Guide for the Ship Condition Assessment Program (CAP) for Bulk Carriers

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1 GENERAL

The aim of this guide is to provide Interested Parties with the criteria followed by Tasneef to carry out a Condition Assessment Program (CAP) in order to assign a rating based on the condition of a ship, independently of its classification. However, it is normally carried out for ships classed by Tasneef.

The CAP is based on visual inspections of structures, thickness measurements, structural calculations, inspections and tests of systems, machinery and equipment.

The rating assigned to the ship and the report issued following the CAP survey are entirely based on what is found at the time of the verification.

The CAP report, provided to the Interested Party, contains a detailed description of the ship's condition at the time of the survey.

The ship's condition is normally assessed for the whole hull structure, machinery and equipment according to a rating system comprising four levels, from 1 to 4, where 1 is the highest score. However, the condition could be assessed for and the rating could be assigned to single parts of the ship, if so agreed with the Interested Party.

Tasneef criteria can be complemented by and/or adjusted to particular requirements addressed by the Interested Parties, e.g. for charter purpose, underwriters' clause.

This guide also provides the requirements to be fulfilled in order to assign a "RightShip-CAP2/5"™ or "RightShip-CAP2/3"™ rating, in accordance with the "RightShip – Condition Assessment Program – Requirements". At this purpose, the requirements in [7.4] are to be fulfilled.

In case only a "RightShip-CAP2/5"™ or "RightShip-CAP2/3"™ rating is required, the requirements in [7.4.2] are to be fulfilled with in lieu of those in [7.2.8] and the requirements in [7.4.3] are to be fulfilled in addition to those in [7.3].

2 FIELD OF APPLICATION

This guide applies to bulk carriers, outside the scope of classification, at the request of the Interested Party, with the scope of issuing a "Condition Assessment Program (CAP)" report.

3 DEFINITIONS

"CAP" means Condition Assessment Program.

"CAP survey" means inspections, tests, checks and structural assessment carried out within the scope of the CAP.

"ESP" means the Enhanced Survey Program established in IMO Resolution MSC.461(101), as amended, in IACS UR Z.10.2 and Z.10.5 and in the relevant Rules.

"Interested Party" means the ship Owner or management company requesting Tasneef to carry out a CAP survey.

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

"As-built scantlings" means the scantlings indicated in the drawings for the ship at the time of construction.

"As-gauged scantlings" means the scantlings derived from thickness measurements taken at the time of the survey.

"Rule scantling" means the scantling required by the Rules.

"Substantial corrosion" is an extent of corrosion such that the assessment of the corrosion pattern indicates a wastage in excess of 75% of the allowable margins but within acceptable limits.

"Suspect area" means a location showing substantial corrosion and/or considered by the Surveyor to be prone to rapid wastage.

"UTM" means ultrasonic thickness measurements.

"Bulk Carrier" is a ship which is constructed generally with single deck, double bottom, hopper side tanks and topside tanks and with single or double side skin construction in cargo length area and intended primarily to carry dry cargoes in bulk.

4 CAP RATING SYSTEM

The condition of a ship is assessed according to the following rating system.

4.1 HULL STRUCTURES

4.1.1 Structural condition rating

1 **"VERY GOOD CONDITION"**

Items examined and measured, found with only superficial reductions from "as new" or current Rule scantlings. No maintenance or repair required.

2 **"GOOD CONDITION"**

Items examined and measured, found to have deficiencies of a minor nature not requiring correction or repairs and/or found to have thicknesses significantly above class limits.

3 **"SATISFACTORY CONDITION"**

Items examined and measured either found to have deficiencies which do not require immediate corrective actions, or found to have thicknesses which, although generally above class renewal levels, have areas of substantial corrosion.

4 **"POOR CONDITION"**

Items examined and measured either found to have deficiencies which may affect the ship's potential to remain in class, or found in some areas to have thicknesses that are at or below the class renewal levels.

4.1.2 Coating rating

1 **"GOOD CONDITION"**

Coating condition with only minor spot rusting (corresponding to the definition "good" according to ESP criteria).

2 **"FAIR CONDITION"**

Coating condition with local breakdown at edges of stiffeners and weld connections and/or light rusting over 20% or more of the areas under consideration, but less than that defined for poor condition (corresponding to the definition "fair" according to ESP criteria).

3 **"SATISFACTORY CONDITION"**

Coating condition with general breakdown of coating over 20% or more of areas or hard scale in 10% or more of areas under consideration (corresponding to the definition "poor" according to ESP criteria) or where the spaces are not coated and, in both cases, provided with cathodic means against corrosion or equivalent systems.

4 **"POOR CONDITION"**

Coating condition with general breakdown of coating over 20% or more of areas or hard scale in 10% or more of areas under consideration (corresponding to the definition "poor" according to ESP criteria) or when the spaces are not coated.

4.2 MACHINERY AND SYSTEMS

1 **"VERY GOOD CONDITION"**

Items and systems examined and function tested, found with no deficiencies affecting safe operation and/or performance. Documentation and maintenance practices considered good. No maintenance or repair required.

2 **"GOOD CONDITION"**

Items and systems examined and function tested, found with some minor deficiencies which do not affect safe operation and/or normal performance. Documentation and maintenance practices considered adequate. No immediate maintenance or repair considered necessary.

3 **"SATISFACTORY CONDITION"**

Items and systems examined and function tested, found with deficiencies not affecting safe operation and/or performance. Documentation and maintenance practices considered of a minimum standard. Some maintenance and repair may be considered necessary.

4 **"POOR CONDITION"**

Items and systems examined and function tested, found with deficiencies significantly affecting operation and/or performance. Documentation and maintenance practices considered inadequate. Maintenance and repair required to reinstate serviceability.

5 SCOPE OF THE CAP SURVEY

The CAP survey is to be carried out, at the Interested Party's request, by exclusive Tasneef Surveyors qualified for ESP surveys, at a class renewal or intermediate survey, or during a docking survey (inclusive of in-water survey in lieu of docking).

For a ship classed by Tasneef, items within the scope of the class survey inspected during the CAP survey and found in satisfactory condition can be credited also with respect to the class survey, when both are due.

If the CAP survey reveals that some items subject to class do not comply with the Rules, e.g. in terms of coating condition, substantial corrosion or suspect areas found during the close-up survey or hot spot items arising from fatigue analysis, corrective actions are required by Tasneef in accordance with the current classification procedures.

If the CAP service is requested by the Interested Party for a ship not classed by Tasneef, the Interested Party is responsible for informing the class Society accordingly. The Interested Party is also responsible for communicating to the Classification Society any recommendation arising from the CAP survey which is relevant to class.

6 DOCUMENTATION REQUIREMENTS

The Interested Party is to submit the following documentation to Tasneef (if not available in the Tasneef file), at the time of the request and in order to plan the CAP survey:

a) Drawings showing the as-built scantlings, including at least:
- general arrangement plan
- midship section
- capacity plan
- shell expansion
- construction profile plan
- transverse bulkheads
- cargo hold hatch covers, coamings and securing devices
- fore peak/aft peak structure;

b) Approved maximum still water bending moments;

c) History of steel renewal and last UTM reports.

7 CAP PROCEDURE

7.1 General

The procedure for carrying out the CAP survey hereinafter detailed is applicable to both ships classed with Tasneef and not.

Possible specific requirements and criteria may be addressed by the Interested Parties (e.g. for charter purpose, underwriters' clause) and applied in addition or as partial modification of the Tasneef procedure.

In case, such requirements and criteria shall be timely declared by the Interested Party to allow

proper planning and arrangement for the CAP survey and relevant reporting.

7.2 Hull structures

7.2.1 Check of ship's damage, repair and classification records

The check of the ship's records relevant to classification, damage and repair, steel renewals and UTM reports is to be carried out in order to address the following close-up surveys, taking into account possible suspect areas, areas with substantial corrosion, items identified by preliminary strength calculations and hot spot items arising from the fatigue analysis.

7.2.2 Critical Structural Areas

"Critical Structural Areas" are locations which have been identified from calculations or from the service history of the subject ship or from similar or sister ships as being sensitive to cracking, buckling or corrosion which would impair the structural integrity of the ship.

Such areas require special monitoring and are to be specially considered during the CAP survey.

7.2.3 Preliminary strength assessment (based on as-built scantlings)

The preliminary hull girder and local strength assessment is carried out on the basis of the as-built scantlings and compared with respect to the Rule requirements for new buildings, by using the Tasneef LEONARDO HULL program.

7.2.4 Fatigue analysis

The fatigue analysis of structural details is carried out according to the procedure specified in Part B, Ch 7, Sec 4 of the Rules.

This procedure is based on the calculation of the fatigue damage originated by the fluctuating stresses induced in the detail by the hull girder and local wave loads, combined with the ballast and full load cargo conditions. The fatigue life of the detail is calculated from the fatigue damage.

The fatigue analysis is based on the following assumptions.

a) Cyclic wave loads are calculated considering the ship engaged in typical worldwide navigation, represented by the North Atlantic scatter diagrams provided by Global Wave Statistics. In this case, the coefficient ξ defined in Pt B, Ch 7, Sec 4 of the Rules is used.

   If the ship is engaged in trade voyages within specific geographic areas, the above coefficient ξ is calculated by means of the formula:

$$\xi = \frac{0{,}47}{\ln \frac{\sigma_8}{\sigma_5}}$$

   The long-term stresses σ_8 and σ_5, at a probability level of 10^{-8} and 10^{-5}, respectively, are obtained by means of seakeeping analyses based on the scatter diagrams representative of the relevant areas.

   In this case, the navigation areas are to be specified by the Owner and are indicated on the ship's Certificate of Classification.

b) The fluctuating stress ranges are calculated in the examined details as being originated by the hull girder and local wave loads in load cases "a", "b", "c" and "d", defined in the Rules, considering the ship in full load and ballast conditions.

   For the detail connections between longitudinal ordinary stiffeners and transverse primary supporting members (transverse bulkheads and web frames), the following contributions to the fluctuating stresses in the stiffeners are accounted for:

   - axial stresses due to the wave hull girder bending moments, vertical and horizontal,
   - bending stresses induced by the local wave loads supported by the stiffener,
   - for the connections with transverse bulkheads, additional bending stresses due to the relative deflections between the transverse bulkheads and the adjacent web frames (see Fig 1).

c) All the wave loads applied to the structural elements are multiplied by the relevant Partial Safety Factors defined in the Rules.

d) The stress ranges for the fatigue checks are calculated considering the structures with their net scantlings, explicitly to take into account the effects of corrosion.

e) The fatigue analysis is based on the notch stress ranges, i.e. the peak stress ranges in the root of the weld (see Fig 2). These peak stresses take into account the stress concentrations due to the presence of welds.

   Notch stress ranges are obtained from the hot spot stress ranges (which account for the detail geometry, but not for the presence of welds) through coefficients defined in the Rules depending on the type of welding adopted.

   Hot spot stresses are obtained from the nominal stresses by applying the Stress Concentration Factors (SCFs) defined in the Rules for the specific geometry of the connection. Where no appropriate SCF values are available, the Rule specifies the procedure for calculating the hot spot stresses through a finite element analysis.

f) The notch stress ranges are multiplied by other coefficients that accounts for the following effects:

   - reduction of the fatigue strength for thicknesses greater than 16 mm,

- increase of the stress range due to possible misalignment,
- in the case of ordinary stiffener connections, increase of the stress range because of the warping stresses that originate in the flange of unsymmetrical profiles.

g) The fatigue damage and the fatigue life are calculated taking into account the Partial Safety Factors on material and resistance, defined in the Rules.

Based on the above procedure, the fatigue life of the examined detail, in years, is obtained from the following formula:

$$f_L = \frac{20}{\gamma_R}\left(\frac{\Delta\sigma_{p0}}{\Delta\sigma_{N,eq}}\right)^3$$

(A) If the calculated fatigue life is between 17 years and 23 years, the item is identified as a "hot spot item" to be subjected to a close-up survey as part of the CAP survey

(B) If:

- the fatigue life is less than 17 years, or
- the calculated fatigue life is less than the actual ship life + 3, in years

the item is identified as a "hot spot item" to be inspected by a close-up survey at the time of the CAP survey and, in addition, it is to be included in the list of items to be closely inspected at every annual class survey, with the purpose of detecting any fatigue related problem.

When deemed necessary, a non-destructive examination, such as the dye penetrant test, may be required to be carried out during the close-up survey.

Figure 1: Additional bending stresses due to the relative deflections between transverse bulkheads and adjacent web frames

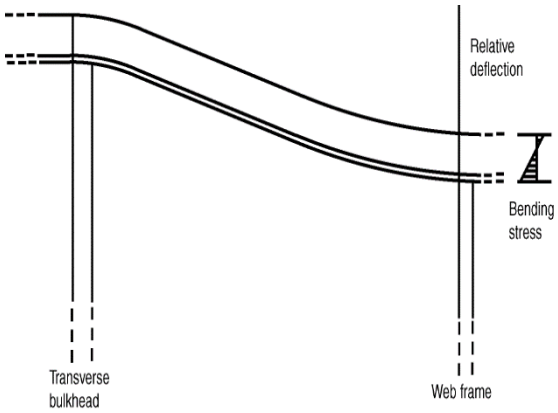
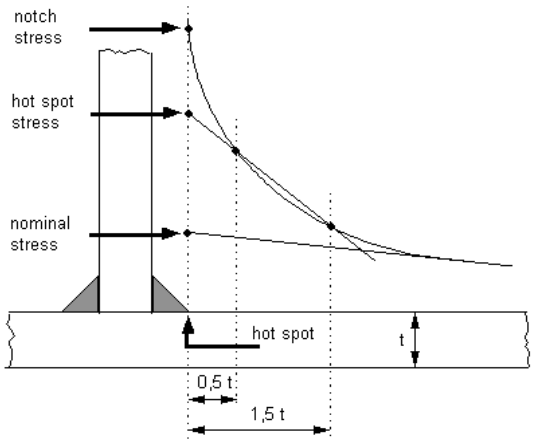


Figure 2: Types of stresses for the fatigue analyses



7.2.5 Inspection

Prior to the inspection, a meeting is to be arranged between the Interested Party's representatives and the attending Tasneef Surveyor in order to discuss the conditions under which the inspections will be carried out, means of access and methods for taking the thickness measurements.

In general, the inspection is to be carried out in dry dock. Tasneef may accept that the inspection is carried out afloat if the ship is anchored in sheltered waters in calm sea and good weather conditions.

The inspection is to be commenced by taking steel thickness measurements and conducting close-up surveys of the internal spaces.

It is the Interested Party's responsibility to ensure that the spaces to be inspected are properly cleaned, ventilated to maintain a safe atmosphere and lit. Provision is to be made to allow Surveyors to perform the planned close-up surveys and thickness measurements.

Inspections of internal spaces (outside the engine room area) are to be carried out in all ballast tanks (including aft and fore peak) and at least 30% of cargo spaces are to be close-up inspected. The remaining spaces are to be subjected to an overall inspection.

A selection of tanks for fuel oil and lube oil within the cargo length area will be accepted for examination. Depending on the outcome of the above-mentioned inspections, the extent of the close-up surveys may be increased to the Surveyor's satisfaction.

A dry dock or underwater inspection is to be conducted outside the engine room area, including the rudder and propeller.

It is to be checked that the Loading Manual and/or Loading Instrument are in accordance with the Rules and that the Master and the deck officers are familiar with them.

Photographs are to be taken to show the condition of the structure as found during the inspection and the improvement obtained as a consequence of steel renewals and/or repairs, if any. The photographs are to be part of the survey documentation and included in the final CAP report.

7.2.6 Thickness measurements

A qualified gauging firm is to carry out the thickness measurements to the extent necessary to calculate the actual structural strength of the ship.

The extent of the thickness measurements is to be discussed and agreed with the attending Tasneef Surveyor before their commencement.

Documentation of measurements carried out during the last 12 months may be taken into account for the purpose of planning the thickness measurements to be carried out during the CAP survey.

The extent of the thickness measurements may be reduced or extended, at the discretion of the attending Tasneef Surveyor, on the basis of the results of close-up surveys and evidence of thickness measurements taken during the inspection.

Thickness measurements are to be taken at least in the following areas:

1) Within the cargo length area:
   - Each deck plate outside the line of cargo hatch openings.
   - Three transverse sections including all longitudinal members such as plating, longitudinal stiffeners and girders at the ship deck, side, inner side if fitted, bottom, inner bottom, hopper tank and topside tank sloping structures.

   The above sections are to be chosen to include representative cargo and ballast tanks.
   - Each bottom plate.
   - All wind and water strakes.
   - Measurements of structural members subject to a close-up survey for general assessment and recording of the corrosion pattern, in accordance with the requirements of the Rules, Pt A, Ch 4, Sec 2, Table 6.
2) Outside the cargo area:
   - Selected wind and water strakes.

7.2.7 Strength assessment based on as-gauged scantlings

Upon verification of the measured scantlings, a strength evaluation based on measured thickness is carried out by Tasneef using the LEONARDO HULL program.

The hull girder section modulus W_M, calculated considering the as-gauged scantlings, is to be not less than 90% of the hull girder section modulus W_{AB} calculated considering the as-built scantlings. 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-mentioned requirement.

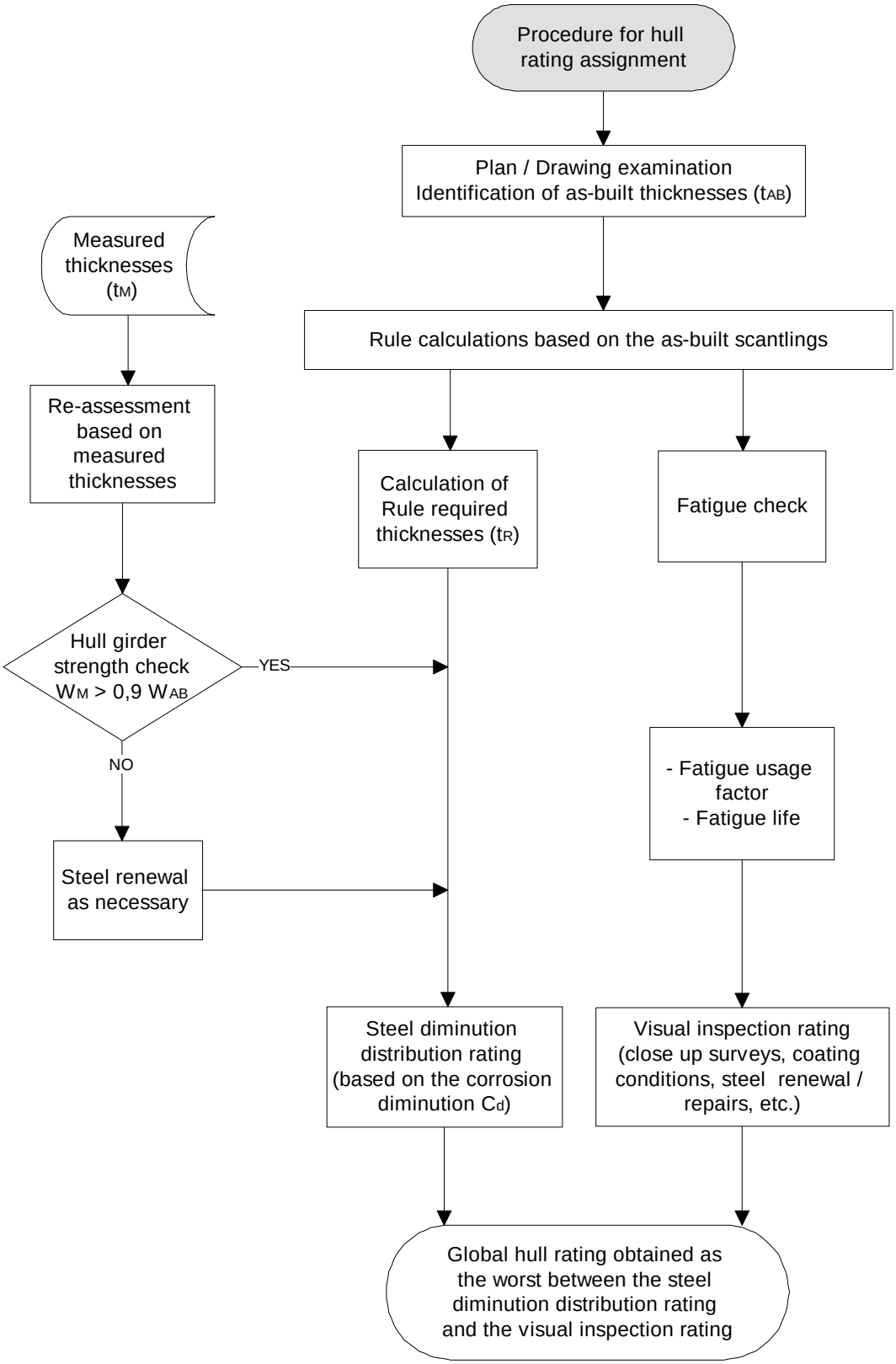
A local strength assessment of structural elements, including yielding and buckling of plates and stiffeners, is carried out on the basis of the as-gauged scantlings and Tasneef criteria for existing ships by means of the Tasneef LEONARDO HULL program.

7.2.8 Hull rating

The hull rating (see Fig 3) is assigned from the evaluation of the inspection rating (based on the strength assessment and fatigue analysis in [7.2.2] and [7.2.3], and derived from the inspections carried out according to [7.2.4]) and from the steel diminution rating (derived from the thickness measurements defined in [7.2.5] and the strength assessment based on as-gauged scantlings in [7.2.6]).

The overall hull rating is assigned as the visual inspection rating or the steel diminution distribution rating, whichever is the worse.

Figure 3: Flow chart of the procedure for assigning a rating to hull structures



7.2.8.1 Visual inspection rating

Further to the visual inspection, a rating is assigned according to the following criteria:

a) Structural condition rating
   This consists of an assessment of the condition of the structure as regards damage, deformations, indents, buckling, cracks, wear and pitting.
   The rating of each item is attributed according to the criteria indicated in [4.1.1].
   The rating is assigned as the average of the ratings attributed to each structural item.

b) Coating rating
   This consists of an assessment of the condition of the coating of the steel structures.
   The rating of each item is attributed according to the criteria indicated in [4.1.2].

For each item inspected, the visual inspection rating is calculated as follows:

visual inspection rating = structural condition rating x 0,80 + coating rating x 0,20

The overall visual inspection rating is the average of the ratings attributed to all items inspected.

7.2.8.2 Steel diminution rating

The criteria for assigning the steel diminution rating to each structural element are indicated in Tab 1, where the steel diminution factor C_d is defined as the ratio of the thickness reduction due to corrosion to the allowable wastage limit for the element under consideration, calculated according to Pt A, Ch 2, App 3 of the Rules (see Fig 4).

Table 1: Rating for steel diminution

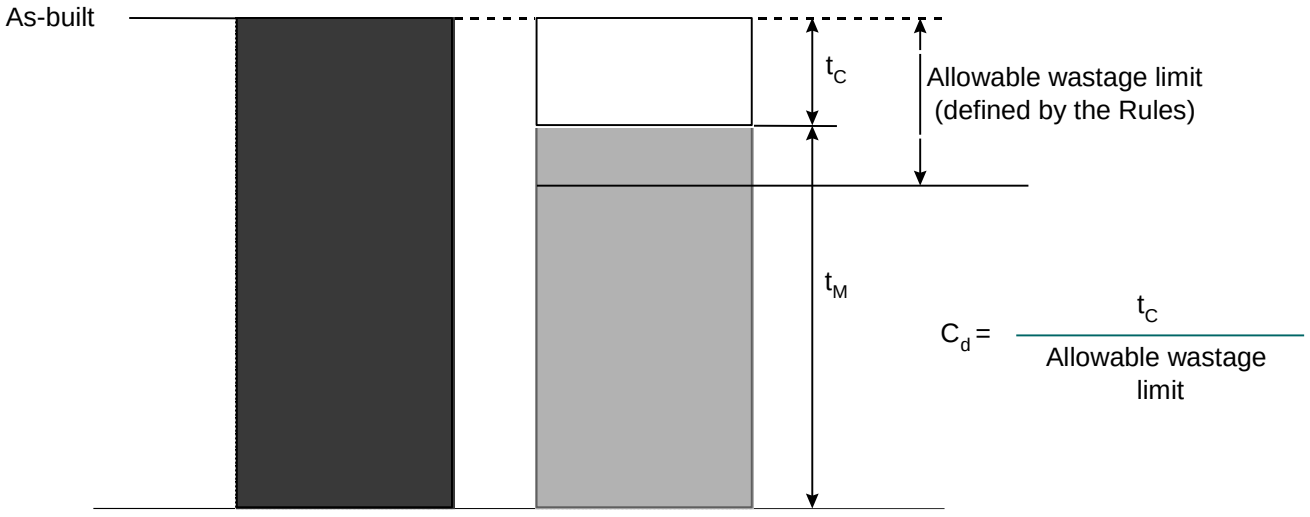
Steel diminution factor C_d	Rating
$0 \le C_d \le 0,33$	1
$0,33 < C_d \le 0,75$	2
$0,75 < C_d \le 1$	3
$C_d > 1$	4

When the as-built scantling of a structural element from the strength assessment in [7.2.2] is lower than the one required by the Rules for a new building, the relevant allowable wastage limits are reduced by the difference between the Rule required thickness t_R and the as-built scantling, as shown in Fig 5 below.

A cumulative distribution curve, as shown in the example in Fig 6, is derived by determining the steel diminution factor and associated rating of all structural elements.

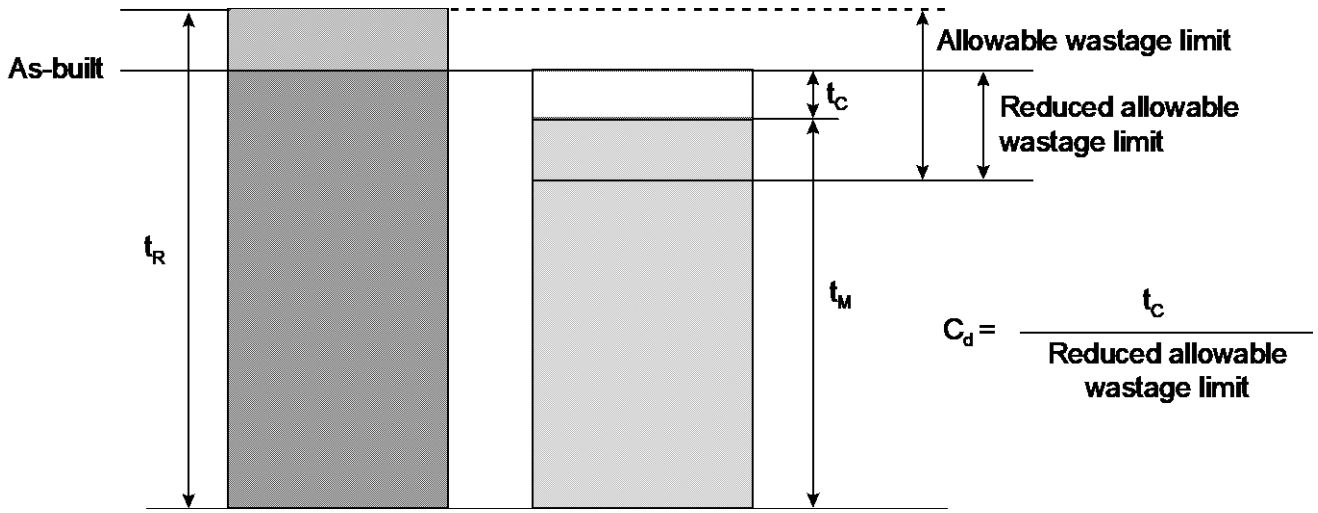
The overall steel diminution rating is assigned as the one corresponding to 90% of the readings (according to the example in Figure 6, rating 2 is assigned).

Figure 4: Steel diminution factor C_d



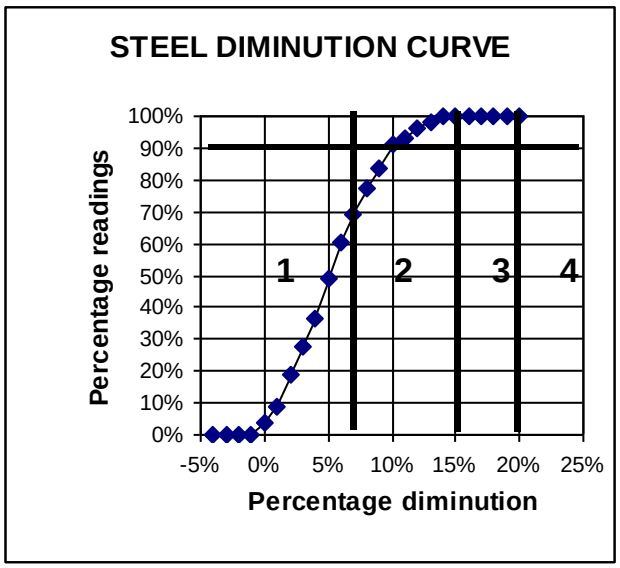
t_c is the thickness diminution due to corrosion
t_M is the actual thickness as gauged

Figure 5: Corrosion diminution C_d



t_c is the thickness diminution due to corrosion
t_M is the actual thickness as gauged
t_R is the required thickness according to the Rules

Figure 6: Cumulative steel diminution distribution curve



7.3 Machinery and systems

7.3.1 General

A general examination of machinery and systems is carried out as part of the CAP survey, paying attention to their overall condition and records of defects and functional tests, without requesting the opening of components.

The rating of each item inspected is attributed according to the criteria indicated in [4.2].

The overall machinery rating is assigned as the average of the ratings attributed to the different parts surveyed.

7.3.2 Machinery

The CAP survey of machinery includes:

a) general examination, including functional tests, of the main propulsion plant;

b) internal inspection of items opened for maintenance:
- for diesel engines, assessment of items such as crankcase, scavenge spaces, piston rings, bearing clearance, cylinder heads;
- the bearing clearance and gearing condition of steam turbines;
- boilers and economisers, where possible including the internal examination of water and gas spaces, and external examination of casing, burner equipment, blowers and safety valves;

c) oil sample of oil systems such as gearing, crankcase, sterntube, to be taken for analysis;

d) assessment of record of maintenance for items under PMS/CBM, when applicable.

7.3.3 Electrical installations

The CAP survey of electrical installations includes:

a) alternators under working conditions, both individually and during load sharing operations;

b) the fittings and equipment of the main and emergency switchboards, section boards and subsidiary distribution boards, including random tests of their safety devices;

c) records of insulation-resistance tests performed on cables, switchgear, generators, motors, heaters and lighting fittings, witnessing sample tests;

d) electrical cables, taking into account the aforementioned insulation resistance tests;
e) the emergency source of power, associated circuits and equipment, including testing under working conditions.

7.3.4 Auxiliary systems

The CAP survey includes the general examination including functional tests of auxiliary systems for propulsion, power generation, steering, fuel oil, lube oil, cooling water, compressed air, steam, ventilation and accommodation services.

Each system is to be examined having regard to the general condition, leakages, supporting instrumentation, emergency arrangements, etc.

7.3.5 Safety protection devices

The various safety protection devices fitted to protect machinery and machinery spaces (alarms, shutdowns, standby pumps cut-in, remote stops, remote closing valves, bilge alarms, fire flaps, etc.) are to be assessed in order to verify their correct operation.

7.3.6 Other equipment

Anchor equipment, mooring systems, hatch cover securing devices (including operating equipment and hydraulic actuators), cargo gear and life-saving appliances are to be inspected and assessed by means of functional tests.

7.3.7 Plant performance in terms of environmental impact

Performance tests and assessments are to be carried out for all equipment that has an impact on the environment such as fuel management, lube oil leakages, air emission, bilge cleanness and oily water management.

7.3.8 Cargo and ballast systems

The CAP survey includes the inspection and testing of cargo related equipment and systems, including cargo equipment and closing devices, bilge, ballast and ventilation systems.

A functional test is to be carried out while the ship is trading (during loading or unloading in the harbour).

7.4 "Rightship"™ rating

7.4.1 General

The requirements in [7.4] are to be fulfilled for the purpose of the assignment of a "RightShip-CAP2/5"™ or "RightShip-CAP2/3"™ rating.

7.4.2 Hull structures

7.4.2.1 General

The requirements of this item [7.4.2] apply to all ballast tanks, cargo spaces and main structure members (side, bottom, deck, inner deck, inner bottom, internal structures, transverse bulkheads and longitudinal bulkheads).

7.4.2.2 Visual inspection rating

The structural condition and coating rating of hatch covers and coamings is to be at least "GOOD".

The coating rating of ballast tank is to be at least "GOOD". A rating "FAIR" may be accepted where anodes are installed.

The coating rating of deck undersides, side shell and bulkheads in cargo holds is to be at least "GOOD" (this request does not apply to ships assigned the service notation **Ore Carrier ESP)**.

7.4.2.3 Steel diminution rating

The steel diminution factor C_d is to result:

a) "RightShip-CAP2/5"™ rating
   $C_d \leq 0,65$
b) "RightShip-CAP2/3"™ rating
   $C_d \leq 0,75$.

7.4.2.4 Cumulative distribution curve

The Cumulative steel diminution distribution curve, as per [7.2.8.2], is to be defined for each ballast tank, cargo space, and main structure members (side, bottom, deck, inner deck, inner bottom, internal structures, transverse bulkheads and longitudinal bulkheads).

7.4.3 Machinery and systems

The overall machinery rating, as per [7.3.1], is to be not less than 2.

The rating of hatch cover securing devices (including operating equipment and hydraulic actuators) is to be at least "GOOD".

All hydraulic pipe works are to be well coated with no active corrosion.

Windlass and winch brakes are to be tested to check the rendering load of the individual brakes. A copy of the brake test results is to be retained on board the vessel.

8 SURVEY REPORTING

The Surveyor in charge of the CAP survey is responsible for providing in the survey report an indication of the ratings assigned to structures and machinery items, based on his observations and the evaluation criteria provided in [4].

The Surveyor's report is to contain a detailed description of the survey findings, including photographs to show the best, worst and average conditions taken into consideration, and relevant upgrading works agreed with and carried out by the Interested Party.

9 SHIP'S OVERALL RATING

The ship's overall rating is assigned by combining the hull rating (weight 70%) with the machinery and system rating (weight 30%).

10 FINAL CAP REPORT

The results of the CAP Survey are summarised in the CAP report. A blank copy of the report is enclosed, as an example, in Annex 1.

In line with the scope of the Condition Assessment Program, this report is to include the following:

a) introduction
b) executive summary
c) ship's description / main data / history
d) details of hull surveys in each compartment, including photographs
e) details of machinery surveys for each component and system, including photographs
f) results of strength assessment and fatigue analysis
g) conclusions
h) references
i) Annexes, including the following:
   - ship's survey status
   - output of structural strength assessment and fatigue analysis based on as-built scantlings with the indication of "hot spots"
   - UTM report (only for ships not classed by Tasneef)
   - details of repairs (if any)
   - structural strength assessment based on as-gauged scantlings.