RULES
FOR THE CLASSIFICATION OF SHIPS

Part 25 – METALLIC MATERIALS
July 2021

Amendments No. 3
July 2023

CROATIAN REGISTER OF SHIPPING

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By the decision of the General Committee of Croatian Register of Shipping,

Amendments No. 3 to the
RULES FOR THE CLASSIFICATION OF SHIPS
Part 25 – METALLIC MATERIALS

have been adopted on 26th June 2023 and shall enter into force on 1st July 2023

GENERAL TERMS AND CONDITIONS

(March 2022)

Article 1
GENERAL

1.1 CROATIAN REGISTER OF SHIPPING (hereinafter: the *Register*) shall at all times remain an independent contractor and neither the *Register* nor any of its officers, surveyors, auditors, inspectors, agents, appointers, officers or managers shall act as an employee, servant or agent of any other party in the performance of the Services rendered by the *Register*.

1.2 The *Register* acts as a service provider. The Services provided by the *Register* cannot be construed as a commitment by the *Register* to achieve any result or as a warranty.

1.3 The provision of Services is subject to these General Terms and Conditions. No other terms and conditions shall apply, either expressly or by implication, unless expressly agreed in writing between the Parties.

1.4 These General Terms and Conditions shall be incorporated into, or referred to in any Contract and shall prevail over and exclude any other terms and conditions that the Client may wish to impose.

Any amendments to and/or deviations from these General Terms and Conditions, as well as any additional terms and conditions of the Client, shall be binding or valid only if set forth in writing and duly signed by the authorised representatives of both Parties.

1.5 The invalidity of one or more provisions of these General Terms and Conditions shall not affect the remaining provisions.

1.6 The Client acknowledges that the latest version of these General terms and Conditions and the latest version of applicable Rules apply to the Services provided by the *Register*.

1.7 Definitions in these General Terms and Conditions take precedence over other definitions that may appear in other documents issued by the *Register*.

1.8 The Client should at all times be aware of the provisions of these General Terms and Conditions, as they may be further amended, with their latest up to date version available on the web site of the *Register*.

Article 2
DEFINITIONS

2.1 **Certificate** means either a class certificate or statutory certificate, statement, attestation, statement of compliance, and a report following the Services provided by the *Register*.

2.2 **Certification** means the activity of certification in application of international and national standards and international industry practice provided by the *Register*.

Certification is an appraisement given by the *Register* to the Client and cannot be construed as an implied or express warranty of safety, fitness for purpose, seaworthiness of the vessel or its value for sale, insurance or chartering.

The purpose of Certification is to provide classification and statutory services and assistance to the maritime industry, Flag State Administrations, and regulatory authorities relating to maritime safety and pollution prevention.

2.3 **Classification** includes all activities and Services provided by the *Register* in accordance with the Rules. Classification may or may not be accompanied by the issuance of a Certificate of class with reference to the Rules.

Certificate of class is valid only if issued by the *Register*.

However, Certificate of class should not be construed as a guarantee of the safety, fitness for purpose or seaworthiness of the vessel. It is merely an attestation that the vessel complies with the Rules developed and published by the *Register*.

In addition, the *Register* is not a guarantee of the safety of life or property at sea or the seaworthiness of a vessel because, although the classification of a vessel is based on the assumption that the vessel will be properly loaded, operated, and maintained by competent and qualified personnel, the *Register* has no control over how a vessel is operated and maintained between the periodic surveys it conducts.

2.4 **Statutory certification** means certification made by the *Register* on behalf of the Flag State Administrations when and to the extent that the *Register* has been authorised to do so by the respective Flag State.

Statutory certification and services include the assessment of vessels registered by the Flag State and/or ship management companies to determine whether such ships/companies comply with the applicable requirements of international conventions, codes and national legislation, and the issuance of, or assistance in the issuance of, the appropriate certificates and documents.

Statutory certification includes, but is not limited to, certification, survey, and issuance of statutory certificates on behalf of the Flag State.

In cases where the *Register* acts on behalf of Flag State Administrations, the *Register* shall follow guidance issued by IMO (Resolutions, Circulars, etc.) or by IACS through Unified Interpretations (UI), unless otherwise directed by the Flag State.

2.5 **Client** means the shipowner, company, shipyard and/or party requesting Services or taking ownership of a classed vessel. In cases where shipowners have authorized another party to operate the vessel on their behalf, that party shall be considered as the company.

In addition to the above the Client means the person and/or entity that has requested Services from the *Register* and that has entered into a Contract or an agreement for Services with the *Register*.

2.6 **Parties** means the *Register* and Client together.

2.7 **Party** means the *Register* or the Client.

2.8 **Contract** means the contract in the form of a written agreement between the Client and the *Register* requesting Services, including these General Terms and Conditions and the Rules.

The provisions related to the Contract in these General Terms and Conditions shall apply even if there is no written agreement between the Client and the *Register*.

The Client may request the *Register* in writing to make a change to the contracted Services. However, the *Register* shall not be obligated to accept or execute any such change until a written agreement has been signed with the Client regarding the compensation and the possible impact of the change on the schedule as an addendum to the originally contracted Services.

2.9 **Services** shall mean the services specified in 2.2. 2.3 and 2.4, but also other services related to certification, classification and statutory certification, such as, but not limited to: ISM Code certification, ISPS Code, MLC 2006 certification, fuel oil consumption reporting, IHM certification, approval of manufacturers and service providers, certification of materials and products, training activities, conformity assessment, and any other relevant activities such as third party inspections, testing, shore and shipboard trials.

The Services provided by the *Register* are performed on a random basis and in no case include a full inspection of all items.

The *Register* shall provide the Services in accordance with related Contract(s), the provisions of these General Terms and Conditions, Rules, the international and national standards, the international conventions, the EU Regulations, the Flag State requirements and the industry practices applicable to the particular Service and always assuming that the Client is aware of these standards and the industry practices.

When providing Services, the *Register* does not guarantee the accuracy of the information or advice provided.

In providing Services, the *Register* does not assess compliance with standards other than the Rules, international and national standards, international conventions, EU regulations, Flag State requirements and industry practice, to the extent agreed in writing or specified in the Contract.

2.10 The ***Register*** means the Croatian Register of Shipping, an entity organized and existing under Croatian law, which, according to the Law on the Croatian Register of Shipping (Official Gazette No. 1996/81, 2013/76 and 2020/62) and the Charter of the *Register*, is an independent, not-for-profit, but public welfare oriented, public foundation that performs tasks:

- classification of sea-going ships,
- statutory certification of sea-going ships on behalf of the Flag State Administrations,
- classification of inland navigation vessels,
- statutory certification of inland navigation vessels,
- statutory certification of recreational crafts,
- certification of materials and products,
- conformity assessment of recreational crafts,
- conformity assessment of marine equipment,
- conformity assessment of pressure vessels,
- certification/registration of quality management systems.

2.11 **Vessel** means a ship, vessel, unit or offshore structure of any kind, whether or not connected to the shore or sea/river bed, located at sea or in inland waters and intended for transportation or special operations on the water, as decided by the *Register*.

2.12 **Rules** means the Rules for the classification, guidelines, instructions, or other documented evidence of the *Register* related to the Services provided.

The competent interpretation of the requirements specified in the Rules or other regulations published by the *Register* shall be the exclusive responsibility of the *Register's* Head Office, notwithstanding any possible different interpretations by other parties.

In cases where the Rules do not contain detailed requirements, the specific approval by the *Register* shall be based on the principles of the Rules and shall ensure a safety standard equivalent to that of the Rules.

Article 3
RESPONSIBILITIES

3.1 It is the Client's responsibility to ensure that all surveys required for vessel's class maintenance are conducted in a timely manner and in accordance with the Rules.

3.2 The *Register* may suspend or withdraw the vessel's existing Certificate of class in the event of serious deficiencies and replace it with a new Certificate of class with a shortened period of validity during which the deficiencies are to be rectified.

In addition, the *Register* shall suspend or withdraw a vessel's Certificate of class if the deficiencies are of such a magnitude as to endanger the class of the vessel, its safety and integrity, the safety of the crew, passengers, or the marine environment, and shall require that the vessel is to be inspected at the first port of call where the necessary repairs are to be carried out.

3.3 The Client should inform the *Register*:

(i) in the event of a change in the intended use of a vessel, a conversion and alteration of the hull, machinery installations and other equipment affecting the Class of the vessel assigned by the *Register*. Conversions and alterations must be made under the supervision of the *Register* and must comply with the requirements of the Rules and/or additional requirements of the *Register*,

(ii) in cases where the vessel has been damaged to such an extent that the Class of the vessel is likely to be affected and the safety and integrity of the vessel is likely to be compromised. In such cases, the vessel must be surveyed at the first port of call or as further directed by the *Register*. The survey shall be to the extent deemed necessary by the *Register*, by taking into account the extent of the damage.

(iii) in cases where class-related deficiencies and/or defects are found as a result of a Flag State inspection or Port State Control. Should the Client fail to notify the *Register* of the detention of the vessel by Port State Authorities due to class related deficiencies, the *Register* reserves the right to suspend or withdraw the Certificate of class.

3.4 The *Register* shall have full control over Certificates issued and may suspend or withdraw a Certificate at any time in its sole discretion if the Client fails to comply with the following requirements set forth in the *Rules for the Classification of Ships, Part 1 - General Requirements, Chapter 1 - General Information*, as applicable:

(i) para. 5.3 - *Maintenance of the validity of Certificate of Class*,
(ii) para. 5.4 - *Period of Validity*,
(iii) para. 5.5 - *Extension of the Period of Validity*,
(iv) para. 5.6 - *Suspension and Reinstatement of Class in the Case of Overdue Surveys*, and
(v) para. 5.7 - *Withdrawal of Class*.

3.5 The *Register* may suspend or withdraw a Certificate at any time in its sole discretion if the Client fails to comply with the following requirements set forth in the *Rules for the Classification of Inland Navigation Vessels, Part 1 - Classification and Surveys, Chapter I - Principles of Classification*, as applicable:

(i) para. 2.8 - *Maintenance of the Validity of the Certificate of Class*,
(ii) para. 2.9 - *Extension of validity of the Certificate of Class*,

and following requirements set forth in the *Rules for the Classification of Inland Navigation Vessels, Part 1 - Classification and Surveys, Chapter II - Classification*, as applicable:

(iii) para. 2.1 – *Suspension of Class*,
(iv) para. 2.2 – *Withdrawal of Class*.

3.6 In addition to clauses 3.2, 3.4 and 3.5 of this Article, the *Register* reserves the right to terminate the Services and related Contract in the event of a breach of the provisions of these General Terms and Conditions.

3.7 If the Client fails to provide the *Register* with the required access or information at the agreed times or fails to prepare for the Service in a timely manner, the *Register* may suspend the provision of the Service until it receives the Client's instructions for access and/or the required information.

The *Register* shall not be liable for the consequences of such suspension, and the Client shall be responsible for the *Register's* additional fees and other unnecessary costs and expenses incurred by the *Register*.

3.8 The Client is obliged to perform timely payments of the invoices for provided Services. However, the *Register* may retain or withhold any Service or Certificate to the Client in the case of outstanding payments, whether mutually related or not, arising out of the entire business relationship with the Client.

Article 4
HEALTH, SAFETY AND ENVIRONMENT

4.1 Both the *Register* and the Client shall apply reasonable standards to promote safety, health, and environmental protection and to provide a safe working environment for their personnel.

4.2 The Client shall provide the *Register* with all access and information necessary for the safe and efficient performance of the requested Services as required by the Rules.

4.3 During the survey, personnel of the *Register* should have secure access to all work that directly or indirectly affects the Service.

4.4 The *Register* has the right to refuse to conduct an activity or visit an area or site if the *Register* in its sole discretion, believes that relevant risks are unacceptable or are not adequately addressed, contained, or otherwise mitigated. Such a decision shall suspend the obligations of both Parties under the Contract without incurring any liability or penalty until the Parties agree on how to proceed.

Article 5
THIRD PARTIES AND SUBCONTRACTORS

5.1 Each specific Contract, including any Certificates issued, relates specifically to the Client, and no rights, obligations, interests, claims, benefits or Certificates issued shall extend to any third party without the prior written consent of the *Register*.

5.2 The Client shall not be entitled to grant any right to use the Certificates to any third party without the prior written consent of the *Register*.

5.3 The Client shall not without *Register's* consent, cede, assign, transfer, subcontract or deal in any manner with all or any of its rights or obligations under any Service and related Contract.

5.4 With regard to third party rights to access information and Certificates under confidentiality clause reference is to be made to Article 9.

Article 6
TAXES

6.1 Each Party shall be responsible for and shall bear all taxes, duties or similar governmental charges levied or imposed on any activity of that Party.

6.2 Prices, fees, rates, or remuneration are exclusive of any form of sales tax, value added tax, administrative fees and services tax and/or other similar taxes, including any surcharges. If any such indirect tax is or becomes applicable to the Services provided under the Contract, the Client shall be responsible for the payment of such indirect taxes.

Article 7
PAYMENT OF INVOICES

7.1 The provision of Services by the *Register*, whether complete or not, shall include payment of fees thirty (30) days after issuance of the invoice for the portion of the Services performed.

7.2 In the event that the Client fails to meet the requirements for payment in accordance with the instalments and terms of payment contained herein, the *Register* reserves the right to charge the Client with the interest rate in accordance with the applicable laws of the Republic of Croatia.

7.3 If the Client disputes an invoice or part of an invoice, the Client shall notify *Register* thereof in writing without undue delay. If no notification is received by the due date, Client shall be deemed to have accepted the invoice in full. If only part of an invoice is disputed, the undisputed amount must be paid by the due date.

Consequently, no disputes arising between the *Register* and the Client shall interfere with prompt payment of invoices by the Client. Any rights of lien or retention in favour of the Client or otherwise, are hereby excluded.

7.4 In the event of cancellation of all or part of the Services prior to their final completion, the Client shall pay all costs incurred by the *Register* on pro-rata basis for the portion of the Services provided to date. In such event, the *Register* will not claim the Client for loss of profit or reduced income. All reasonable costs directly attributable to the early termination and all amounts due to the *Register* at that time shall become immediately due and payable.

7.5 In the event of termination of the Service and related Contract, the *Register* shall be entitled to retain any payments, deposits or prepayments of fees made by the Client prior to the date of termination up to the amount to which the *Register* is entitled.

Article 8
TERMINATION

8.1 The Parties shall have the right to terminate the Services and the related Contract(s) by written notice to the other Party, and without prejudice to Article 7, in the following cases:

(i) if the other Party commits a material breach of these General Terms and Conditions and/or the Contract and fails to rectify such breach in accordance with clause 8.4 of this Article,
(ii) if the other Party becomes insolvent, is unable to pay its debts as they become due, or becomes subject to bankruptcy proceedings, administration, receivership, dissolution, liquidation, winding up or otherwise ceases to carry on its business; or
(iii) for convenience, after giving the other Party thirty (30) days' prior written notice of termination.

8.2 The Classification issued for the relevant vessel and the Certificates previously issued shall remain valid until the effective date of termination or, in the event of such termination, immediately, subject to compliance with Article 3 and Article 7.

8.3 If, in the reasonable opinion of the *Register*, the Client breaches or is suspected of breaching Article 14 or Article 15, the *Register* shall have the right to terminate the Service and related Contract with immediate effect.

8.4 Notwithstanding the provisions of clause 8.1 of this Article, the Party intending to terminate Services for non-compliance or breach of the provisions of these General Terms and Conditions shall notify the other Party of the non-compliance or violation of the provisions of these General Terms and Conditions and set a reasonable deadline of 15 (fifteen) days for the other Party to remedy the breaches of the provisions of these General Terms and Conditions.

If the Party fails to remedy the breaches of the provisions of these General Terms and Conditions within the aforementioned period, the other Party shall have the right to terminate Services without further notice.

8.5 Termination of the Service and related Contract pursuant to the provisions of these General Terms and Conditions shall not give either Party the right to claim any additional compensation, indemnity or reimbursement from the other Party as a result of such termination, but such termination shall not affect any rights or remedies available to a Party at the time the termination becomes effective or any obligations or liabilities incurred by a Party.

Article 9
CONFIDENTIALITY

9.1 The Parties agree to keep confidential all facts, data, information, etc. related to the other Party's business that they have learned in the course of providing Services. Such information and data shall not be disclosed by the Parties to any third party and shall not be used or misused to the detriment of the other Party.

9.2 The *Register* will keep confidential any data, plans or other technical information received from the Client and will not disclose it to any third party outside the *Register*, unless authorised by the Client. This obligation shall continue to apply after termination of the Services. This obligation shall not apply to any data, plans or other technical information that was in the possession of the *Register* prior to being disclosed to the *Register* by or on behalf of the Client, or that becomes publicly available through no fault of the *Register*, or is otherwise provided to the *Register* by an independent source that is under no obligation of confidentiality to the *Register*.

9.3 Certificates issued by the *Register* to the Client as a result of the Services provided shall not be covered by the confidentiality Article.

Notwithstanding the foregoing, the Client shall be entitled to disclose any data to its affiliates involved in the transactions related to the Services or the Client's core activities.

9.4 Notwithstanding clause 9.1 and clause 9.2 of this Article, the *Register* shall have the right to disclose the Confidential Information to the following parties if required by regulations of:

(i) authorised representatives of the Flag State Administration,
(ii) authorised audit teams (i.e., accreditation body or EC auditors),
(iii) the International Association of Classification Societies (IACS),
(iv) a court of competent jurisdiction, government agency, or other relevant public authority, in accordance with applicable law, court order, or other public regulation.

9.5 The Client acknowledges that the *Register* is required to provide access to information to the EU Commission or any person acting on its behalf in accordance with applicable EU requirements and that the Client shall give the EU Commission with unrestricted access to the vessels for the purpose of inspection.

9.6 The obligations in this Article shall survive the conclusion of the Service or the termination of related Contract and shall continue for as long as the relevant information remains confidential.

Article 10
INTELLECTUAL PROPERTY

10.1 Each Party shall be the sole owner of all rights to its Intellectual Property created before or after the effective date of these General Terms and Conditions, whether or not associated with any Contract between the Parties.

10.2 The Intellectual Property developed by the *Register* for the provision of the Services, including but not limited to drawings, calculations and reports, shall remain the exclusive property of the *Register*.

Article 11
PROFESSIONAL ETHICS

11.1 Each of the Parties warrants that, with respect to the matters contemplated herein, neither it nor its affiliates has made or will make, directly or indirectly, any offer, payment, gift or authorization of money to any government official or employee, political party, public official or candidate for the benefit or advantage thereof.

11.2 In providing the Services, the *Register* shall strictly adhere to the requirements of its Code of Ethics relating to business activities.

Article 12
FORCE MAJEURE

12.1 For the purposes of these General Terms and Conditions, the term "Force Majeure" includes any event that directly or indirectly prevents the Parties from fulfilling their obligations due to events beyond their control, such as: strikes, wars, riots, piracy, civil commotion, malicious damage, pandemic, compliance with laws or government orders, rules, regulations or directives, sanctions and embargoes, accidents, defects of plants or machinery, seizures, fires, floods, storms and the like.

12.2 If either Party is prevented or delayed from performing its obligations by Force Majeure, such Party shall promptly notify the other Party in writing of the circumstances of the Force Majeure and its influence and, after such notification, shall not be liable for performance of any obligations prevented by the influence of the Force Majeure during its duration. Upon termination of the influence of the Force Majeure, the same Party should proceed with the planned activities in order to fulfil its obligations.

12.3 If one of the Parties is prevented by Force Majeure in its activities and fulfilment of its obligations and this event lasts continuously for three (3) months, the other Party shall be entitled to terminate the Service and related Contract without liability.

12.4 Neither of the Parties shall be liable for non-compliance with these General Terms and Conditions due to Force Majeure. If one of the Parties is prevented from fulfilling its obligations under these General Terms and Conditions due to Force Majeure, it shall immediately notify the other Party in writing within a reasonable period of time, stating the reasons for the Force Majeure and providing relevant evidence, if any.

Article 13
INDEMNIFICATIONS

13.1 Each Party shall indemnify the other Party against all claims arising out of the performance of the Services in respect of bodily injury, illness or death of any of its employees or other representatives and in respect of loss of or damage to the Party's property.

This provision shall apply whether or not the damage is caused or contributed to by the negligence of the other Party. Both Parties are obliged to take out separate insurances for these liabilities.

13.2 The Client shall indemnify the *Register* from and against all claims arising from the Client's violation of the provisions of these General Terms and Conditions and from the misuse of the Certificates issued by the *Register*.

13.3 The Client shall indemnify the *Register* against any financial responsibility or amounts arising from non-payment, late payment or payment of withholding taxes to the non-relevant tax authority or any other relevant governmental body.

13.4 Each Party shall notify the other Party without undue delay as soon as it becomes aware of any incident that could give rise to a claim against the other Party in respect of the Service provided and related Contract.

Article 14
ANTI-CORRUPTION

14.1 Each Party agrees that in performing its obligations under any Service, it will ensure that its affiliates, employees and/or agents, subsidiaries, subcontractors, consultants, and any other persons providing Services will:

(i) comply with all applicable anti-bribery and anti-corruption laws (collectively, Anti-Bribery Laws) and, in particular, do not, directly or indirectly, offer, promise, grant, authorise the payment of, or confer any financial or other benefit on any public or government official:
- to a public or governmental official to obtain or retain business with the intent to influence such official in his or her capacity as an official, if such official is not permitted or required by written law to be influenced by the offer, promise or gift; or
- to another person with the intent to induce or reward the improper performance of a function or activity or for any other illegal purpose,

(ii) maintain adequate systems and procedures designed to prevent activities, practises, or conduct in connection with services that would constitute an offence under an anticorruption law; and
(iii) take reasonable steps to prevent similar acts by customers, contractors, subcontractors, agents and other third parties, persons under its control or influence.

14.2 Any failure by a Party to comply with or ensure compliance with its obligations under this Article shall, notwithstanding anything to the contrary in these General Terms and Conditions, be deemed a breach of these General Terms and Conditions which shall entitle the other Party to suspend and/or terminate the Services by notice in writing with immediate effect without further liability to the other Party except for any liability which may have arisen prior to the date of termination or suspension (as the case may be).

14.3 If a Party elects to suspend the provision of Services under these General Terms and Conditions pursuant to this Article, it shall have the sole and absolute discretion to determine:

(i) when it will resume performance (if at all); and
(ii) extend the period for performance of its obligations under the Services in its sole discretion.

Article 15
SANCTIONS

15.1 Each Party shall conduct all activities in compliance with all laws, statutes, rules, economic and trade sanctions (including, but not limited to, U.S. sanctions and EU sanctions) and regulations applicable to such Party, including, but not limited to: child labour, forced labour, collective bargaining, discrimination, abuse, working hours and minimum wages, anti-bribery, anti-corruption, copyright and trademark protection, personal data protection.

15.2 Each Party hereby represents and warrants that it is not or will not be subject to any economic or trade sanctions ("Sanctions") imposed by the United States of America, the European Union, the United Kingdom, any EU Member State, or the United Nations with respect to any country and/or by any sanction giver with respect to any company/individual.

15.3 Each Party represents and warrants that it will strictly comply with all Sanctions.

15.4 Nothing in these General Terms and Conditions shall be construed as causing or obligating either Party to act or refrain from acting in a manner inconsistent with, punishable by, or prohibited by any Sanctions.

15.5 Neither Party shall be obligated to perform any obligation arising under these Terms and Conditions (including, without limitation, the obligation to):

(i) perform, deliver, accept, sell, purchase, pay or receive any funds to, from or through any person or entity; or
(ii) engage in any other action whatsoever,

if doing so violates or is inconsistent with sanctions and/or recommendations of international (intergovernmental) organisations to combat the financing of terrorism and other criminal activities and/or money laundering or exposes such Party to investigation or penalties.

15.6 In the event that a Party breaches any Sanctions or the Party's Business and/or Transactions arising out of or in connection with these General Terms and Conditions breach any Sanctions or otherwise violate the recommendations of one or more international (intergovernmental) organisations for combating the financing of terrorism and other criminal activities and/or money laundering, the other Party shall be entitled to terminate these General Terms and Conditions by written notice with immediate effect without incurring any liability to the other Party, except for liabilities (if any) incurred prior to the date of termination.

Article 16
LIABILITY

16.1 The *Register* is not, and cannot be considered as, an underwriter, consulting engineer, naval architect, shipbuilder, shipowner, or ship management company, nor can it assume the obligations and responsibilities associated with such functions, although the *Register's* experience may enable it to respond to inquiries about matters not covered by its Rules, policies, instructions, or other documented evidence.

16.2 The practices and procedures of the *Register* shall be selected by the *Register* in its sole and absolute discretion based on its experience and knowledge and in accordance with generally accepted professional standards in the relevant field of classification societies.

16.3 Nothing herein contained shall release any designer, naval architect or engineer, shipbuilder or manufacturer, shipyard, vendor, supplier, contractor or subcontractor, repairer or owner, from any information, report, certificate or similar document issued in connection with the provision of Services by the *Register*, operator, manager or other person or entity from any express or implied warranty or other contractual obligation or responsibility, or from any negligent act, error or omission of any kind whatsoever, nor shall they create any right, claim or benefit for any third party.

16.4 The *Register* shall exercise due care in the selection or appointment of its surveyors and all other employees whose presence and work is necessary for the provision of the Services.

16.5 If any person or entity using the Services of the *Register* suffers any loss, damage or expense that is or is shown to have been caused by a negligent act, omission or error of the *Register's* officers, surveyors, auditors, inspectors, agents, appointers, officers or managers, or those purporting to act in the name of and on behalf of the *Register*, or a negligent inaccuracy, advice, report or evidence given by or in the name of or/and on behalf of the *Register*, then the liability of the *Register* is limited in respect of any direct or indirect claim shall be limited to an amount not exceeding five times the fee charged or to be charged by the *Register* for the relevant Service.

16.6 Any liability for consequential damages is expressly excluded.

For purposes of this clause, consequential damages include, without limitation:

(i) indirect or consequential damages,
(ii) loss and/or delay of production, loss of products, loss of use, loss of bargain, loss of revenue, loss of profit or anticipated profit, loss of business and business interruption, in each case directly or indirectly.

16.7 The Parties are not entitled to assign the performance of obligations under these General Terms and Conditions or parts thereof to third parties without the prior written consent of the other Party.

16.8 If during the term of the Contract, there is a transfer of function due to change of status (merger, acquisition, division, etc.), all obligations and rights under these General Terms and Conditions and associated Contract will be transferred to the legal successor of the Party concerned.

Article 17
GOVERNING LAW AND RESOLVING OF DISPUTES

17.1 These General Terms and Conditions and any dispute or claim between the Parties arising from or in connection with it, or the Services provided hereunder, will be governed and interpreted in accordance with the English law.

17.2 The Parties shall use their reasonable efforts to resolve any claim or dispute arising in relation to rendered Service by negotiations within a reasonable time.

17.3 Should the Parties fail to resolve any claim or dispute by negotiations, the dispute shall be exclusively subject to the jurisdiction of the Permanent Arbitration Court with the Croatian Chamber of Economy in Zagreb, Republic of Croatia.

17.4 The Parties agree to keep the any arbitration proceedings confidential.

17.5 Notwithstanding the above, any claim not presented within three (3) months of the completion of the particular Services, or within three (3) months of from the date when the events which are relied on were first discovered by the Client, shall be deemed waived and absolutely time barred.

17.6 Any objections against the line adopted by any of the *Register's* servants in fulfilling their duties or against the conclusions reached are to be raised to the *Register* by the Party as soon as possible.

If the Party is not satisfied with the final conclusions and interpretations by the *Register* the arbitration lays upon the Commission for appeal for Classification and Statutory certification of ships, which is to be formed according to the Regulation 39 of the Charter of the *Register*.

INTRODUCTORY NOTES

These amendments shall be read together with the requirements in the Rules for the Classification of Ships, Part 25 – Metallic materials, edition July 2021, as last amended by Amendments No. 2, edition January 2023.

Table 1 contains review of amendments, where items changed or added in relating to previous edition are given, with short description of each modification or addition. All major changes throughout the text are shaded.

TABLE 1 – REVIEW OF AMENDMENTS

This review comprises amendments in relation to the Rules for the Classification of Ships, Part 25 – Metallic materials, edition July 2021, as last amended by Amendments No. 2, edition January 2023.

ITEM	*DESCRIPTION OF THE AMENDMENTS*
SECTION 3 - STEEL AND IRON MATERIALS	
Head 3.11	is partly changed to align with UR W7, Rev.4, Feb 2022
Head 3.12	is partly changed to align with UR W8, Rev.3, Mar 2022

This Part of the Rules includes the requirements of the following international Organisations:

International Association of Classification Societies (IACS)

Unified Requirements (UR): W2 (Rev.3, Sep 2021),W7 (Rev.4, Feb 2022), W8 (Rev.3, Mar 2022), W9 (Rev.2, 2004), W10 (Rev.2, 2004), W11 (Rev.9, 2017), W13 (Rev.7, Sep 2021), W14 (Rev.3, Sep 2021), W16 (Rev 3, 2016), W18 (Rev. 6, Sep 2021), W24 (Rev. 4, July 2020), W25 (Rev. 6, Sep 2021), W27 (Rev. 2, July 2020, corr. 1, Sep 2020), W29 (2005), W30 (2013), W31 (rev. 2, 2019), S33 (Rev. 3, Feb 2020)

Recommendations (Rec.): Rec. 139 (2015), Rec. 69 (Rev. 2, Oct 2020), Rec.68 (Rev.1, Apr 2021), Rec.169 (Sep 2021)

3 STEEL AND IRON MATERIALS

■ **Head 3.11 HULL AND MACHINERY STEEL FORGINGS** is partly changed, and should be read as:

3.11 HULL AND MACHINERY STEEL FORGINGS

3.11.1 Scope

3.11.1.1 These requirements are applicable to steel forgings, intended for hull and machinery applications as specified in the *Rules for the classification of ships, Part 3 – Hull equipment, Part 7 – Machinery installation, Part 9 – Machines, etc*. Where relevant, these requirements are also applicable to material for forging stock and to rolled bars, intended to be machined into components of simple shape.

3.11.1.2 These requirements are applicable only to steel forgings, where the design and acceptance tests are related to mechanical properties at ambient temperature. For other applications, additional requirements may be necessary, especially when the forgings are intended for service at low or elevated temperatures.

3.11.1.3 Alternatively, forgings which comply with national or proprietary specifications may be accepted provided such specifications give reasonable equivalence to these requirements or are otherwise specially approved or required by the *Register*.

3.11.2 Manufacture

3.11.2.1 Forgings are to be made at a manufacturer, approved by the *Register*.

3.11.2.2 The steel used in the manufacture of forgings is to be made by a process approved by the *Register*. The works at which the steel was produced is to be approved by the *Register*. Where the steel is produced at a separate works to the forging, the steel manufacturer is also to be approved by the *Register*.

3.11.2.3 Adequate top and bottom discards are to be made to ensure freedom from piping and harmful segregation in the finished forgings.

3.11.2.4 The plastic deformation is to be such as to ensure soundness, uniformity of structure and satisfactory mechanical properties after heat treatment. The reduction ratio is to be calculated with reference to the average cross-sectional area of the cast material. Where the cast material is initially upset, this reference area may be taken as the average cross-sectional area after this operation. Unless otherwise approved, the total reduction ratio is to be at least:

- for forgings made from ingots or from forged blooms or billets, 3:1 where L > D and 1.5:1 where L ≤ D
- for forgings made from rolled products,
  4:1 where L > D and 2:1 where L ≤ D
- for forgings made by upsetting, the length after upsetting is to be not more than one-third of the length before upsetting or, in case of an initial forging reduction of at least 1.5:1, not more than one-half of the length before upsetting
- for rolled bars, 6:1.

L and D are the length and diameter respectively of the part of the forging under consideration.

3.11.2.5 For crankshafts, where grain flow is required in the most favourable direction having regard to the mode of stressing in service, the proposed method of manufacture may require special approval by the *Register*. In such cases, tests may be required to demonstrate that a satisfactory structure and grain flow are obtained.

3.11.2.6 The shaping of forgings or rolled slabs and billets by flame cutting, scarfing or arc-air gouging is to be undertaken in accordance with recognized good practice and, unless otherwise approved, is to be carried out before the final heat treatment. Preheating is to be employed when necessitated by the composition and/or thickness of the steel.

For certain components, subsequent machining of all flame cut surfaces may be required.

3.11.2.7 When two or more forgings are joined by welding to from a composite component, the proposed welding procedure specification is to be submitted for approval. Welding procedure qualification tests are be required by the *Register*.

3.11.2.8 *Rules for the classification of ships, Part 26 – Welding, 1.4 Welding procedure tests* is applicable to the requirements for welding procedure qualification tests of steel forgings intended to be used for the components of hull construction and marine structures. Requirements for other WPS and qualification thereof, for welder certification and for type approval of welding consumables are at the discretion of the *Register*.

3.11.2.9 Welders intended to be engaged in fusion welding of steel forgings for hull structures are to be qualified in accordance with the *Rules for the classification of ships, Part 26 – Welding, 1.3 Qualification testing and certification of welders.*

3.11.3 Quality of forgings

3.11.3.1 All forgings are to be free from surface or internal defects which would be prejudicial to their proper application in service.

3.11.4 Chemical composition

3.11.4.1 All forgings are to be made from killed steel and the chemical composition is to be appropriate for the type of steel, dimensions and required mechanical properties of the forgings being manufactured.

3.11.4.2 The chemical composition of each heat is to be determined by the manufacturer on a sample taken preferably during the pouring of the heat. When multiple heats are tapped into a common ladle, the ladle analysis shall apply.

3.11.4.3 The chemical composition is to comply with the overall limits given in Tables 3.11.4.3.1 and 3.11.4.3.2, or where applicable, the requirements of the approved specification.

3.11.4.4 At the option of the manufacturer, suitable grain refining elements such as aluminium, niobium or vanadium may be added. The content of such elements is to be reported.

3.11.4.5 Elements designated as residual elements in the individual specifications are not be intentionally added to the steel. The content of such elements is to be reported.

Table 3.11.4.3.1
Chemical composition limits[1)] for hull steel forgings[6)]

Steel type	C	Si	Mn	P	S	Cr[4)]	Mo[4)]	Ni[4)]	Cu[4)]	Total residuals
C, C-Mn	0.23[2), 3)]	0.45	030-1.50	0.035	0.035	0.30[4)]	0.15[4)]	0.40[4)]	0.30	0.85
Alloy	[5)]	0.45	[5)]	0.035	0.035	[5)]	[5)]	[5)]	0.30	-

1) Composition in percentage mass by mass maximum unless shown as a range.
2) The carbon content may increased above this level provided that the carbon equivalent (Ceq) is not more than 0,41%, calculated using the following formula:

$$Ceq = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \%$$

3) The carbon content of C and C-Mn steel forgings not intended for welded construction may be 0.65 maximum.
4) Elements are considered as residual elements.
5) Specification is to be submitted for approval.
6) Rudder stocks and pintles should be of weldable quality.

Table 3.11.4.3.2
Chemical composition limits[1)] machinery steel forgings

Steel type	C	Si	Mn	P	S	Cr[4)]	Mo[4)]	Ni[4)]	Cu[4)]	Total residuals
C, C-Mn	0.23[2), 3)]	0.45	030-1.50	0.035	0.035	0.30	0.15	0.40	0.30	0.85
Alloy[5)]	0.45	0.45	030-1.00	0.035	0.035	Min 0.40[6)]	Min 0.15[6)]	Min 0.40[6)]	0.30	-

1) Composition in percentage mass by mass maximum unless shown as a range or a minimum.
2) The carbon content may increased above this level provided that the carbon equivalent (Ceq) is not more than 0,41%.
3) The carbon content of C and C-Mn steel forgings not intended for welded construction may be 0.65 maximum.
4) Elements are considered as residual elements unless shown as a minimum.
5) Where alloy steel forgings are intended for welded constructions, the proposed chemical composition is subject to approval by the *Register*.
6) One more of the elements is to comply with the minimum content.

3.11.5 Heat treatment (including surface hardening and straightening)

3.11.5.1 At an appropriate stage of manufacture, after completion of all hot working operations, forgings are to be suitably heat treated to refine the grain structure and to obtain the required mechanical properties.

3.11.5.2 Except as provided in 3.11.5.6 and 3.11.5.7 forgings are to be supplied in one of the following conditions:

a) Carbon and carbon-manganese steel
Fully annealed
Normalized
Normalized and tempered
Quenched and tempered

b) Alloy steel
Normalized
Normalized and tempered
Quenched and tempered

For all types of steel the tempering temperature is to be not less than 550ºC.

The delivery condition shall meet the design and application requirements, it is the manufacturers responsibility to select the appropriate heat treatment method to obtain the required mechanical properties. Where forgings for gearing are not intended for surface hardening, lower tempering temperature may be allowed.

3.11.5.3 Heat treatment is to be carried out in properly constructed furnaces which are efficiently maintained and have adequate means for control and recording of temperature. The furnace dimensions are to be such as to allow the whole furnace charge to be uniformly heated to the necessary temperature. In the case of very large forgings alternative methods of heat treatment will be specially considered by the *Register*.

Sufficient thermocouples are to be connected to the furnace charge to measure and record that its temperature is adequately uniform, unless temperature uniformity of the furnace is verified at regular intervals.

3.11.5.4 If for any reasons a forging is subsequently heated for further hot working, the forging is to be reheat treated.

3.11.5.5 Where it is intended to surface harden forgings, full details of the proposed procedure and specification are to be submitted for the approval of the *Register*. For the purposes of this approval, the manufacture may be required to demonstrate by test that the proposed procedure gives a uniform surface layer of the required hardness and depth and that it does not impair the soundness and properties of the steel.

3.11.5.6 Where induction hardening or nitriding is to be carried out, forgings are to be heat treated at an appropriate stage to a condition suitable for this subsequent surface hardening.

3.11.5.7 Where carburizing is to be carried out, forgings are to be heat treated at an appropriate stage (generally either by full annealing or by normalizing and tempering) to a condition suitable for subsequent machining and carburizing.

3.11.5.8 If a forging is locally reheated or any straightening operation is performed after the final heat treatment consideration is to be given to a subsequent stress relieving heat treatment. The manufacturer shall have strict control of this temperature in order to avoid any detrimental effects to the final heat treatment and resultant microstructure and mechanical properties of the forging.

3.11.5.9 The forge is to maintain records of heat treatment identifying the furnace used, furnace charge, date, temperature and time at temperature. The records are to be presented to the Surveyor on request.

3.11.6 Mechanical tests

3.11.6.1 Test material, sufficient for the required test and for possible retest purposes, is to be provided with a cross-sectional area of not less than that part of the forging which it represents. This test material is to be integral with each forging except as provided in 3.11.6.8 and 3.11.6.11. Where batch testing is permitted according to 3.11.6.11, the test material may alternatively be a production part or separately forged. Separately forged test material is to have a reduction ratio similar to that used for the forgings represented.

3.11.6.2 For the purpose of these requirements a set of test is to consist of one tensile test specimen and, when required, three Charpy V-notch impact test specimens.

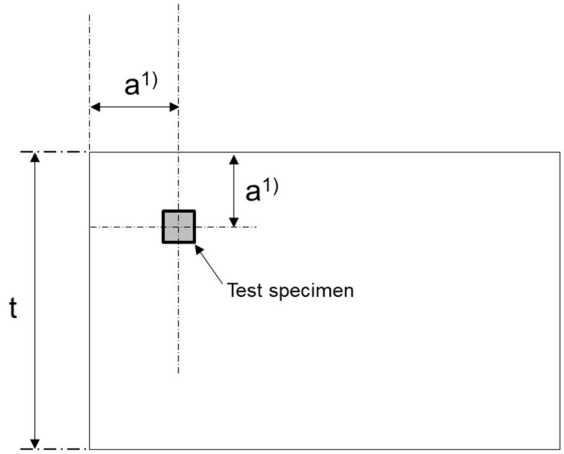
3.11.6.3 Test specimens are normally to be cut with their axes either mainly paralleled (longitudinal test) or mainly tangential (tangential test) to the principal axial direction of each product.

3.11.6.4 The test specimens shall be positioned as follows:

a) For forgings having a thickness, t, or diameter D up to maximum 50 mm, the longitudinal axis of the test specimen is to be located at a distance of t/2 or D/2 below the heat treated surfaces.

b) For forgings having a thickness, t, or diameter D greater than 50 mm, the longitudinal axis of the test specimen is to be located at a distance of t/4 or D/4 (mid-radius) or 80 mm, whichever is less, below any heat treated surface.

Test specimen is to be located with its longitudinal axis at a distance from any heat treated surface as shown in Figure 3.11.6.4.1.



1) "a" is the distance from the test specimen to heat treated surface based on the above b) or c).

Figure 3.11.6.4.1
Position of the test specimen

3.11.6.5 Where the manufacturer can demonstrate that a proposed testing location or orientation is more representative of the required mechanical properties of a component, this may be agreed with the *Register*. In such cases, the heat treatment process, a proposed testing location or orientation, and technical justification shall be submitted to the *Register* for approval.

3.11.6.6 Except as provided in 3.11.6.11 the number and direction of tests is to be as follows.

a) *Hull components such as rudder stocks, pintles etc. General machinery components such as shafting, connecting rods, etc.*
One set of tests is to be taken from the end of each forging in a longitudinal direction except that, at the discretion of the manufacture, the alternative directions or positions as shown in Fig. 3.11.6.5.1, 3.11.6.5.2 and 3.11.6.5.3 may be used. Where a forging exceeds both 4 tonnes in mass and 3 m in length, one set of tests is to be taken from each end. These limits refer to the "as forged" mass and length but excluding the test material.

b) *Pinions*
Where the finished machined diameter of the toothed portion exceeds 200 mm one set of tests is to be taken from each forging in a tangential direction adjacent to the toothed portion (test position B in Fig. 3.11.6.5.4). Where the dimensions preclude the preparation of tests from this position, tests in a tangential direction are to be taken from the end of the journal (test position C in Fig. 3.11.6.5.4). If however, the journal diameter is 200 mm or less the tests are to be taken in a longitudinal direction (test position A in Fig. 3.11.6.5.4). Where the finished length of the toothed portion exceed 1.25 m, one set of tests is to be taken from each end.

c) *Small pinions*
Where the finished diameter of the toothed portion is 200 mm or less one set of tests is to be taken in a longitudinal direction (test position A in Fig. 3.11.6.5.4).

d) *Gear wheels*
One set of tests is to be taken from each forging in a tangential direction (test position A or B in Fig. 3.11.6.5.5).

e) *Gear wheel rims (made by expanding)*
One set of tests is to be taken from each forging in a tangential direction (test position A or B in Fig. 3.11.6.5.6). Where the finished diameter exceeds 2.5 m or the mass (as heat treated including test material) exceeds 3 tonnes, two sets of tests are to be taken from diametrically opposite positions (test positions A and B in Fig. 3.11.6.5.6). The mechanical properties for longitudinal test are to be applied.

f) *Pinion sleeves*
One set of tests is to be taken from each forging in a tangential direction (test position A or B in Fig. 3.11.6.5.7). Where the finished length exceeds 1.25 m one set of tests is to be taken from each end.

g) *Crankwebs*
One set of tests is to be taken from each forging in a tangential direction.

h) *Solid open die forged crankshafts*
One set of tests is to be taken in a longitudinal direction from the driving shaft end of each forging (test position A in Fig. 3.11.6.5.8).
Where the mass (at heat treated but excluding test material) exceeds 3 tonnes, test in a longitudinal direction are to be taken from each end (test position A and B in Fig. 3.11.6.5.8). Where, however, the crankthrows are formed by

machining or flame cutting, the second set of tests is to be taken in a tangential direction from material removed from the crankthrow at the end opposite the driving shaft end (test position C in Fig. 3.11.6.5.8).

i) One set of tests is to be taken from each forging in a tangential direction (test positions are shown in Fig. 3.11.6.5.9). Where the finished diameter exceeds 2.5m or the mass (as heat treated, including test material) exceeds 3 tonnes then two sets of tests are to be taken diametrically opposite positions.

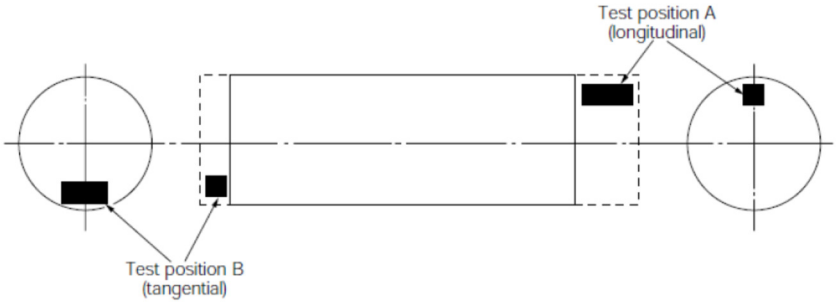


Figure 3.11.6.5.1
Plain shaft

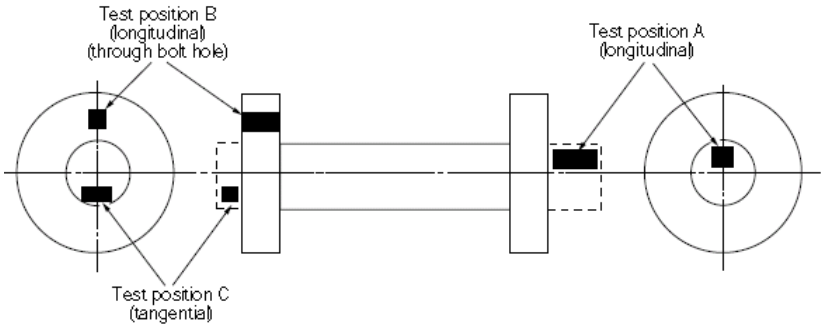


Figure 3.11.6.5.2
Flanged shaft

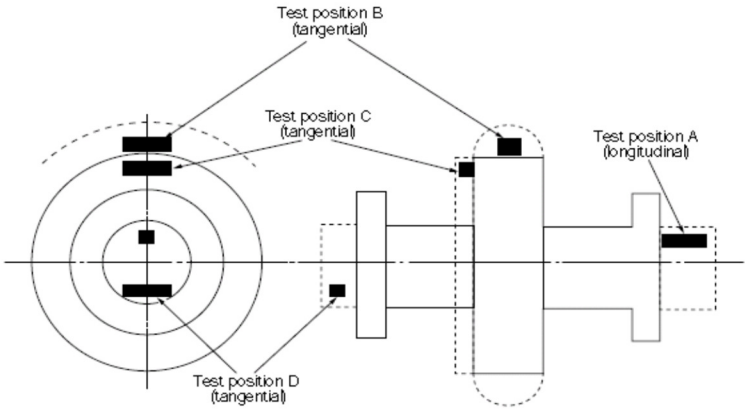
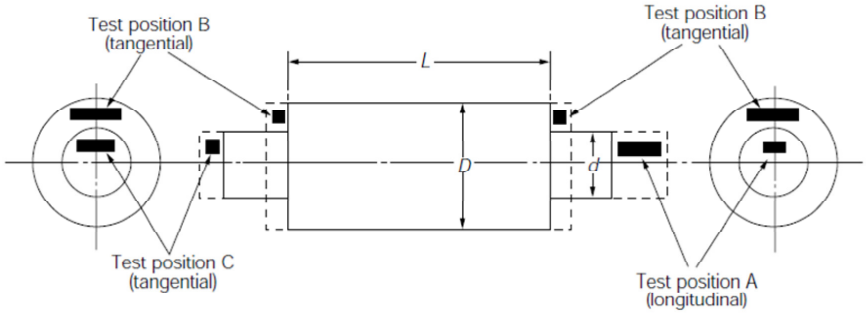


Figure 3.11.6.5.3
Flanged shaft with collar



L = length of toothed portion
D = diameter of toothed portion
d = journal diameter

Figure 3.11.6.5.4
Pinion

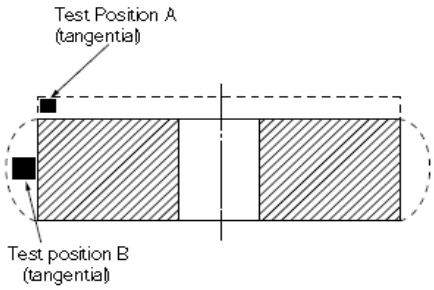


Figure 3.11.6.5.5
Gear wheel

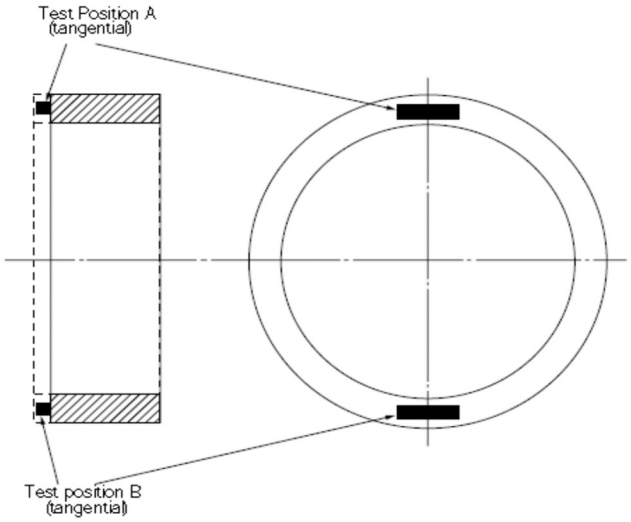


Figure 3.11.6.5.6
Gear rim (made by expanding)

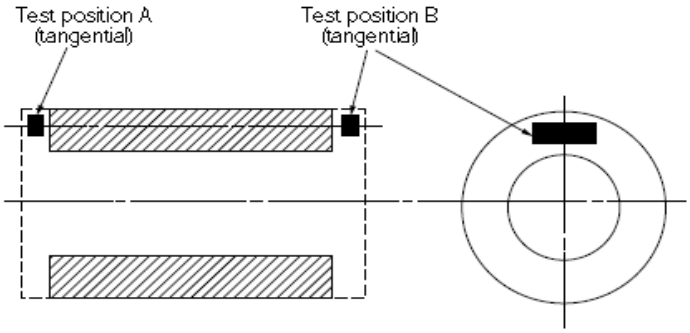


Figure 3.11.6.5.7
Pinion sleeve

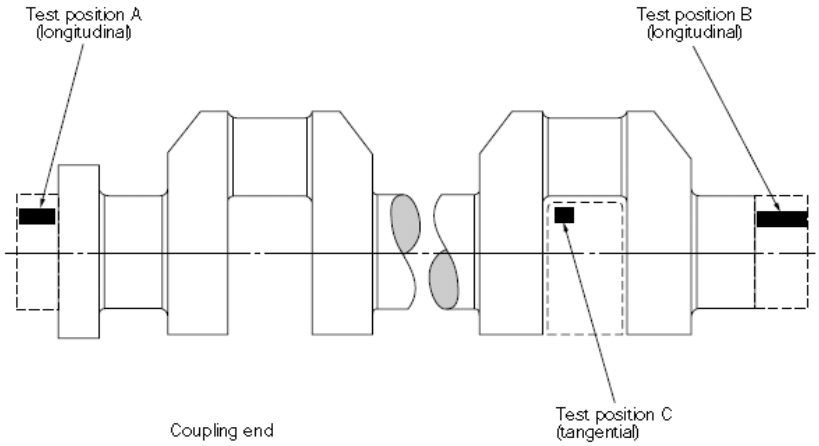


Figure 3.11.6.5.8
Solid forged crankshaft

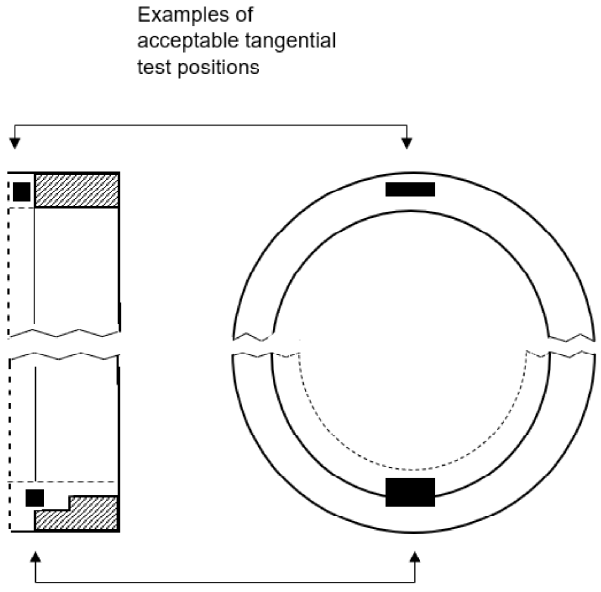


Figure 3.11.6.5.9
Forged rings

3.11.6.7 For closed die crankshaft forgings and crankshaft forgings where the method of manufacture has been specially approved in accordance with 3.11.2.5, the number and positions of test specimens is to be agreed with the *Register,* having regard to the method of manufacture employed.

3.11.6.8 When a forging is subsequently divided into a number of components, all of which are heat treated together in the same furnace charge, for test purposes this may be regarded as one forging and the number of tests required is to be related to the total length and mass of the original multiple forging.

3.11.6.9 Except for components which are to be carburized or for hollow forgings where the ends are to be subsequently closed, test material is not to be cut from a forging until all heat treatment has been completed.

3.11.6.10 When forgings are to be carburized, sufficient test material is to be provided for both preliminary tests at the forge and for final tests after completion of carburizing.

For this purpose duplicate sets of test material are to be taken from positions as detailed in 3.11.6.6, except that irrespective of the dimensions or mass of the forging, tests are required from one position only and, in the case of forgings with integral journals, are to be cut in a longitudinal direction.

This test material is to be machined to a diameter of $D/4$ or 60 mm, whichever is less, where D is the finished diameter of the toothed portion.

For preliminary tests at the forge one set of test material is to be given a blank carburizing and heat treatment cycle simulating that which subsequently will be applied to the forging.

For final acceptance tests, the second set of test material is to be blank carburized and heat treated along with the forgings which they represent.

At the discretion of the forgemaster or gear manufacture test samples of larger cross section may be either carburized or blank carburized, but these are to be machined to the required diameter prior to the final quenching and tempering heat treatment.

Alternative procedures for testing of forgings which are to be carburized may be specially agreed with the *Register*.

3.11.6.11 Normalized forgings with mass up to 1000 kg each and quenched and tempered forgings, with mass up to 500 kg each, may be batch tested. A batch is to consist of forgings of similar shape and dimensions, made from the same heat of steel, heat treated in the same furnace charge and with a total mass not exceeding 6 tonnes for normalized forgings and 3 tonnes for quenched and tempered forgings, respectively.

3.11.6.12 A batch testing procedure may also be used for hot rolled bars. A batch is to consist of either:

a) material from the same rolled ingot or bloom provided that where this is cut into individual lengths, these are all heat treated in the same furnance charge, or

b) bars of the same diameter and heat, heat treated in the same furnace charge and with a total mass, not exceeding 2.5 tonnes.

3.11.6.13 The preparation of test specimens and the procedures used for mechanical testing are to comply with the relevant requirements of Chapter 2. Unless otherwise agreed, all tests are to be carried out in the presence of the Surveyor.

3.11.7 Mechanical properties

3.11.7.1 Tables 3.11.7.1.3 and 3.11.7.1.4 give the minimum requirements for yield stress, elongation, reduction of area and impact test energy values corresponding to different strength levels but it is not intended that these should necessarily be regarded as specific grades. Where it is proposed to use a steel with a specified minimum tensile strength intermediate to those given, corresponding minimum values for the other properties may be obtained by interpolation.

3.11.7.2 Forgings may be supplied to any specified minimum tensile strength selected within the general limits detailed in Tables 3.11.7.1.3 or 3.11.7.1.4, but subject to any additional requirements of the relevant *Rules*.

3.11.7.3 The mechanical properties are to comply with the requirements of Tables 3.11.7.1.3 or 3.11.7.1.4 appropriate to the specified minimum tensile strength or, where applicable, the requirements of the approved specification.

3.11.7.4 At the discretion of *Register,* hardness tests may be required on the following:

- Gear forgings after completion of heat treatment and prior to machining the gear teeth. The hardness is to be determined at four positions equally spaced around the circumference of the surface where teeth will subsequently be cut. Where the finished diameter of the toothed portion exceeds 2.5 m, the above number of test positions is to be increased to eight. Where the width of a gear wheel rim forging exceeds 1.25 m, the hardness is to be determined at eight positions at each end of the forging.
- Small crankshaft and gear forgings which have been batch tested. In such cases at least one hardness test is to be carried out on each forging.

The results of hardness test are to be reported and, for information purposes, typical Brinell hardness values are given in Table 3.11.7.1.4.

3.11.7.5 Hardness tests may also be required on forgings which have been induction hardened, nitrided or carburized. For gear forgings these tests are to be carried out on the teeth after, where applicable, they have been ground to the finished profile. The results of such tests are to comply with the approved specifications (see 3.11.5.5).

3.11.7.6 Re-test requirements for Charpy impact test are to be in accordance with Chapter 2.

3.11.7.7 Re-test requirements for tensile tests are to be in accordance with Chapter 2.

3.11.7.8 The additional tests detailed in 3.11.7.6 and 3.11.7.7 are to be taken, preferably from material adjacent to the original tests, but alternatively from another test position or sample representative of the forging or batch of forgings.

3.11.7.9 At the option of the manufacturer, when a forging or a batch of forgings has failed to meet the test requirements, it may be reheat treated and re-submitted for acceptance tests.

Table 3.11.7.1.3
Mechanical properties for hull steel forgings

Steel type	Tensile strength[1] R_m min. N/mm^2	Yield stress R_e min. N/mm^2	Elongation A_5 min. %		Reduction of area Z min. %		Charpy V-notch impact test[2]		
			Long.	Tang.	Long.	Tang.	Test temperature (°C)	Minimum average energy (J)	
								Long.	Tang.
C and C-Mn	400	200	26	19	50	35	0	27	18
	440	220	24	18	50	35			
	480	240	22	16	45	30			
	520	260	21	15	45	30			
	560	280	20	14	40	27			
	600	300	18	13	40	27			
Alloy	550	350	20	14	50	35			
	600	400	18	13	50	35			
	650	450	17	12	50	35			

1) The following ranges for tensile strength may be additionally specified:
specified minimum tensile strength: < 600 N/mm^2 ≥ 600 N/mm^2
tensile strength range: 120 N/mm^2 150 N/mm^2

2) Special consideration may be given to alternative requirements for Charpy V-notch test, depending on design and application, and subject to agreement by the *Register*.

Table 3.11.7.1.4
Mechanical properties for machinery steel forgings[2)]

Steel type	Tensile strength[1)] R_m min. N/mm^2	Yield stress R_e min. N/mm^2	Elongation A_5 min. %		Reduction of area Z min. %		Hardness[3)] (Brinell)	Charpy V-notch impact test[2)]		
			Long.	Tang.	Long.	Tang.		Test temperature (°C)	Minimum average energy (J) Long.	Minimum average energy (J) Tang.
C and C-Mn	400	200	26	19	50	35	110-150	AT[5)]	27	18
	440	220	24	18	50	35	125-160			
	480	240	22	16	45	30	135-175			
	520	260	21	15	45	30	150-185			
	560	280	20	14	40	27	160-200			
	600	300	18	13	40	27	175-215			
	640	320	17	12	40	27	185-230			
	680	340	16	12	35	24	200-240			
	720	360	15	11	35	24	210-250			
	760	380	14	10	35	24	225-265			
Alloy	600	360	18	14	50	35	175-215			
	700	420	16	12	45	30	205-245			
	800	480	14	10	40	27	235-275			
	900	630	13	9	40	27	260-320			
	1000	700	12	8	35	24	290-365			
	1100	770	11	7	35	24	320-385			

1) The following ranges for tensile strength may be additionally specified:

specified minimum tensile strength:	< 900 N/mm^2	≥ 900 N/mm^2
tensile strength range:	150 N/mm^2	200 N/mm^2

2) For materials used for machinery exposed to sea water temperature, such as propeller shafts and shaft bolts, intended for ships with ice class notation IA Super, IA, IB and IC, Charpy V-notch impact testing is to be carried out for all steel types at –10°C and the average energy value is to be minimum 20J (longitudinal test). One individual value may be less than the required average value provided that it is not less than 70% of this average value.

3) The hardness values are typical and are given for information purposes only.

4) Special consideration may be given to alternative requirements for Charpy V-notch test, depending on design and application, and subject to agreement by the *Register*.

5) AT refers to Ambient Temperature (i.e. 23°C±5°C), which is specified in ISO 148-1:2016.

3.11.8 Inspection

3.11.8.1 All forgings should be subjected to a 100% visual examination of all accessible surfaces by the manufacturer and made available to the Surveyor. Where applicable, this visual examination is to include the examination of internal surfaces and bores. Unless otherwise agreed the verification of dimensions is the responsibility of the manufacturer.

3.11.8.2 When required by the relevant *Rules*, or by approved procedure for welded composite components (see 3.11.2.7) appropriate non-destructive testing is also to be carried out before acceptance and the results are to be reported by the manufacturer.

3.11.8.3 Where required by the relevant *Rules* or *IACS Recommendation No.68 Guidelines for non-destructive testing of hull and machinery steel forgings* (Work instruction *QW73 Non-destructive testing of hull and machinery steel forgings* respectively), ultrasonic examination is to be carried out after the forgings have been machined to a condition suitable for this type of examination and after the final heat treatment. Both radial and axial scanning are to be carried out where appropriate for the shape and the dimensions of the forgings being examined.

3.11.8.4 The method and the extent of inspection, NDT and acceptance criteria are to be agreed with the *Register*. *IACS Recommendation No. 68 Guidelines for non-destructive testing of hull and machinery steel forgings (Work* instruction *QW73 Non-destructive testing of hull and machinery steel forgings* respectively) is regarded as an example of an acceptable standard.

For mass produced forgings the extent of examination is to be established at the discretion of the *Register*.

3.11.8.5 Unless otherwise agreed, examinations are to be carried out by the manufacturer, although Surveyors may request to be present in order to verify that the examination is being carried out in accordance with the agreed procedure.

3.11.8.6 If the forging is supplied in the 'as forged' condition for machining at a separate works, the manufacturer is to ensure that a suitable ultrasonic examination is carried out to verify the internal quality of the forging.

3.11.8.7 Where advanced ultrasonic testing methods are applied, e.g. PAUT or TOFD, reference is made to *Rules for the classification of ships, Part 26 – Welding, 2.6 Advanced non-destructive testing of materials and welds*, for general approach in adopting and application of these advanced methods.

In such cases, acceptance levels regarding accept/reject criteria may be as per the applicable section in the *IACS Recommendation No. 68 Guidelines for non-destructive testing of hull and machinery steel forgings* (Work instruction *QW 73 Non-destructive testing of hull and machinery steel forgings* respectively)

3.11.8.8 When required by the conditions of approval for surface hardened forgings (3.11.5.5 refers) additional test samples are to be processed at the same time as the forgings which they represent. These test samples are subsequently to be sectioned in order to determine the hardness, shape and depth of the locally hardened zone and which are to comply with the requirements of the approved specification.

3.11.8.9 In the event of any forging proving defective during subsequent machining or testing, it is to be rejected notwithstanding any previous certification.

3.11.9 Rectification of defective forgings

3.11.9.1 Defects may be removed by grinding or chipping and grinding provided the component dimensions are acceptable. The resulting grooves are to have a bottom radius of approximately three times the groove depth and are to be blended into the surrounding surface so as to avoid any sharp contours. Complete elimination of the defective material is to be verified by magnetic particle testing or liquid penetrant testing.

3.11.9.2 Repair welding of forgings except those subjected to torsional fatigue, such as crankshaft forgings and propeller shaft forgings, may be permitted subject to prior approval of the *Register*. In such cases, full details of the extent and location of the repair, the proposed welding procedure, heat treatment and subsequent inspection procedures are to be submitted for the approval.

3.11.9.3 The forging manufacturer is to maintain records of repairs and subsequent inspections traceable to each forging repaired. The records are to be presented to the Surveyor on request.

3.11.10 Identification of forgings

3.11.10.1 The manufacturer is to adopt a system of identification which will enable all finished forgings to be traced to the original cast and the Surveyor is to be given full facilities for so tracing the forgings when required.

3.11.10.2 Before acceptance, all forgings which have been tested and inspected with satisfactory results are to be clearly marked by the manufacturer. At the discretion of *Register* any of the following particulars may be required:

- Steel quality.
- Identification number, cast number or other marking which will enable the full history of the forging to be traced.
- Manufacturer's name or trade mark.
- Test pressure where applicable.
- Date of final inspection.
- The *Register's* name, initials or symbol.
- Abbreviated name of the *Register* local office.
- Personal stamp of Surveyor responsible for inspection.

3.11.10.3 Where small forgings are manufactured in large numbers, modified arrangements for identification may be specially agreed with the *Register.*

3.11.11 Certification

3.11.11.1 The manufacturer is to provide the required type of inspection certificate giving the following particulars for each forging or batch of forgings which has been accepted:

- Purchaser's name and other number.
- Description of forgings and steel quality.
- Identification number.
- Steelmaking process, cast number and chemical analysis of ladle sample.
- Results of mechanical tests.
- Results of non-destructive tests, where applicable.
- Details of heat treatment, including temperature and holding times.

▪ **Head 3.12 HULL AND MACHINERY STEEL CASTINGS** is partly changed, and should be read as:

3.12 HULL AND MACHINERY STEEL CASTINGS

3.12.1 Scope

3.12.1.1 These requirements are applicable to C, C-Mn and alloy steel castings intended for hull and machinery applications for ships and offshore units for worldwide services specified in the relevant *Rules* and/or other requirements of the *Register*. These requirements also makes consideration for grades that are intended for fabrication by welding, as well as grades not intended for welding.

3.12.1.2 Additional requirements may be necessary, especially when the casting are intended for service at low or elevated temperatures, e.g. for ships with ice-class or for boilers.

Additional requirements will typically be required for castings for offshore units depending on applicable service temperature and environment.

3.12.1.3 Similarly, C and C-Mn steel castings and alloy steel castings which comply with national or proprietary specifications may be accepted provided such specifications give reasonable equivalence to these requirements or are otherwise specially approved or required by the *Register.*

3.12.2 Manufacture

3.12.2.1 Castings are to be made at a manufacturer approved by the *Register*.

3.12.2.2 The steel is to be manufactured by a process, approved by the *Register*.

3.12.2.3 All flame cutting, scarfing or arc-air gouging to remove surplus metal is to be undertaken in accordance with recognized good practice and is to be carried out before the final heat treatment. Preheating is to be employed when necessitated by the chemical composition and/or thickness of the castings. If necessary, the affected areas are to be either machined or ground smooth.

3.12.2.4 For certain components including steel castings subjected to surface hardening process, the proposed method of manufacture may require special approval by the *Register*.

3.12.2.5 Joining of two or more castings by welding to from a composite component:

Requirements for welding procedure qualification tests of steels for hull construction and marine structures are specified in *Rules for the classification of ships, Part 26 – Welding, 1.4 Welding procedure tests*. Welders for hull structural steel castings are to be qualified in accordance with *Rules for the classification of ships, Part 26 – Welding, 1.3 Qualification testing and certification of welders*. Requirements for other WPS and qualification thereof, for welder certification and for type approval of welding consumables are at the discretion of the *Register.*

3.12.2.6 Temporary welds made for operations such as lifting, handling, staging, etc., are to be in accordance with approved welding procedures and qualified welders, and are to be removed, ground and inspected using suitable NDT methods.

3.12.3 Quality of castings

3.12.3.1 All castings are to be free from surface or internal defects, which would be prejudical to their proper application in service. The surface finish is to be in accordance with good practice and any specific requirements of the approved plan.

3.12.4 Chemical composition

3.12.4.1 All castings are to be made from killed steel and the chemical composition is to be appropriate for the type of steel and the mechanical properties specified for the castings.

The chemical composition of each heat is to be determined by manufacturer on a sample taken preferably during the pouring of the heat. When multiple heats are tapped into a common ladle, the ladle analysis shall apply.

3.12.4.2 The chemical composition is to comply with the overall limits given in Table 3.12.4.2.1 and Table 3.12.4.2.2, respectively or, where applicable, the requirements of the approved specification.

3.12.4.3 Suitable grain refining elements such as aluminium may be used at the discretion of the manufacturer or as agreed with the *Register*.

Table 3.12.4.2.1
Chemical composition limits for hull and machinery steel castings: C, C-Mn steels (%)

Steel type	Applications	C (max.)	Si (max.)	Mn	S (max.)	P (max.)	Residual elements (max.)				Total residuals (max.)
							Cu	Cr	Ni	Mo	
C, C-Mn	Castings for non-welded construction	0.40	0.60	0.50-1.60	0.035	0.035	0.30	0.30	0.40	0.15	0.80
	Castings for welded construction	0.23	0.60	0.50-1.60	0.035	0.035	0.30	0.30	0.40	0.15	0.80

Table 3.12.4.2.2
Chemical composition limits for hull and machinery steel castings: Alloy steels (%)

Steel type	Applications	C (max.)	Si (max.)	Mn	S (max.)	P (max.)	Alloying elements[1] (min.)			
							Cu	Cr	Ni	Mo
C, C-Mn	Castings for non-welded construction	0.45	0.60	0.50-1.60	0.030	0.035	0.30	0.30	0.40	0.15
	Castings for welded construction	alloying element values to be agreed with *the Register*								
1) At least one of the elements shall comply with the minimum content.										

3.12.5 Heat treatment (including straightening)

3.12.5.1 Castings are to be supplied in one of the following delivery conditions:

a) Carbon and carbon-manganese steels:
Fully annealed
Normalized
Normalized and tempered
Quenched and tempered.

b) Alloy steels:
Normalized
Normalized and tempered
Quenched and tempered.

For all types of steel the tempering temperature is to be not less than 550°C.

The delivery condition shall meet the design and application requirements. It is the manufacturers responsibility to select the appropriate heat treatment method to obtain the required mechanical properties.

3.12.5.2 Castings for components such as crankshafts and engine bedplates, where dimensional stability and freedom from internal stresses are important, are to be given a stress relief heat treatment. This is to be carried out at a temperature of not less than 550°C followed by furnace cooling to 300°C or lower.

3.12.5.3 Heat treatment is to be carried out in properly constructed furnaces which are efficiently maintained and have adequate means for control and recording of temperature. The furnace dimensions are to be such as to allow the whole casting to be uniformly heated to the necessary temperature. In the case of very large castings alternative methods for heat treatment will be specially considered by the *Register*. Sufficient thermocouples are to be connected to the furnace charge to measure and record that its temperature is adequately uniform unless the temperature uniformity of the furnace is verified at regular intervals.

3.12.5.4 If a casting is locally reheated or any straightening operation is performed after the final heat treatment, a subsequent stress relieving heat treatment may be required in order to avoid the possibility of harmful residual stresses. The manufacturer shall have strict control of this temperature in order to avoid any detrimental effects to the final heat treatment and resultant microstructure and mechanical properties of the casting.

3.12.5.5 The foundry is to maintain records of heat treatment identifying the furnace used, furnace charge date, temperature and time at temperature. The records are to be presented to the Surveyor on request.

3.12.6 Mechanical tests

3.12.6.1 Test material, sufficient for the required tests and for possible re-testing purposes is to be provided for each casting or batch of castings.

3.12.6.2 At least one test block is to be provided for each casting. Unless otherwise agreed these test blocks are to be either integrally cast or gated to the castings and are to have a thickness of not less than 30 mm.

3.12.6.3 The size of the test blocks for mechanical testing is to be such that the heat treatment and microstructure is representative for the section of the casting with the ruling section, i.e. the section for which the specified mechanical properties apply, see also ISO 683-1:2018 and ISO 683-2:2018, respectively.

For C, C-Mn steel castings this is in general to be achieved as follows:

The test block shall have a thickness (t_S) of not less than the ruling section of the casting, or 30 mm, whichever is larger.

For large thickness castings other than stern tube, stern frame, anchor and rudder horn, t_S normally need not to exceed 150 mm. Length and width of the test block is normally to be at least three times t_S, unless otherwise agreed with the *Register*, as shown in Figure 3.12.6.1. (Note that longer or wider test blocks may be necessary in order to accommodate the required test specimens.)

For castings for stern tube, stern frame, anchor and rudder horn the test block thickness t_S shall represent the ruling section.

Guidance:

Shorter width or length may be accepted for test blocks where actual casting width or length (t_A) is in the range between t_S and $3t_S$.

Example 1: For a general casting with dimensions 140 x 160 x 1250 mm the required test block size would typically be 140 x 160 x 420 mm (that is: t_S x t_A x $3t_S$).

Example 2: For a stern tube casting with ruling section t_S = 170 mm and width/height/length $t_{A1}/t_{A2}/t_{A3}$ = 1000/600/1800 mm, the required test block size would typically be 170 x 510 x 510 mm (that is: t_S x $3t_S$ x $3t_S$) see Figure 3.12.6.2.

(end of guidance)

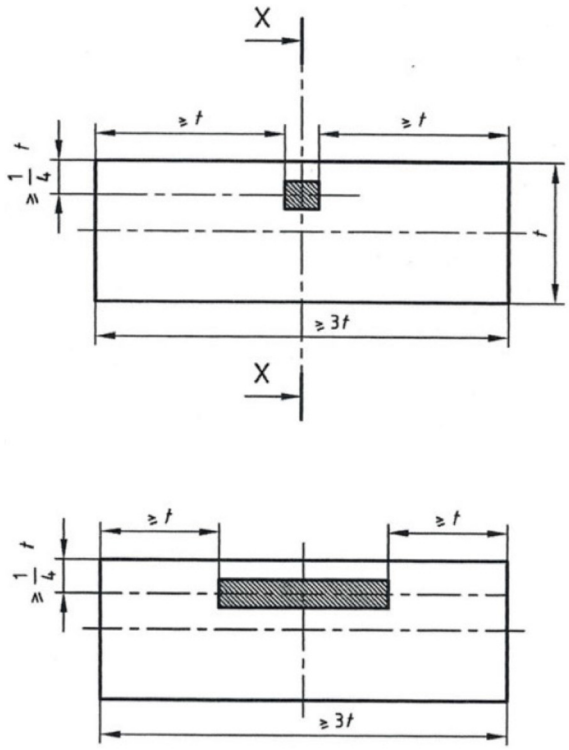


Figure 3.12.6.1
Specimen positions relative to the test block in accordance with ISO 4990:2015*

**- The figure taken from ISO 4990:2015, Steel castings — General technical delivery requirements, is reproduced with the permission of the International Organization for Standardization, ISO. This standard can be obtained from any ISO member and from the website of the ISO Central Secretariat at the following address: www.iso.org. Copyright remains with ISO.*

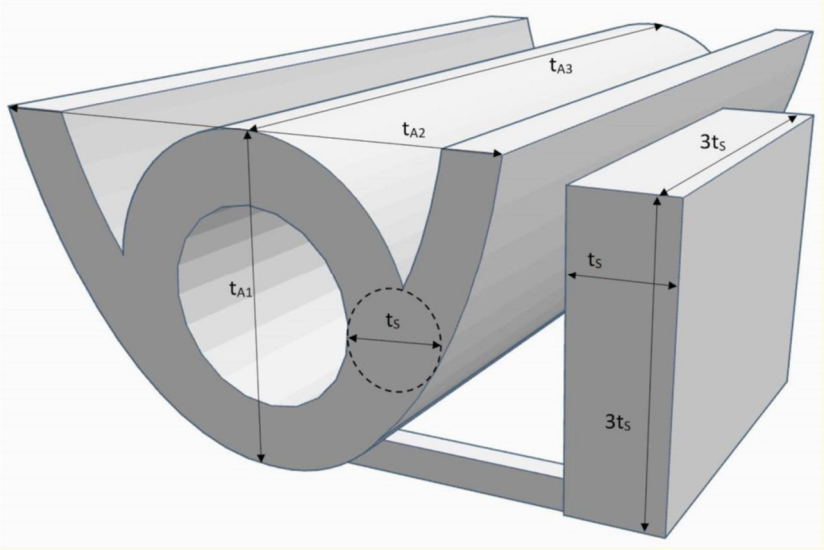


Figure 3.12.6.2
Example 2: test block gated to stern tube casting

For alloy steel castings the manufacturer shall propose dimensions for the test block and demonstrate the representative nature of it.

3.12.6.4 For test blocks with thickness ≤ 56 mm, the longitudinal axis of the test specimens is to be located at ≥ 14 mm from the surface in the thickness direction. For test blocks with thickness > 56 mm, the longitudinal axis of the test specimens is to be located at ≥ ¼ tS from the surface. Test specimens shall be taken in such a way that no part of the gauge length is machined from material closer than tS to any of the other surfaces. For impact testing, this requirement shall apply to the complete test specimen - refer to Figure 3.12.6.1 for location of test specimens in relation to the test block.

3.12.6.5 Where the casting is of complex design or where the finished mass exceeds 10 tonnes, two cast on test blocks are to be provided from the heaviest section, located as far as practicable from each other.

3.12.6.6 Where large castings are made from two or more casts, which are not mixed in a ladle prior to pouring, two or more test blocks are to be provided corresponding to the number of casts involved. These are to be integrally cast at locations as widely separated as possible.

3.12.6.7 For castings where the method of manufacture has been specially approved by the *Register* in accordance with 3.12.2.4, the number and position of test blocks is to be agreed with the *Register* having regard to the method of manufacture employed.

3.12.6.8 As an alternative to 3.12.6.2, where a number of small castings of about the same size, each of which is under 1000 kg in mass, are made from one cast and heat treated in the same furnace charge, a batch testing procedure may be adopted using separately cast test blocks of suitable dimensions. At least one test block is to be provided for each batch of castings.

3.12.6.9 The test blocks are not to be detached from the casting until the specified heat treatment has been completed and they have been properly identified.

3.12.6.10 One tensile test specimen and one set of impact tests are to be taken from each test sample.

3.12.6.11 The preparation of test specimens and the procedures used for mechanical testing are to comply with the relevant requirements of Chapter 2. Unless otherwise agreed, all tests are to be carried out in the presence of the Surveyors.

3.12.7 Mechanical properties

3.12.7.1 Table 3.12.7.1 and Table 3.12.7.2 give the minimum requirements for yield stress, elongation, reduction of area and impact test energy values corresponding to steel types and different strength levels. Where it is proposed to use a steel with a specified minimum tensile strength intermediate to those given, corresponding minimum values for the other properties may be obtained by interpolation.

3.12.7.2 Castings may be supplied to any specified minimum tensile strength selected within the general limits detailed in Table 3.12.7.1 and Table 3.12.7.2 respectively, but subject to any additional requirements of the relevant construction *Rules*.

3.12.7.3 The mechanical properties are to comply with the requirements of Table 3.12.7.1 and Table 3.12.7.2 respectively, appropriate to the specified minimum tensile strength or, where applicable, the requirements of the approved specification.

3.12.7.4 Re-test requirements for tensile tests to be in accordance with Section 2.

3.12.7.5 The additional tests detailed in 3.12.7.4 are to be taken, preferably from the same, but alternatively from another, test sample block representative of the casting or batch of castings.

3.12.7.6 At the option of the manufacturer, when a casting or batch of castings has failed to meet the test requirements, it may be reheat treated and re-submitted for acceptance tests.

Table 3.12.7.1
Mechanical properties for castings intended for welding

Steel type	Specified minimum tensile strength[1] (N/mm^2)	Yield stress (N/mm^2) min.	Elongation on $5{,}65\sqrt{S_o}$ (%) min.	Reduction area (%) min.	Charpy V-notch impact test[2]	
					Test temperature (°C)	Minimum average energy (J)
C, C-Mn	400	200	25	40	0	27
	440	220	22	30		
	480	240	20	27		
	520	260	18	25		
	560	300	15	20		
	600	320	13	20		
Alloy	550	355	18	30	0	27
	600	400	16	30		
	650	450	14	30		
	700	540	12	28		

Note:
1) A tensile strength range of 150 N/mm^2 may additionally be specified.
2) Special consideration may be given to alternative requirements for Charpy V-notch impact test, depending on design and application, and subject to agreement by the Register.

Table 3.12.7.2
Mechanical properties for machinery steel castings not intended for welding

Steel type	Specified minimum tensile strength[1] (N/mm^2)	Yield stress (N/mm^2) min.	Elongation on $5{,}65\sqrt{S_o}$ (%) min.	Reduction area (%) min.	Charpy V-notch impact test[2]	
					Test temperature (°C)	Minimum average energy (J)
C, C-Mn	400	200	25	40	AT[3]	27
	440	220	22	30		
	480	240	20	27		
	520	260	18	25		
	560	300	15	20		
	600	320	13	20		
Alloy	550	340	16	35	AT[3]	27
	600	400	16	35		
	650	450	14	32		
	700	540	12	28		

Note:
1) A tensile strength range of 150 N/mm^2 may additionally be specified.
2) Special consideration may be given to alternative requirements for Charpy V-notch impact test, depending on design and application, and subject to agreement by the *Register*.
3) AT refers to Ambient Temperature (i.e. 23°C±5°C), which is specified in ISO 148-1:2016

3.12.8 Inspection

3.12.8.1 All castings are to be cleaned and adequately prepared for examination; suitable methods include pickling, caustic cleaning, wire brushing, local grinding, shot or sand blasting. The surfaces are not to be hammered, penned or treated in any way which may obscure defects.

3.12.8.2 Before acceptance all castings are to be presented to the Surveyors for visual examination. Where applicable, this is to include the examination of internal surfaces. Unless otherwise agreed, the verification of dimensions is the responsibility of the manufacturer.

3.12.8.3 When required by the relevant construction *Rules*, or by the approved procedure for welded composite components (see 3.12.2.6), appropriate non-destructive testing is also to be carried out before acceptance and the results are to be reported by the manufacturer. The extent of testing and acceptance criteria are to be agreed with the *Register*. *IACS Recommendation No. 69 (Guidelines for non-destructive testing of hull and machinery steel forgings* (Work instruction *QW74 Non-destructive testing of marine steel castings* respectively*)* is regarded as an example of an acceptable standard specifying suitable minimum requirements.

3.12.8.4 When required by the relevant construction *Rules* castings are to be pressure tested before final acceptance. These tests are to be carried out in the presence of the Surveyor and are to be to their satisfaction.

3.12.8.5 In the event of any casting proving to be defective during subsequent machining or testing, it is to be rejected notwithstanding any previous certification.

3.12.9 Rectification of defective castings

3.12.9.1 General

a) Where castings are to be repaired, the manufacturer shall exercise robust controls of all repair operations regarding the repair of castings, with respect to dimensions, heat treatment, inspection and quality control.

b) The approval of the *Register* is to be obtained where steel castings, from which defects were removed, are to be used with or without weld repair.

c) Defects and unacceptable indications must be repaired as indicated below:
Defective parts of material may be removed by grinding, or by chipping and grinding, or by arc air-gouging and grinding. Thermal methods of metal removal of defect shall only be allowed before the final heat treatment. All grooves shall have a bottom radius of approximately three times the groove depth and should be smoothly blended to the surface area with a finish equal to that of the adjacent surface.

d) For NDT of steel castings after repair, see 3.12.8.3.

e) Where the defective area is to be repaired by welding, excavations are to be suitably shaped, to allow good access for welding. The resulting grooves are to be subsequently ground smooth and complete elimination of the defective material is to be verified by MT or PT.

f) Shallow grooves or depressions resulting from the removal of defects may be accepted provided that they will cause no appreciable reduction in the strength of the casting or affect the intended use, and the depth of defect removal is not over 15 mm or 10% of wall thickness, whichever is less. The resulting grooves or depressions are to be subsequently ground smooth and complete elimination of the defective material is to be verified by MT or PT. Small surface irregularities sealed by welding are to be treated as weld repairs, see 3.12.9.2.

3.12.9.2 Weld repairs

In addition to the requirements given in 3.12.9.1, the following apply for weld repairs:

1) For C and C-Mn steel castings weld repairs shall be suitably classified as major or minor. For alloy steel castings, repair requires approval from the *Register*.
   a) Major repairs are those where:
      - the depth is greater than 25% of the wall thickness or 25mm whichever is less, or
      - the total weld area on a casting exceeds 0.125m^2 of the casting surface noting that where a distance between two welds is less than their average width, they are to be considered as one weld.
   b) Minor weld repairs:
      Weld repairs not classified as major are considered as minor and need to be carried out in accordance with a qualified welding procedure.

2) The following is required for major repairs:
   a) Shall be carried out before the final delivery heat treatment condition
   b) Shall comply with the requirements in 4) below
   c) Before welding is started, full details of the extent and location of the repair, the proposed welding procedure, heat treatment and subsequent inspection procedures are to be submitted for approval.

3) The following is required for minor repairs:
   a) Shall be carried out before the final delivery heat treatment condition

b) Shall comply with the requirements in 4) below (also with respect to records, see 4) f) and g).
c) With the exception of alloy steels, do not require prior approval by the *Register*, except as given in (d)
d) The *Register* may request minor repairs in critical areas to be treated as major repairs.

4) The following requirements apply for all weld repairs (major and minor):
a) All castings in alloy steels and all castings for crankshafts are to be suitably pre-heated prior to welding. Castings in carbon or carbon-manganese steel may also require to be pre-heated depending on their chemical composition and the dimensions and position of the weld repairs.
b) Welding procedures are to be qualified and shall match the delivery condition of the casting. Qualification of welding procedures shall follow the *Register's* rules, or subject to agreement with the *Register*, a recognised standard (e.g. *Rules for the classification of ships, Part 26 – Welding, 1.4 Welding procedure tests* or ISO 11970:2016.
c) Welding is to be done under cover in positions free from draughts and adverse weather conditions by qualified welders with adequate supervision. As far as possible, all welding is to be carried out in the downhand (flat) position.
d) The welding consumables used are to be of an appropriate composition, giving a weld deposit with mechanical properties similar and in no way inferior to those of the parent castings. Welding procedure tests are to be carried out by the manufacturer to demonstrate that satisfactory mechanical properties can be obtained after heat treatment as detailed in 3.12.5.1.
e) After welding has been completed the castings are to be given either a suitable heat treatment in accordance with the requirements of 3.12.5.1 or a stress relieving heat treatment at a temperature of not less than 550°C for C and C-Mn steel castings. For alloy steel castings, the heat treatment has to be agreed with the *Register*. The type of heat treatment employed will be dependent on the chemical composition of the casting and the dimensions, positions and nature of the repairs, and should not affect the properties of the casting.
Subject to the prior agreement of *Register*, special consideration may be given to the omission of post weld heat treatment or to the acceptance of local stress-relieving heat treatment where the repaired area is small and machining of the casting has reached an advanced stage.
f) On completion of heat treatment the weld repairs and adjacent material are to be ground smooth and examined by magnetic particle or liquid penetrant testing. Supplementary examination by ultrasonic or radiographic testing may also be required depending on the dimensions and nature of the original defect. Satisfactory results are to be obtained from all forms of non-destructive testing used.
g) The manufacturer is to maintain full records detailing the extent and location of repairs made to each casting and details of weld procedures and heat treatments applied for repairs. These records are to be available to the Surveyor and copies provided on request.

3.12.9.3 Recommendation for welding: For steels with C ≥ 0.23 or Ceq ≥ 0.45, the WPQT on which the WPS is based, should be qualified on a base material having a Ceq as follows: the Ceq of the base material should not fall below more than 0.02 of the material to be welded. (Example: WPQT for a material with actual Ceq = 0.50 may be qualified on a material with Ceq ≥ 0.48.)

3.12.10 Identification of castings

3.12.10.1 The manufacturer is to adopt a system of identification which will enable all finished castings to be traced to the original cast and the Surveyors are to be given full facilities for so tracing the castings, when required.

3.12.10.2 Before acceptance, all castings which have been tested and inspected with satisfactory results are to be clearly marked by the manufacturer. At the discretion of *Register* any of the following particulars may be required:
- Steel quality.
- Identification number, cast number or other marking which will enable the full history of the casting to be traced.
- Manufacturer's name or trade mark.
- The *Register's* name, initials or symbol.
- Abbreviated name of the *Register's* local office.
- Personal stamp of Surveyors responsible for inspection.
- Where applicable, test pressure.

3.12.10.3 Where small castings are manufactured in large numbers, modified arrangements for identification may be specially agreed with the *Register*.

3.12.11 Certification

3.12.11.1 The manufacturer is to provide the required type of inspection certificate, giving the following particulars for each casting or batch of castings which has been accepted:
- Purchaser's name and order number.
- Description of castings and steel quality.
- Identification number.
- Steel making process, cast number and chemical analysis of ladle samples.

- Results of mechanical tests.
- Results of non-destructive tests, where applicable.
- Details of heat treatment, including temperatures and holding times.
- Where applicable, test pressure.