision is made for the manufacturing approval of important forgings as required by Tasneef.

1.2 Information to be submitted for approval

1.2.1 The following specific information and applicable documentation are to be submitted together with the request for approval and the general information specified in Ch 1, Sec 1, [1.5.1] as applicable:

- a) material specifications
- b) production method of original steel (steel making, vacuum degassing casting, ingot weights)
- c) description of forging facilities (presses, hammers, heat treating furnaces, etc.)
- d) description of forging process with sketches showing forming of forging from the ingot stage and relevant reduction area
- e) description of processes adopted for grain flow forged products and for forgings partially made by welding
- f) production capacity, size of products (dimensions) and weight range
- g) laboratory facilities and equipment for inspection and testing
- h) quality control/assurance system description; the description is to include a process flow chart detailing all main inspection points and a list of applicable instructions.
- i) heat treatment procedure (heating and cooling rate, holding time)
- j) alternative procedure to the conventional heat treatment, such as controlled cooling from finishing forging temperature, when adopted

1.3 Requirements for manufacturing

1.3.1 When forgings are made directly from ingots or from blooms or billet forged from ingots, the ingots are to be cast in moulds with the larger part uppermost and provided with suitable feeders.

The required minimum reduction ratios are indicated in Part D, Ch 2, Sec 3 [1.3.2], [1.3.3], [1.3.4] of the Rules.

When a grain flow is required in a particular direction, tests are required to demonstrate that a satisfactory structure and grain flow are obtained.

1.4 Test program

1.4.1 Sampling

The type of forgings and the number of samples to be taken depending on the steel grades, shapes and supply condition of the forged products are to be agreed with Tasneef.

In general, two samples representative of the type of forgings to be approved and taken from two different casts are to be tested for each steel type.

Where, for the same type of forging, approval is jointly requested for carbon, low alloyed and alloyed steel, one cast for each type of steel may be sufficient at Tasneef discretion.

1.4.2 Testing

The following tests are generally to be performed on each sample:

- a) tensile tests in the longitudinal, transverse and radial direction as applicable at the discretion of Tasneef
- b) 3 Charpy V-notch impact tests as above at +20°C and 0°C. Other temperatures may be required depending on the application
- c) hardness test as specified in the applicable requirements of the Rules
- d) check of chemical composition
- e) micro examination for structure
- f) macro examination for grain flow forged products
- g) sulphur print.

The position and size of test specimens are to be in accordance with Part D Ch 2, Sec 3, [3] of the Rules for the different types of forgings.

Non-destructive examination for detection of external (magnetic particle) or internal (ultrasonic) imperfections is generally required.

1.5 Results

1.5.1 All the results, which are in any case to comply with the requirements in Part D, Ch 2, Sec 3, [3] of the Rules, are evaluated for approval; depending on the outcome, particular conditions, as deemed appropriate, may be specified by Tasneef in the approval document.

All the information required under [1.2] applicable to the material submitted to the tests is to be collected by the Manufacturer in the dossier, which is to include all the results of the tests.

SECTION 4 CASTINGS

1 Application

1.1

1.1.1 Provision is made for the manufacturing approval of important castings, as required by Tasneef.

1.2 Specific information to be submitted for approval

1.2.1 The following specific information and applicable documentation are to be submitted together with the request for approval and the general information specified in Ch 1, Sec 1, [1.5.1] as applicable:

- a) material specifications
- b) steel making production method, vacuum degassing casting, ingot weights
- c) description of facilities
- d) description of special casting method processes
- e) production capacity, product size (dimensions) and weight range
- f) laboratory facilities and equipment for inspection and testing
- g) quality control/assurance system description; the description is to include a process flow chart detailing all main inspection points and a list of applicable instructions
- h) heat treatment procedure (heating and cooling rate, holding time).

1.3 Test program

1.3.1 Sampling

The type of castings and the number of samples to be taken depending on the steel grades, shapes and supply condition of the castings are to be agreed with Tasneef.

In general, two samples representative of the type of castings to be approved and taken from two different casts are to be tested for each steel type.

Where approval is jointly requested for carbon, low alloyed and alloyed steel and in particular cases at Tasneef discretion, the number of casts may be reduced to one for each type of steel.

1.3.2 Testing

The following tests are generally to be performed on each sample. The position of the samples and specimens is to be agreed with Tasneef.

- a) tensile test
- b) 3 Charpy V-notch impact tests at +20°C and 0°C. Other temperatures may be specified depending on the application
- c) hardness test as specified in the applicable requirements of the Rules
- d) check of chemical composition
- e) micro examination for structure.

The position of test specimens is to be in accordance with Part D, Ch 2, Sec 4 of the Rules for the different types of castings.

Non-destructive examination for detection of external (magnetic particle method) or internal (radiographic) imperfections is generally required.

At the Tasneef discretion ultrasonic examination may be also required.

1.4 Results

1.4.1 All the results, which are in any case to comply with the requirements of Part D, Ch 2, Sec 4 of the Rules, are evaluated for approval; depending on the outcome, particular conditions, as deemed appropriate, may be specified by Tasneef in the approval document.

All the information required under [1.2] applicable to the material submitted to the tests is to be collected by the Manufacturer in the dossier, which is to include all the results of the approval tests.

NON FERROUS METALS

SECTION 1 ALUMINIUM ALLOYS

SECTION 1

ALUMINIUM ALLOYS

1 Aluminium alloy plates and sections

1.1 Application

1.1.1 When approval is required, the provisions given in Ch 1, Sec 1 apply, as appropriate, in addition to those specified in this Article [1].

1.2 Specific information to be submitted for approval

1.2.1 The specific information is to include the following particulars:

- a) type of product (rolled or extruded)
- b) proprietary name or number of alloy according to the international designation of the Aluminium Association
- c) chemical composition of the alloy (range of alloying elements and max. impurity content)
- d) delivery condition, temper condition (i.e. annealed, strain hardened, naturally or artificially hardened etc.) referring to the designation given by the Aluminium Association
- e) mechanical properties guaranteed for the various delivery conditions
- f) size range applied for approval
- g) production facilities and in particular:
 - melting and pouring (in moulds, semi-continuous, etc.)
 - extrusion and /or rolling procedures
 - stretching and flattening systems

1.3 Approval test program

1.3.1 For each alloy grade to be approved, in general two plates or sections originating from different production heats are to be subjected to the tests required in Part D, Ch 3, Sec 2 of the Rules.

For each type of product, the pieces for the approval tests are to be taken from products as far as possible representative of the range of dimensions to be approved (in general minimum and maximum size).

The chemical analysis is to be stated for each heat and checks are generally required on the products.

All the results, which are in any case to comply with the requirements in Part D, Ch 3, Sec 2 of the Rules, are to be considered for approval.

2 Transition joints

2.1 Application

2.1.1 Provision is made in this Article [2] for the approval of the manufacturing process of aluminium/steel transition joints used for joining aluminium superstructures to hull steel. The processes considered are explosion bonding or rolling.

2.2 Specific information to be submitted for approval

2.2.1 The specific information is to include the following particulars:

- a) description of the manufacturing process
- b) aluminium and steel grades used for the manufacture of the joints
- c) dimensions of the joints and thickness of the different layers
- d) non-destructive testing procedures adopted
- e) particular instructions for application (welding, cutting)
- f) results of corrosion and fatigue test (if available).

2.3 Approval test program

2.3.1 Two test pieces, representative of the size range proposed for the approval, are to be selected from every combination of aluminium /steel.

The following tests are to be carried out on each test piece:

- a) two tensile tests across the bond
- b) four bend tests (two with the steel surface and two with the aluminium surface in tension) on a mandrel having six times the specimen thickness
- c) two side bends
- d) two shear tests

The procedures for tests are to be in compliance with Part D, Ch 3, Sec 2, [4] of the Rules.

All the results, which are in any case to comply with the requirements in Part D, Ch 3, Sec 2, [4] of the Rules, are to be considered for approval.

3 Aluminium alloy castings

3.1 Application

3.1.1 The provisions of item [3] apply to the manufacturing approval of aluminium alloy castings, as required in Part D of Tasneef Rules.

3.2 Specific information to be submitted for approval

3.2.1 The following specific information and applicable documentation are to be submitted together with the request for approval and the general information specified in Ch 1, Sec 1, [1.5.1] as applicable:

- a) alloy designation or specification
- b) chemical composition (range of alloying elements and max. impurity content)
- c) casting method
- d) delivery condition
- e) mechanical properties guaranteed for the various delivery conditions
- f) production capacity, product size (dimensions) and weight range
- g) description of production and laboratory facilities.

3.3 Approval test program

3.3.1 For each alloy designation, two samples representative of the type of castings to be approved and taken from two different casts are to be tested.

The following tests are generally to be performed on each sample. The position of the samples and specimens is to be agreed with Tasneef.

- a) chemical analysis
- b) tensile test
- c) hardness test as specified in the applicable requirements of the Rules.

All the results, which are in any case to comply with the requirements of Part D, Ch 3, Sec 2 of the Rules, are evaluated for approval.

MISCELLANEOUS EQUIPMENT

SECTION 1 EQUIPMENT

SECTION 2 VARIOUS FINISHED PRODUCTS

SECTION 1 EQUIPMENT

1 Chain cables and accessories

1.1 Application

1.1.1 Provision is made in this Article [1] for the approval of manufacturing processes of welded chain cable links and accessories (shackles and swivels) for anchors or other uses, as deemed appropriate by Tasneef.

The following manufacturing processes are considered:

- flash welding for grades Q1, Q2, Q3
- resistance welding (pressure butt welding) only for grade Q1 and Q2 stud less link chain up to 25 mm
- casting and drop forging for grades Q2, Q3

Accessories are generally to be made by casting or forging in steel of at least grade Q2. The studs are to be forced, or forced and welded, or solid with the link.

1.2 Information to be submitted for approval

1.2.1 General information

The general information specified in Ch 1, Sec 1, [1.5.1] as applicable, is to be submitted with the request for approval.

1.2.2 Rolled round bars

Information relevant to the manufacturing process of the rolled steel bars (chemical composition, steel making, rolling and heat treatment) is to be submitted; the relevant requirements are indicated in Part D, Ch 4, Sec 1, [2.5] of the Rules.

1.2.3 Welded chain cables

The following information is to be submitted:

- grade of chain and relevant link size range for which approval is requested
- description of the chain manufacturing process; in particular:
 - type and characteristics of the plant and welding equipment.
 - specification of the heat treatment cycles
 - welding procedure
 - controls along the manufacturing line

The following main variables of the welding processes are to be indicated in the procedure, as applicable:

- base material
- diameter of the bars to be welded
- forming operations
- thermal cycles during manufacture of the chain and the final heat treatment, if any
- type and location in the link of the welded joint
- main parameters which characterise the automatic welding operation (such as, in general: temperature and

time of pre-heating, gap and pressure of the clamps, welding time, reduction in length due to burning and upset, upsetting pressure) and which may vary depending on the base material and the section to be welded.

- fitting procedure of studs

1.2.4 Approval range

Approvals refer to clearly identified individual equipment, diameter and type of base material and production procedures, as characterized by the variables listed in [1.2.3].

The approval test on bars is to be carried out at the steel bar Manufacturers or, if agreed, in particular cases, at the chain factory.

Steel bars corresponding to the specification submitted by the Manufacturer are to be used for approval tests; for the purpose of approval tests Tasneef may require the range of some chemical elements of the steel to be more restricted than allowed in the specification in order to improve the significance of the tests.

1.3 Chemical composition, mechanical properties and supply condition

1.3.1 Chemical composition and mechanical properties of the materials used

Requirements are as follows:

- rolled bars for flash welded link: mechanical properties for all grades and chemical composition for grades Q1, and Q2 as per Table 2 and Table 3 of Part D, Ch 4, Sec 1 of the Rules
- drop forged steel links : mechanical properties as per Table 2 of Part D, Ch 4, Sec 1 of the Rules and manufacture as per general requirements specified in Part D, Ch 2, Sec 3 of the Rules for forged steels
- cast steel links : mechanical properties as per Table 2 of Part D, Ch 4, Sec 1 of the Rules and manufacture as per general requirements specified for cast steels in Part D Ch 2, Sec 4 of the Rules.

1.3.2 Condition of supply

The condition of supply of the material used and of the finished chains is to comply with the appropriate requirements of Part D, Ch 4, Sec 1 of the Rules.

The required condition of supply of finished chains is given for ease of reference in Table 1.

Table 1

Grade	Condition of supply
Q1	As welded or normalised
Q2 and Q3	Normalised or normalised and tempered or quenched and tempered (1)
(1) Chain cables of grade Q2 are generally supplied in the normalised condition; however, at Tasneef discretion and at the request of the interested parties, chains may be allowed to be supplied in the as welded condition, subject to additional testing requirements ensuring the equivalent suitable uniformity.	

1.4 Manufacture

1.4.1 Manufacturing methods, production machinery and heat treatments are to be suitable for the purpose and such as to ensure a consistently uniform product of the required quality.

1.4.2 The storage and identification of raw materials during fabrication and the internal quality controls on the materials and chains are to be such as to allow each length of chain to be traced back to the type of steel, the heat, the respective analyses, the heat treatment, the tests and the controls performed.

In particular, the Manufacturer is to adopt appropriate methods, to the satisfaction of the Tasneef Surveyor, for the identification during fabrication of the grade of steel and heat of the bars used.

1.5 Approval test program

1.5.1 General

On the basis of the information submitted in [1.2], an approval program is prepared also taking into account the indications in [1.4.2] for the extension of the tests.

Approval tests carried out on higher strength chain cables may cover approval of lower grades, at Tasneef discretion, provided that the type of material, method of manufacture and heat treatment are the same.

Tasneef is to be informed when the chain samples are to be fabricated so that it may appoint a Surveyor to attend; in any event, the Manufacturer is to submit a report detailing the fabrication and any heat treatment of specimens and the identification of the base material, its chemical analysis and mechanical properties, including certificates of origin of the raw material and, if deemed appropriate, a diagram of the heat treatment.

The required tests are to be carried out in the presence of the Tasneef Surveyor, in laboratories and testing stations provided with adequate facilities; the testing machine for the tensile tests of the chain cable samples is to be of a recognised type and accurately calibrated.

1.5.2 Samples for testing of base material (round bars)

Two bar samples of the maximum diameter from each grade (unless testing of a higher grade is accepted) are to be tested and submitted to the tensile and impact test as required Part D, Ch 4, Sec 1, [2.5.5] of the Rules.

1.5.3 Samples for testing of links

Tests are generally required for each grade (unless testing of a higher grade is accepted) on two sizes of chain close to the maximum and the minimum, and one or more intermediate sizes, depending on the range of sizes and the type of steel for which approval is requested.

Links forming test samples for approval of the welding process are to be fabricated according to the process to be approved, with a method of fabrication reflecting the actual procedure for the production of the chain.

Where a heat treatment is required on the fabricated chains, the samples for approval tests are to be heat treated in the same manner.

1.6 Inspections and tests required for the approval

1.6.1 General

In general, for each of the sizes selected in [1.5.2] and [1.5.3], the fabrication of the following is required:

- a) 5 five-link samples
- b) single links sufficient in number for the required testing on individual links and for machining the test pieces.

1.6.2 Tests

The following is to be performed:

- a) visual examination and check of dimension :
 - bars: the material is to be free from harmful imperfections and tolerances on diameters are to comply with the requirements specified in Part D, Ch 4, Sec 1 Table 4 of the Rules
 - links: the test samples are to be carefully examined for fabrication, shape and size of the links. The workmanship is to be satisfactory and appropriate to the service behaviour of fabricated chains; the dimensions of the links, which are to be carefully checked and indicated in the report, are to be in compliance with the specified tolerance
- b) the usual mechanical tests required for acceptance of the bars
- c) tensile test on three five-link samples; the samples are to be loaded in tension to the proof load and minimum breaking loads specified Part D, Ch 4, Sec 1, Table 8
- d) bend test on individual links; at least two links for each size selected are to be bent on a suitable support in such a manner such that the welded joint is located at the middle of the span during the bending test; the mandrel diameter is to be equal to the diameter of the chain, for chain sizes up to about 80 mm, or to 1,5 to 2 times the chain diameter for larger sizes
- e) a bend test alternative to d), when agreed with Tasneef, to be carried out on longitudinal strips cut out from the link such that part of the original cylindrical surface is retained and subjected to tension in the course of the test; in such cases, the test is to be repeated a sufficient number of times to allow a significant portion of the original cylindrical surface to be tested. Reference marks are to be made on both sides of the welded joint on the tension side at 5 mm intervals so as to provide

convenient means for evaluating the elongation. The test is to be extended up to the maximum achievable angle of bending

- f) Macrographic examination to be carried out on a longitudinal section, including both principal axes, of an individual link for each size of chain selected; the examination is to cover the welded joint and the adjacent zones
- g) Micrographic examination and HV30 Vickers hardness tests carried out on significant points of the welded joints, transition zone and adjacent areas of the base material
- h) Mechanical tests on specimens obtained from the links as follows:
 - 2 cylindrical specimens for tensile tests. The two specimens are to be obtained so that their axes fall approximately at one half of the radius of the links; their diameter is to be not less than 15 mm or greater than 25 mm. The test length is to be equal to five times the diameter and the cylindrical portion is to extend at least 5 mm beyond the ends of the test length. The welded zone is to fall at the mid-point of the test length.
 - 2 rectangular specimens for the bend tests, with the welded zone at mid-length. The two specimens are to be obtained so that their axes fall approximately at one half of the radius of the links; their thickness is to be about 20 mm and their width equal to 1,5 times the thickness (or equal to the thickness, for chain sizes not exceeding 35 mm). The bend test is to be performed over a mandrel having a diameter equal to twice the thickness of the specimen, for grade Q1 steel, and 3 times the thickness of the specimen for grade Q2 and Q3 steels; the weld zone is to be located at mid-span between the supports, in way of the axis of the mandrel. With the exception of small size chains, where the neutral axis of the specimen practically coincides with the axis of the link of chain, the test is to be performed by positioning one specimen such that the side nearest to the surface of the link is in tension, and the other specimen such that the side nearest to the core of the link is in tension.
 - 3 (or more, as specified later) sets of impact test specimens. Each set is to include at least three Charpy V-notch specimens. In one set of specimens the notch is to be located in way of the weld; a second set of specimens is to have the notch in way of the transition zone, while the third set is to have the notch far enough from the weld such as to represent the base metal. Specimens for chain links of less than 80 mm in diameter and all specimens relative to the base material are to be obtained so as to have their axes at approximately one half of the radius of the link. Specimens for chain links of not less than 80 mm in diameter are to consist of two sets (of three specimens each) with the notch in way of the weld, and two sets (of three specimens each) with the notch in way of the transition zone. One set of specimens of each type is to be derived from the

material near the surface of the link, while the second set of each type is to be obtained near the core.

In all cases, impact test specimens are to be prepared with the notch cut in a radial direction.

Impact tests are to be performed at the following temperatures:

- grade Q1 steel: +20°C
- grade Q2 and Q3 steels: 0°C.

1.7 Results

1.7.1 Tensile tests on five links

For the tensile test of the five-link specimen, after the proof load is applied and removed, the resultant permanent deformation is to be recorded and proved to be less than 5% of the original length.

The specimen is to be carefully examined to ascertain whether defects of any kind have emerged in the course of the test; care is also to be taken to verify that the contact zones of each link have adequate radius of curvature to permit free relative movements.

The same specimen is then subjected to a second tensile test to the prescribed minimum breaking load; the test will also be considered valid if the rupture is not obtained, provided of course the applied load exceeds the prescribed minimum breaking load.

The maximum applied load, the deformations and any defects as well as the location and type of the final fracture are to be measured and recorded.

1.7.2 Bend tests

For the bend test on individual links, the angle at which cracks of max. 4 mm in length appear and the maximum bend angle are to be measured and recorded. For the acceptance, the specimens are required to attain a bend angle of at least 90° without fractures, and an angle of at least 60° before cracks of max. 4 mm in length appear.

1.7.3 Macrographic and micrographic examinations and hardness tests

The macrographic examination is to prove the absence of defects, segregations and inclusions.

The hardness measurements on the base material, transition zone and weld material are to be sufficiently uniform and to correspond to the grade of steel used in manufacturing the chain link.

Neither excessive grain size nor unreasonable metallic structures are to appear in the various link areas on either side of the weld under micrographic examination.

1.7.4 Mechanical tests from the links

The following requirements are applicable to the mechanical tests of specimens machined from the links:

- a) tensile test on cylindrical specimens: the yield strength, ultimate tensile strength, elongation and reduction of area (when required) are to be not less than the minimum values specified for the base material of the link
- b) bend test on rectangular specimens: an angle of 180° is required without cracks or other defects appearing

- c) Charpy V impact test: the following minimum values of absorbed energy are required, at the temperatures indicated. The values specified are averages of three tests. The value of one test may be less provided that it is not less than 70% of the average value:
- grade Q1 steel: 27 J at + 20°C
 - grade Q2 steel: 27 J at 0°C
 - Q3 steel: 60 J at 0°C in base metal - 50 J at 0°C in welded metal.

2 Steel wire ropes

2.1 Application

2.1.1 Provision is made in this Article [2] for the approval of manufacturing processes of steel wire ropes having wire with nominal tensile strength $> 1960 \text{ N/mm}^2$, or having construction different from those indicated in the Rules or not covered by a recognised standard.

2.2 Information to be submitted for approval

2.2.1 The following information is to be submitted together with the request for approval:

- a) general information relevant to the factory and approval already granted
- b) types of ropes manufactured, dimensions construction and relevant tensile properties
- c) production methods and equipment
- d) procedures for inspection and testing of the current production
- e) laboratory facilities for testing and inspection

2.3 Approval program, tests and results

2.3.1 Ropes of each construction proposed and of diameter representative of the dimension to be approved (in general maximum diameter and diameter corresponding to the majority of the production) are to be submitted in the presence of the Tasneef Surveyor to the usual acceptance tests specified in Part D, Ch 4, Sec 1, [4.4] of the Rules; the tests are carried out during a visit to be paid to the works in order to inspect the manufacturing and control facilities.

2.3.2 The results of the tests are to comply with the requirements of Part D, Ch 4, Sec 1, [4.4] of the Rules or with the applicable specification.

SECTION 2

VARIOUS FINISHED PRODUCTS

1 Pressure bottles

1.1 Application

1.1.1

Provision is made in this Article [1] for the approval of manufacturing processes of:

- seamless bottles for CO₂ or compressed gases (air, N₂) in general having capacity less than 150 litres
- welded bottles for portable fire extinguishers.

The following manufacturing processes are considered:

- seamless bottles
 - backwards hot extrusion of billets
 - spinning of seamless pipes
 - backwards cold extrusion and drawing of plates
- welded bottles for portable fire extinguishers
 - circumferential welding of pipe sections and pressed caps; pipe sections may be made from welded pipe generally produced by induction welding or directly from plate by bending and longitudinal welding
 - circumferential welding of two extruded caps.

1.2 Information to be submitted for approval

1.2.1 The Manufacturer is to submit to Tasneef, together with the letter of application, a detailed description of the manufacturing process adopted, the type and capacity of the pressure bottles to be approved and the relevant constructional drawings in four copies.

1.2.2 The description of the manufacturing process is to include:

- production facilities
- quality control routines in the current production (inspection points, non-destructive examinations)
- laboratory facilities and equipment for inspection and testing).

Documentation relevant to approvals already granted by other IACS (International Association of Classification Societies) Classification Societies will be considered in order to reduce the extension of the type tests required.

1.3 Approval program and sampling for tests

1.3.1 Subject to the approval of the plans submitted and on the basis of the information under [1.2], the approval program is prepared and communicated to the Manufacturer.

The approval program will include for each type of bottle:

- visual examination, non-destructive examination and dimensional checks of cylinders taken from production or from stock as deemed necessary to verify the reliability of the process
- burst test on one cylinder with determination of the type and dimension of the fracture
- mechanical tests: one tensile test, two bend tests to be performed in the circumferential direction, 1 set of Charpy V-notch impact tests at -20 °C on bottles having thickness greater than 5 mm, hardness tests
- qualification of welding procedure, if applicable, with:
 - radiographic testing and macro examination
 - 2 tensile tests transverse to the weld
 - 2 face and 2 root bends transverse to the weld
- in the case of bottles for portable fire extinguishers, flattening tests and burst tests are to be in accordance with EN 3 standard.

1.4 Tests and results

1.4.1 General

The tests are generally to be witnessed by the Surveyor during the visit to be paid to the factory for approval.

1.4.2 Results

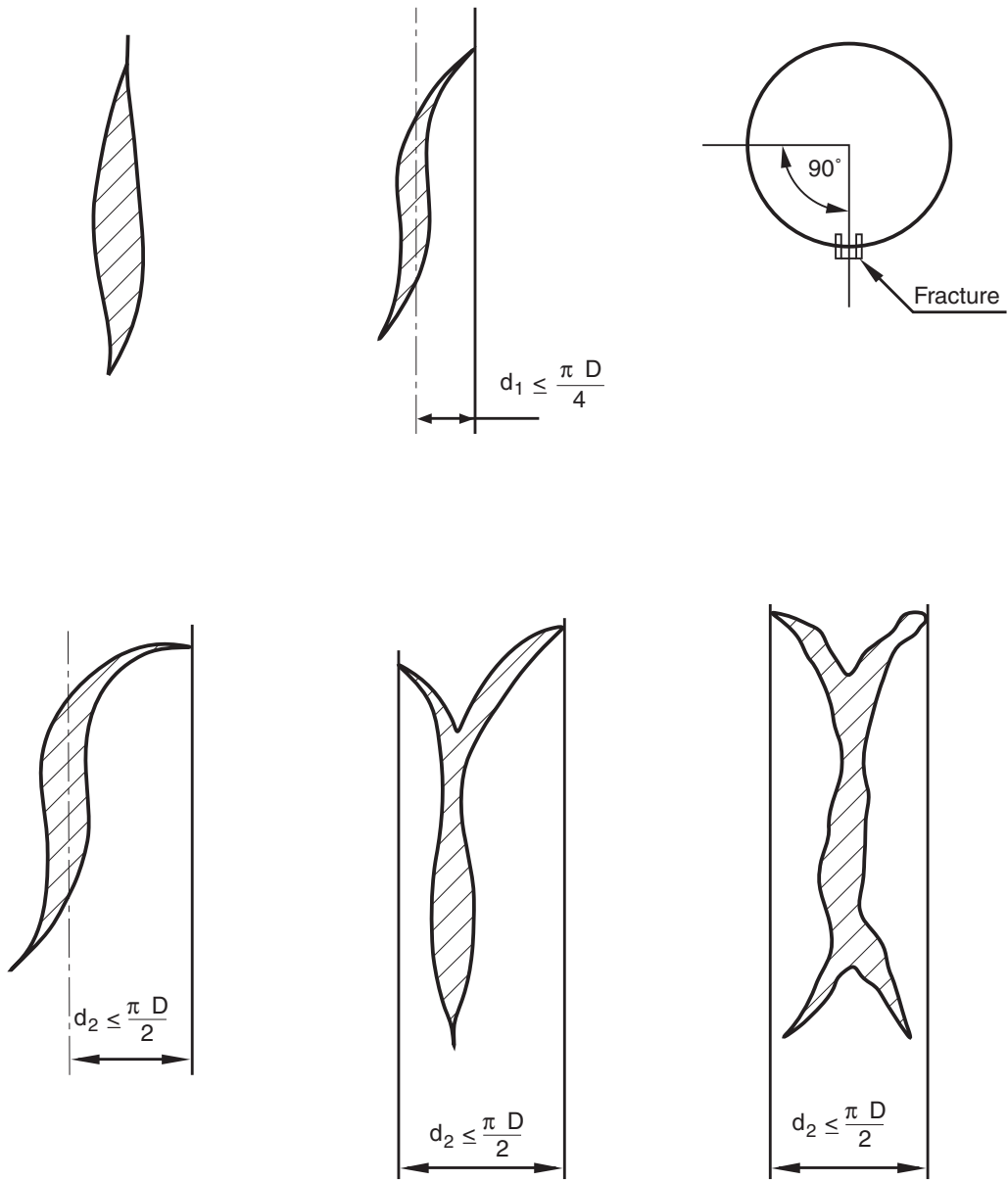
- The dimensional check is to show compliance with the approved drawing; the visual examination is to show no evidence of harmful defects
- The burst pressure of seamless bottles is to be higher than the value given by the following formula:

$$P = \frac{2 \cdot t \cdot R_m}{D_e - t}$$

where: P burst pressure (MPa); R_m: nominal tensile strength (N/mm²); D_e: outside diameter (mm); t: thickness (mm)

- The fracture is to be ductile and in accordance with Fig 1; during the burst test it will be verified that no plastic deformation occurred at a pressure equal to twice the working pressure; the verification may be performed by measuring the volume of water added after the pressure has been released (water jacked method) or by plotting the diagram of the increasing pressure.
- The burst pressure of welded bottles for portable fire extinguishers is to be not lower than 2,7 times the service pressure at 60 °C with minimum of 5,5 MPa
- Mechanical tests are to comply with the requirements foreseen for acceptance tests in Part D, Ch 4, Sec 2, [2.3] of the Rules.

Figure 1 : Acceptable burst profile



2 Copper castings for propellers

2.1 Application

2.1.1 The provisions of item [2] apply to the manufacturing approval of copper castings for propellers, as required in Part D of Tasneef Rules.

2.2 Specific information to be submitted for approval

2.2.1 The following specific information and applicable documentation are to be submitted together with the request for approval and the general information specified in Ch 1, Sec 1, [1.5.1] as applicable:

- a) alloy specifications
- b) manufacturing, repair and NDT procedures
- c) delivery condition
- d) mechanical properties guaranteed for the various delivery conditions
- e) production capacity, product size (dimensions) and weight range
- f) description of production and laboratory facilities.

2.3 Approval test program

2.3.1 For each alloy type, two samples representative of the type of castings to be approved and taken from two different casts are to be tested.

The following tests are generally to be performed on each sample. The position of the samples and specimens is to be agreed with Tasneef.

- a) chemical analysis
- b) tensile test
- c) metallographic examination.

All the results, which are in any case to comply with the requirements of Part D, Ch 4, Sec 2 of the Rules, are evaluated for approval.