Guide for the Hull Structures Reassessment of in Service Ships

Effective from 1 January 2016

GENERAL CONDITIONS

Definitions:

"*Administration*" means the Government of the State whose flag the Ship is entitled to fly or under whose authority the Ship is authorized to operate in the specific case.

"*IACS*" means the International Association of Classification Societies.

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

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

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

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

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

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

"*Surveyor*" means technical staff acting on behalf of the Society in performing the Services.

Article 1

1.1. The purpose of the Society is, among others, the classification and certification of ships and the certification of their parts and components. In particular, the Society:
(i) sets forth and develops Rules;
(ii) publishes the Register of Ships;
(iii) issues certificates, statements and reports based on its survey activities.

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

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

Article 2

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

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

2.3. The Society exercises due care and skill:
(i) in the selection of its Surveyors
(ii) in the performance of its Services, taking into account the level of its technical knowledge at the time the Services are performed.

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

Article 3

3.1. The class assigned to a Ship, like the reports, statements, certificates or any other document or information issued by the Society, reflects the opinion of the Society concerning compliance, at the time the Service is provided, of the Ship or product subject to certification, with the applicable Rules (given the intended use and within the relevant time frame).
The Society is under no obligation to make statements or provide information about elements or facts which are not part of the specific scope of the Service requested by the Interested Party or on its behalf.

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

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

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

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

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

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

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

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

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

Article 4

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

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

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

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

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

Article 5

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

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

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

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

Article 6

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

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

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

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

Article 7

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

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

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

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

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

Article 8

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

Guide for the hull structures reassessment of in service ships

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1 GENERAL

The aim of this guide is to specify the criteria for the reassessment of the hull structural elements of ships in service, which may be carried out by Tasneef, at the request of the Owner.

The reassessment analysis is to be planned by the Owner and Tasneef before commencing a Class survey requiring thickness gauging.

The reassessment is carried out by checking the strength of the ship in her actual state, as shown by the thickness gauging, against the acceptance criteria stated in this guide for the hull girder, plating, ordinary stiffeners and primary supporting members.

The strength checks are also carried out to identify possible "hot spot items" (see [3]) to address the following close-up surveys. Other "hot spot items" may result from fatigue analyses and surveyors inspections.

This guide is also intended to provide the criteria for a local strength assessment of structural elements based on the measured thicknesses, to be carried out on the occasion of a CAP survey as required by the Tasneef " Guide for the Ship Condition Assessment Programme (CAP) ".

2 FIELD OF APPLICATION

This guide applies to all types of ships to which the Rules (as defined in 3) apply.

3 DEFINITIONS AND SYMBOLS

"Rules" means the Rules for the Classification of Ships in force at the time of reassessment.

"As-built thickness" means the thickness indicated on the drawings for the ship at the time of construction.

"Rule thickness" and "Rule section modulus" mean the thickness of plating and the section modulus of ordinary stiffeners, as required by the Rules.

"Hot spot items" means those items that are to be closely inspected during surveys.

t_A : As-built thickness of plating, in mm

t_M : Measured thickness of plating, in mm

t_C : Corrosion additions, in mm, defined in Pt B, Ch 4, Sec 2, [3] of the Rules

t_{C1}, t_{C2} : Corrosion additions, in mm, defined in Pt B, Ch 4, Sec 2, [3] of the Rules for the two compartments separated by the plating under consideration. For internal plating of a compartment, $t_{C1} = t_{C2} = t_C$

t_R : Overall renewal thickness, in mm, of plating, in mm, defined in:
[6.2.1] in general
[8.3.1] for the plating which constitutes primary supporting members

t_{R1} : Minimum renewal thickness, in mm, of plating defined in [6.2.2]

t_{R2} : Renewal thickness, in mm, of plating subjected to lateral pressure or wheeled loads, i.e. the thickness that the plating of a ship in service is to have in order to fulfil the strength check, according to the strength principles in Pt B, Ch 4, Sec 3, [1.1] of the Rules. This thickness is to be calculated as specified in [6.2.3]

t_{R3} : Compression buckling renewal thickness, in mm, i.e. the thickness that the plating of a ship in service is to have in order to fulfil the compression buckling check, according to the strength principles in Pt B, Ch 4, Sec 3,

[1.3.1] of the Rules. This thickness is to be calculated as specified in [6.2.4]

t_{R4} : Shear buckling renewal thickness, in mm, i.e. the thickness that the plating of a ship in service is to have in order to fulfil the shear buckling check, according to the strength principles in Pt B, Ch 4, Sec 3, [1.3.1] of the Rules. This thickness is only to be considered for ships equal to or greater than 90 m in length and is to be calculated as specified in [6.2.5]

t_G : Rule gross thickness, in mm, of plating, defined in [6.2.6]

$t_{A,W}$: As-built thickness of ordinary stiffener web, in mm

$t_{A,F}$: As-built thickness of ordinary stiffener face plate, in mm

$t_{M,W}$: Measured thickness of ordinary stiffener web, in mm

$t_{M,F}$: Measured thickness of ordinary stiffener face plate, in mm

w_M : Section modulus, in cm^3, of ordinary stiffeners, to be calculated as specified in Pt B, Ch 4, Sec 3, [3.4] of the Rules on the basis of the measured thicknesses of web, face plate and attached plating

w_R : Renewal section modulus, in cm^3, of ordinary stiffeners i.e. the section modulus that an ordinary stiffener of a ship in service is to have to fulfil the yielding check, according to the strength principles in Pt B, Ch 4, Sec 3, [1.2.1] of the Rules

$t_{R,W}$: Renewal thickness, in mm, of ordinary stiffener web, i.e. the web thickness that an ordinary stiffener of a ship in service is to have in order to fulfil the buckling check, according to the strength principles in Pt B, Ch 4, Sec 3, [1.3.2] of the Rules. This thickness is to be calculated as specified in [7.2.2]

$t_{R,F}$: Renewal thickness, in mm, of ordinary stiffener face plate, i.e. the face plate thickness that an ordinary stiffener of a ship in service is to have in order to fulfil the buckling check, according to the strength principles in Pt B, Ch 4, Sec 3, [1.3.2] of the Rules. This thickness is to be calculated as specified in [7.2.2]

w_G : Rule gross section modulus, in cm^3, of ordinary stiffeners, defined in [7.2.3]

W_{RR} : Reassessment work ratio, defined in [8.2.1]

W_{RA} : As-built work ratio, defined in [8.2.2]

t_{RY} : Yielding renewal thickness, in mm, of primary supporting members, i.e. the thickness that the plating which constitutes primary supporting members of a ship in service is to have in order to fulfil the yielding check, according to the strength principles in Pt B, Ch 4, Sec 3, [1.2.2] of the Rules. This thickness is to be calculated as specified in [8.3.2]

t_{RB} : Buckling renewal thickness, in mm, of primary supporting members, i.e. the thickness that the plating which constitutes primary supporting members of a ship in service is to have in order to fulfil the buckling check, according to the strength

principles in Pt B, Ch 4, Sec 3, [1.3.1] of the Rules. This thickness is to be calculated as specified in [8.3.3]

E : Young's modulus, in N/mm^2, to be taken equal to:
$E = 2,06.10^5 N/mm^2$: for steels in general
$E = 1,93.10^5 N/mm^2$: for stainless steels:

ν : Poisson's ratio. Unless otherwise specified, a value of 0,3 is to be taken into account

R_{eH} : Minimum yield stress, in N/mm^2, of the material, defined in Pt B, Ch 4, Sec 1, [2] of the Rules

$\gamma_m, \gamma_R, \gamma_{K1}, ..., \gamma_{K9}$: Partial safety factors, defined in [4].

4 PARTIAL SAFETY FACTORS

4.1 General

The partial safety factors γ_m and γ_R are defined in:
- Pt B, Ch 7, Sec 1, [1.2] or Pt B, Ch 8, Sec 3, [1.2] of the Rules, as applicable, for plating
- Pt B, Ch 7, Sec 2, [1.2] or Pt B, Ch 8, Sec 4, [1.2] of the Rules, as applicable, for ordinary stiffeners
- Pt B, Ch 7, Sec 3, [1.3] or Pt B, Ch 8, Sec 5, [1.3] of the Rules, as applicable, for primary supporting members.

4.2 Partial safety factors based on the increased knowledge of the structure

4.2.1 General

The partial safety factors γ_{K1}, γ_{K2}, ... to γ_{K9} take into account the increased knowledge of the structural behaviour obtained through surveys carried out on the structures of ships in service and verification of their performance. Therefore, they have values equal to or less than 1,0 and apply to reduce the partial safety factor on resistance, *R, adopted in the strength checks of new ships (see Part B, Chapter 7 or Part B, Chapter 8 of the Rules, as applicable).

4.2.2 Partial safety factors γ_{K1}, γ_{K2}, γ_{K3} and γ_{K4} for plating

The partial safety factors γ_{K1}, γ_{K2}, γ_{K3} and γ_{K4} are to be calculated as specified in:
- [6.2.2] for minimum thickness checks (γ_{K1})
- [6.2.3] for the strength checks of plate panels subjected to lateral pressure or wheeled loads (γ_{K2})
- [6.2.4] for compression buckling strength checks (γ_{K3})
- [6.2.5] for shear buckling strength checks (γ_{K4})

4.2.3 Partial safety factor γ_{K5} for ordinary stiffeners

The partial safety factor for yielding strength checks (γ_{K5}) is to be calculated as specified in [7.2.1].

4.2.4 Partial safety factors γ_{K6}, γ_{K7}, γ_{K8} and γ_{K9} for primary supporting members

The partial safety factors γ_{K6}, γ_{K7}, γ_{K8} and γ_{K9} are to be calculated as specified in:
- [8.2.1] for reassessment structural analyses (γ_{K6}, γ_{K7})
- [8.3.2] for yielding strength checks (γ_{K8})

- [8.3.3] for buckling strength checks (γ_{K9})

5 ACCEPTANCE CRITERIA FOR THE HULL GIRDER STRENGTH

The hull girder section modulus calculated considering the measured thicknesses is to be not less than 90% of the hull girder section modulus required by the Rules for new ships.

Where this check is not complied with, steel renewals of the continuous longitudinal elements in the deck and bottom zones are to be carried out as far as deemed necessary to fulfil the above requirement.

6 ACCEPTANCE CRITERIA FOR PLATING

6.1 Application

6.1.1 General

The acceptance criteria for measured thicknesses of plating, together with the application procedure to be adopted during the reassessment of hull structures, are represented in the flow chart in Fig 1.

The meaning of the symbols utilised in the flow chart is specified in [6.2].

6.1.2 Specific cases

For the specific cases indicated in Tab 1, the acceptance criteria to be applied, in lieu of those in [6.1.1], are those specified in the Rules to which reference is made in the same table.

6.2 Renewal thicknesses

6.2.1 Overall renewal thickness

The overall renewal thickness is to be obtained, in mm, from the following formula:

$t_R = \max (t_{R1}, t_{R2}, t_{R3}, t_{R4})$

6.2.2 Minimum renewal thickness

The minimum renewal thickness is to be obtained, in mm, from the following formula:

$t_{R1} = t_1 \gamma_{K1}$

where:

t_1 : Minimum net thickness, in mm, to be calculated as specified in Pt B, Ch 7, Sec 1, [2.2] or Pt B, Ch 8, Sec 3, [2.2] of the Rules, as applicable

γ_{K1} : Partial safety factor for minimum thickness checks:

$\gamma_{K1} = N_P \psi_1$

without being greater than 1,0

N_p : Coefficient defined in Tab 2

$$\psi_1 = 1 + \frac{t_{C1} + t_{C2}}{t_1}$$

Figure 1 : Acceptance criteria for measured thicknesses of plating and application procedure
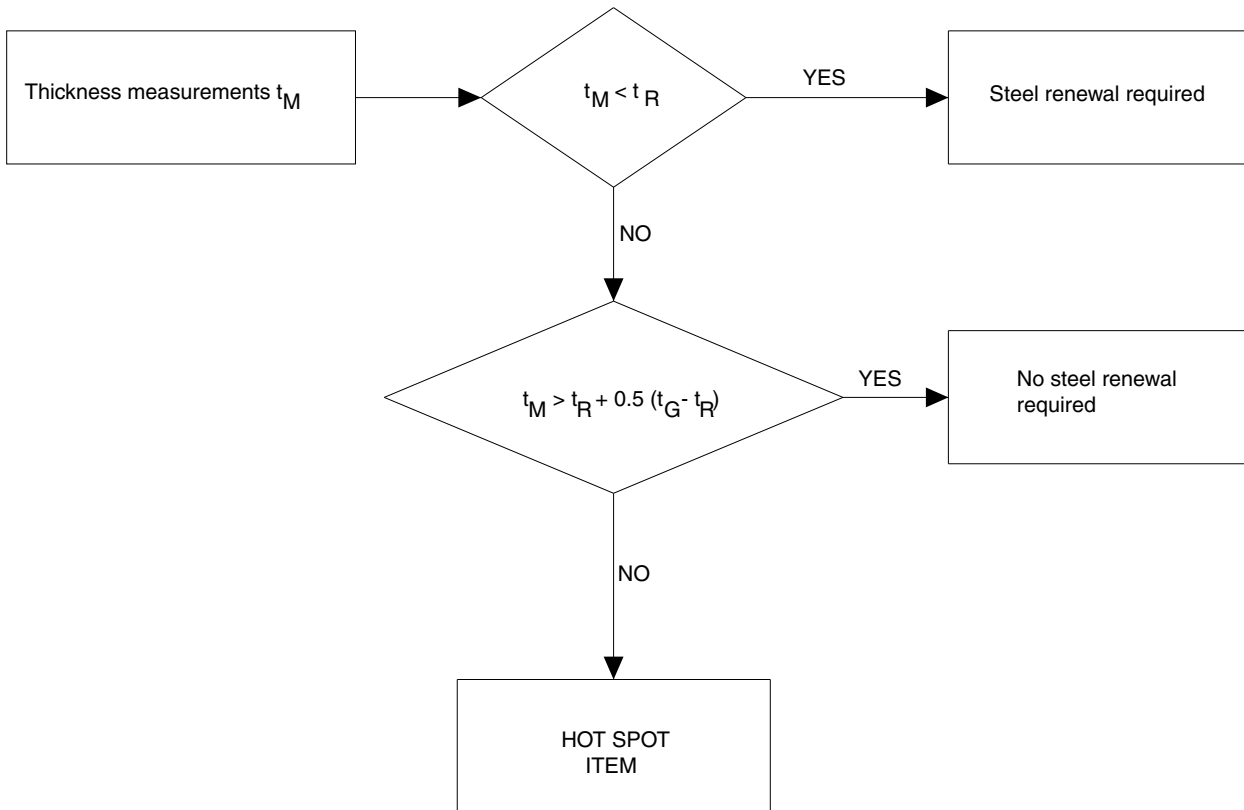

Table 1 : Renewal thicknesses for plating in specific cases

Ship type	Item	Rules to be applied
Ships with the service notation **bulk carrier ESP**, of single side skin construction, having L≥150 m, intended for the carriage of bulk cargoes having dry bulk density equal to or greater than 1,0 t/m^3, contracted for construction on or after 1 July 1998	Plating of vertically corrugated transverse watertight bulkheads	Part A of the Rules
Ships with the service notation **bulk carrier ESP**, contracted for construction on or after 1 July 1998	Hatch cover plating	Part A of the Rules
Ships with the service notation **bulk carrier ESP**, of single side skin construction, having L≥150 m, intended for the carriage of bulk cargoes having dry bulk density equal to or greater than 1,78 t/m^3, contracted for construction prior to 1 July 1998	Plating of vertically corrugated transverse watertight bulkhead between cargo holds No. 1 and 2	Pt A, Ch 6, App 1 of the Rules

Table 2 : Coefficient N_P

Plating	Coefficient N_P	
	L < 90 m	L ≥ 90 m
In general, including that which constitutes the web of primary supporting members	0,75	0,80
Plating which constitutes the face plate of primary supporting members	0,80	0,85
Bottom primary supporting members of ships with one of the service notations **bulk carrier ESP, ore carrier ESP or combination carrier ESP**	0,80	0,85
Hatch coaming brackets	0,70	0,75
Cross ties of ships with the service notation **oil tanker ESP**	0,80	0,85

6.2.3 Renewal thickness of plating subjected to lateral pressure or wheeled loads

The renewal thickness of plating subjected to lateral pressure or wheeled loads is to be obtained, in mm, from the following formula:

$t_{R2} = t_2 \, \gamma_{K2}$

where:

t_2 : Net thickness, in mm, to be calculated as specified in:
- Pt B, Ch 7, Sec 1, [3] or Pt B, Ch 8, Sec 3, [3] of the Rules, as applicable, for plating subjected to lateral pressure
- Pt B, Ch 7, Sec 1, [4] or Pt B, Ch 8, Sec 3, [4] of the Rules, for plating subjected to wheeled loads

where the hull girder stresses are to be calculated considering the hull girder transverse sections constituted by elements (plating, ordinary stiffeners, primary supporting members) having their measured thicknesses and scantlings

γ_{K2} : Partial safety factor for the strength checks of plate panels subjected to lateral pressure or wheeled loads:

$\gamma_{K2} = N_P \, \psi_2$

without being taken greater than 1,0

N_p : Coefficient defined in Tab 2

$$\psi_2 = 1 + \frac{t_{C1} + t_{C2}}{t_2}$$

6.2.4 Compression buckling renewal thickness

The compression buckling renewal thickness is to be obtained, in mm, from the following formula:

$t_{R3} = t_3 \, \gamma_{K3}$

where:

t_3 : Net thickness to be obtained, in mm, from the following formulae:

for $\gamma_m \, \gamma_R \, \sigma_{x1} \le \dfrac{R_{eH}}{2}$:

$$t_3 = \frac{b}{\pi} \sqrt{\frac{\sigma_{x1} \, \gamma_R \, \gamma_m \, 12 \left(1 - v^2\right)}{E K_1 \, \varepsilon}} 10^3$$

for $\gamma_m \, \gamma_R \, \sigma_{x1} > \dfrac{R_{eH}}{2}$:

$$t_3 = \frac{b}{\pi} \sqrt{\frac{3 \left(1 - v^2\right) R_{eH}^2}{E K_1 \, \varepsilon \left(R_{eH} - \sigma_{x1} \, \gamma_R \, \gamma_m\right)}} 10^3$$

b : Length, in m, of the plate panel side, defined in Pt B, Ch 7, Sec 1, [5.1.2] or Pt B, Ch 8, Sec 3, [5.1.2] of the Rules, as applicable

σ_{x1} : In plane hull girder normal stress, in N/mm^2 to be calculated as specified in Pt B, Ch 7, Sec 1, [5.2.2] or Pt B, Ch 8, Sec 3, [5.2.2] of the Rules, as applicable, considering the hull

girder transverse sections as being constituted by elements (plating, ordinary stiffeners, primary supporting members) with measured thicknesses and scantlings

ε_1, K_1 : Coefficients defined in Pt B, Ch 7, Sec 1, [5.3.1] or Pt B, Ch 8, Sec 3, [5.3.1] of the Rules, as applicable

γ_{K3} : Partial safety factor for compression buckling strength checks:

$\gamma_{K3} = N_P \, \psi_3$

without being greater than 1,0

N_p : Coefficient defined in Tab 2

$$\psi_3 = 1 + \frac{t_{C1} + t_{C2}}{t_3}$$

6.2.5 Shear buckling renewal thickness

The shear buckling renewal thickness is to be obtained, in mm, from the following formula:

$t_{R4} = t_4 \, \gamma_{K4}$

t_4 : Net thickness to be obtained, in mm, from the following formulae:

for $\gamma_m \, \gamma_R \, \tau_1 \le \dfrac{R_{eH}}{2\sqrt{3}}$:

$$t_4 = \frac{b}{\pi} \sqrt{\frac{\tau_1 \, \gamma_R \, \gamma_m \, 12 \left(1 - v^2\right)}{E K_2}} 10^3$$

for $\gamma_m \, \gamma_R \, \tau_1 > \dfrac{R_{eH}}{2\sqrt{3}}$:

$$t_4 = \frac{b}{\pi} \sqrt{\frac{\sqrt{3} \left(1 - v^2\right) R_{eH}^2}{E K_2 \left(R_{eH} - \sqrt{3} \, \tau_1 \, \gamma_R \, \gamma_m\right)}} 10^3$$

b : Length, in m, of the plate panel side, defined in Pt B, Ch 7, Sec 1, [5.1.3] of the Rules

τ_1 : In plane hull girder shear stress, in N/mm^2, to be calculated as specified in Pt B, Ch 7, Sec 1, [5.2.3] of the Rules, considering the hull girder transverse sections as being constituted by elements (plating, ordinary stiffeners, primary supporting members) with measured thicknesses and scantlings

K_2 : Coefficient defined in Pt B, Ch 7, Sec 1, [5.3.2] of the Rules

γ_{K4} : Partial safety factor for shear buckling strength checks:

$\gamma_{K4} = N_P \, \psi_4$

without being greater than 1,0

N_p : Coefficient defined in Tab 2

$$\psi_4 = 1 + \frac{t_{C1} + t_{C2}}{t_4}$$

6.2.6 Rule gross thickness

The Rule gross thickness is to be obtained, in mm, from the following formula:

$t_G = \max(t_1, t_2, t_3, t_4) + t_{C1} + t_{C2}$

where t_1, t_2, t_3 and t_4 are the net thicknesses defined in [6.2.2], [6.2.3], [6.2.4] and [6.2.5], respectively.

7 ACCEPTANCE CRITERIA FOR ORDINARY STIFFENERS

7.1 Applications

The acceptance criteria for measured scantlings of ordinary stiffeners, together with the application procedure to be adopted during the reassessment of hull structures, are represented in the flow chart in Fig 2.

The meaning of the symbols utilised in the flow chart is specified in [7.2].

7.2 Renewal scantlings

7.2.1 Renewal section modulus

The renewal section modulus is to be obtained, in cm^3, from the following formula:

$w_R = w_Y \, \gamma_{K5}$

where:

w_Y : Net section modulus, in cm^3, to be calculated as specified in Pt B, Ch 7, Sec 2, [3] or Pt B, Ch 8, Sec 4, [3] of the Rules, as applicable, where the hull girder stresses are to be calculated considering the hull girder transverse sections constituted by elements (plating, ordinary stiffeners, primary supporting members) with measured thicknesses and scantlings

γ_{K5} : Partial safety factor for yielding strength checks:

$\gamma_{K5} = N_S \, \psi_5$

without being greater than 1,0

N_S : Coefficient defined in Tab 3

$$\psi_5 = \frac{1 + \dfrac{\beta t_C}{w_Y}}{1 - \alpha t_C}$$

α, β : Parameters, depending on the type of ordinary stiffener, defined in Pt B, Ch 4, Sec 2, Tab 1 of the Rules.

Table 3 : Coefficient NS

Ordinary stiffeners	Coefficient N_S	
	L < 90 m	L ≥ 90 m
Flat bars and bulb profiles	0,75	0,80
Flanged profiles	0,80	0,81

7.2.2 Renewal web and face plate thicknesses

The renewal web and face plate thicknesses are to be obtained, in mm, from the following formulae:

$t_{R,W} = h_W / C_W$

$t_{R,F} = b_F / C_F$

where:

h_w : Web height, in mm

b_f : Face plate breadth, in mm

C_W, C_F : Coefficients depending on the type and material of ordinary stiffeners, defined in Tab 4.

In any case, the renewal web and face plate thicknesses are to be not less than those obtained according to Pt A, Ch 2, App 3, [4] of the Rules.

7.2.3 Rule gross section modulus

The Rule gross section modulus is to be obtained, in cm^3, from the following formula:

$$w_G = \frac{w_Y + \beta t_C}{1 - \alpha t_C}$$

where:

α, β : Parameters, depending on the type of ordinary stiffener, defined in Pt B, Ch 4, Sec 2, Tab 1 of the Rules

w_Y : Net section modulus, in cm^3, defined in [7.2.1].

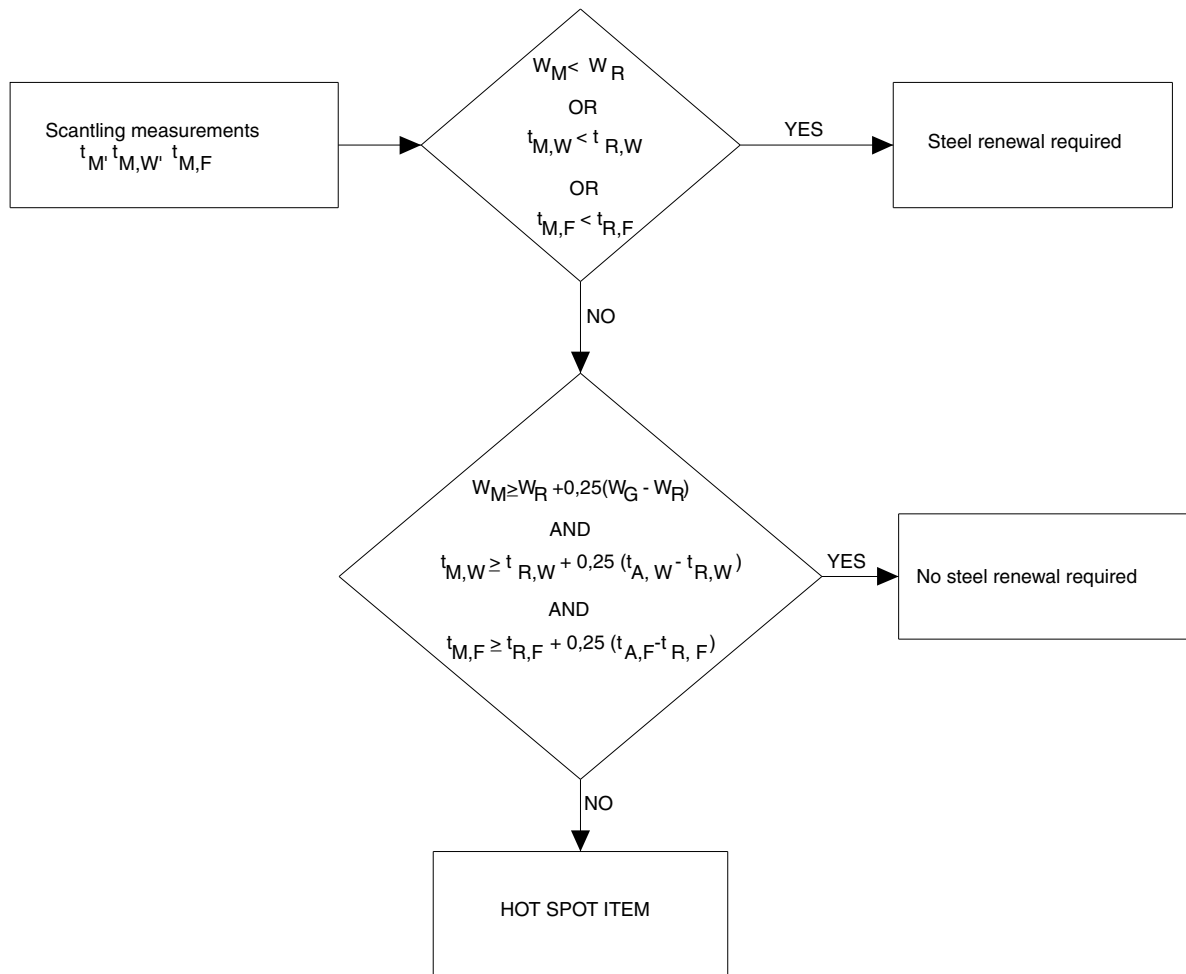**Figure 2 : Acceptance criteria for measured scantlings of ordinary stiffeners and application procedure**

Table 4 : Coefficients C_W and C_F

Type of ordinary stiffeners	C_W			C_F		
	$R_{eH} = 235$ N/mm^2	$R_{eH} = 315$ N/mm^2	$R_{eH} = 355$ N/mm^2	$R_{eH} = 235$ N/mm^2	$R_{eH} = 315$ N/mm^2	$R_{eH} = 355$ N/mm^2
Flat bar	20	18	17,5	Not applicable		
Bulb	56	51	49	Not applicable		
With symmetrical face plate	**56**	**51**	49	34	30	29
With non-symmetrical face plate	**56**	**51**	49	17	15	14,5

8 ACCEPTANCE CRITERIA FOR PRIMARY SUPPORTING MEMBERS

8.1 Application

The acceptance criteria for measured scantlings of primary supporting members, together with the application procedure to be adopted during the reassessment of hull structures, are represented in the flow chart in Fig 3.

The meaning of the symbols utilised in the flow chart is specified in [8.2] and [8.3].

8.2 Work ratios

8.2.1 Reassessment work ratio

The reassessment work ratio is to be obtained from the following formula:

$WR_R = \max(\gamma_{K6}WR_Y, \gamma_{K7}WR_B)$

where:

γ_{K6}, γ_{K7} : Partial safety factors for reassessment structural analyses:

$\gamma_{K6} = 0{,}85$

$\gamma_{K7} = 1{,}00$

WR_Y : Yielding work ratio, defined in [8.2.3]

WR_B : Buckling work ratio, defined in [8.2.4].

8.2.2 As-built work ratio

The as-built work ratio is to be obtained from the following formula:

$WR_A = \max(WR_Y, WR_B)$

where:

WR_Y : Yielding work ratio, defined in [8.2.3]

WR_B : Buckling work ratio, defined in [8.2.4].

8.2.3 Yielding work ratio

The yielding work ratio is to be obtained from the following formula:

$$WR_y = \frac{\gamma_R \gamma_m \sigma_{VM}}{R_y}$$

where:

σ_{VM} : Equivalent stress, in N/mm^2, to be calculated as specified in Pt B, Ch 7, App 1, [5.1.2] of the Rules, considering the hull structure as being constituted by elements (plating, ordinary stiffeners, primary supporting members) with measured thicknesses and scantlings

R_y : Minimum yield stress, in N/mm^2, of the material, to be taken equal to 235/k N/mm^2

k : Material factor, defined in Pt B, Ch 4, Sec 1, [2.3] of the Rules.

8.2.4 Buckling work ratio

The buckling element work ratio is to be obtained from the following formula:

$WR_B = \max(WR_{B1}, WR_{B2}, WR_{B3}, WR_{B4})$

where:

WR_{B1} : Compression buckling work ratio:

$$WR_{B1} = \frac{\gamma_R \gamma_m \sigma_b}{\sigma_C}$$

WR_{B2} : Shear buckling work ratio:

$$WR_{B2} = \frac{\gamma_R \gamma_m \tau_b}{\tau_C}$$

WR_{B3} : Compression, bending and shear buckling work ratio:

$$WR_{B3} = \frac{F}{F_C}$$

WR_{B4} : Bi-axial compression and shear buckling work ratio:

$$WR_{B4} = \gamma_R \gamma_m \left(\left(\frac{\sigma_a}{R_a \sigma_{c,a}} \right)^n + \left(\frac{\sigma_b}{R_b \sigma_{c,b}} \right)^n \right)^{\frac{1}{n}}$$

$\sigma_a, \sigma_b, \tau_b$: Normal and shear stresses, in N/mm^2, defined in Pt B, Ch 7, Sec 1, [5.4] of the Rules

σ_c, τ_c : Critical buckling stresses, in N/mm^2, defined in Pt B, Ch 7, Sec 1, [5.3] of the Rules

F : Coefficient defined in Pt B, Ch 7, Sec 1, [5.4.4] of the Rules

F_c : Coefficient to be obtained from the following formula:

for $\dfrac{\sigma_{comb}}{F} \leq \dfrac{R_{eH}}{2\gamma_R \gamma_m}$: $F_c = 1$

for $\dfrac{\sigma_{comb}}{F} > \dfrac{R_{eH}}{2\gamma_R \gamma_m}$:

$$F_c = \frac{4\sigma_{comb}}{R_{eH}/\gamma_R \gamma_m} \left(1 - \frac{\sigma_{comb}}{R_{eH}/\gamma_R \gamma_m} \right)$$

σ_{comb} : Combined stress in N/mm^2, defined in Pt B, Ch 7, Sec 1, [5.4.4] of the Rules

$\sigma_{c,a}, \sigma_{c,b}$: Critical buckling stresses, in N/mm^2, defined in Pt B, Ch 7, Sec 1, [5.4.5] of the Rules

n, R_a, R_b : Coefficients defined in Pt B, Ch 7, Sec 1, [5.4.5] of the Rules.

The above quantities are to be calculated considering the hull structure as being constituted by elements (plating, ordinary stiffeners, primary supporting members) with measured thicknesses and scantlings.

Figure 3 : Acceptance criteria for measured scantlings of primary supporting members and application procedure
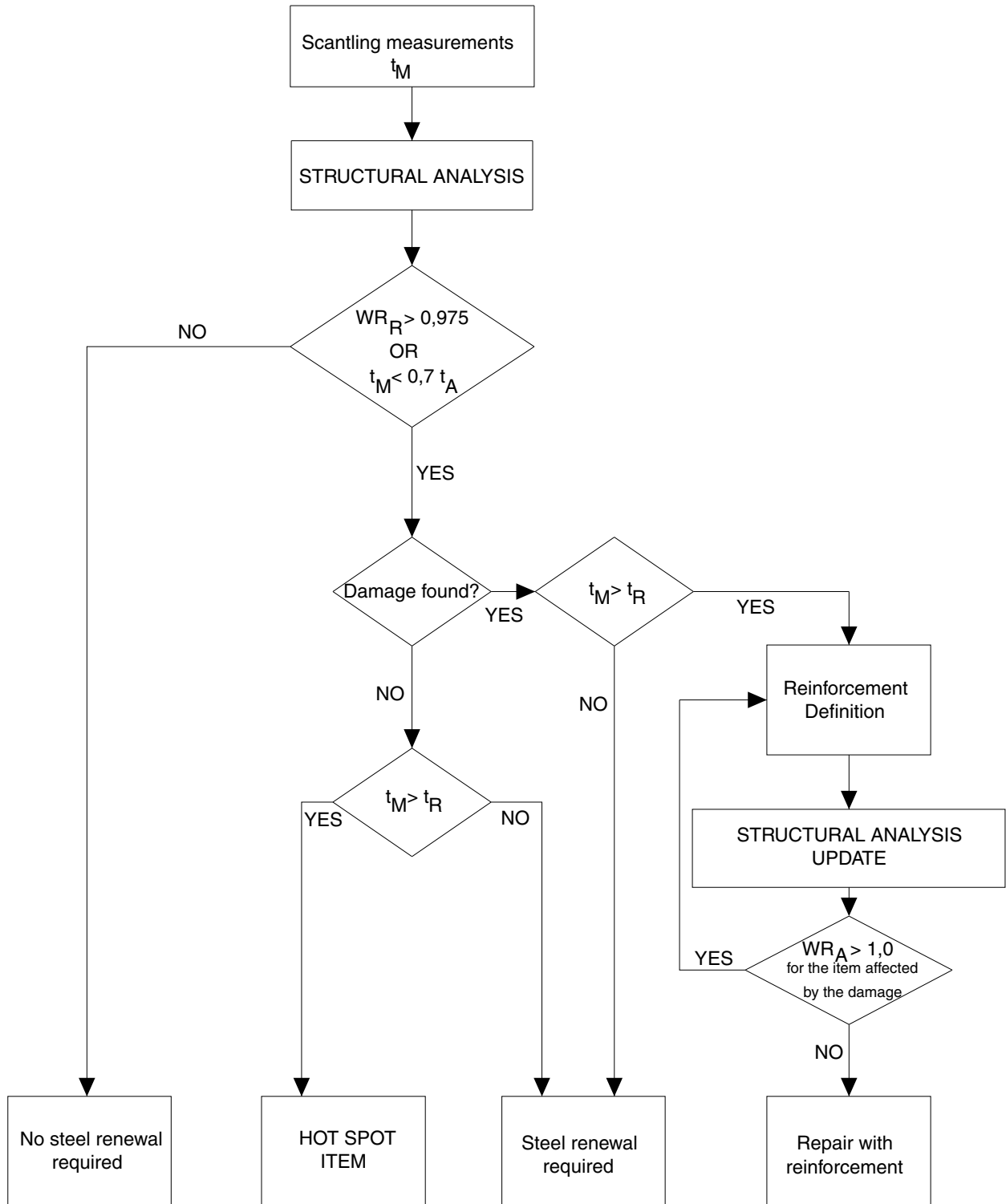
8.3 Renewal scantlings

8.3.1 Overall renewal thickness

The overall renewal thickness is to be obtained, in mm, from the following formula:

t_R = max (t_{RY}, t_{RB}, 0,75t_A)

8.3.2 Yielding renewal thickness

The yielding renewal thickness is to be obtained, in mm, from the following formula:

t_{RY} = t_Y γ_{K8}

where:

t_Y :   Net thickness to be obtained, in mm, from the following formula:

t_Y = [t_A - 0,5 (t_{C1} + t_{C2})] WR_Y

WR_Y :   Yielding work ratio, defined in [8.2.3]

γ_{K8} :   Partial safety factor for yielding strength checks:

γ_{K8} = N_P ψ_Y

N_p :   Coefficient defined in Tab 2

$$\psi_Y = 1 + \frac{0,25(t_{C1} + t_{C2})}{t_y}$$

8.3.3 Buckling renewal thickness

The buckling renewal thickness is to be obtained, in mm, from the following formula:

t_{RB} = t_B γ_{K9}

where:

t_B :   Net thickness to be obtained, in mm, from the following formula:

$$t_B = [t_A - 0,5(t_{C1} + t_{C2})]^3 \sqrt{WR_B}$$

WR_B :   Buckling work ratio, defined in [8.2.4]

γ_{K9} :   Partial safety factor for buckling strength checks:

γ_{K9} = N_P ψ_B

N_p :   Coefficient defined in Tab 2

$$\psi_B = 1 + \frac{0,25(t_{C1} + t_{C2})}{t_B}$$