

Guideline for DNV's Condition Assessment Programme – Bulk



<http://cap.dnv.com>

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CAP BULK GUIDELINE

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1 Summary

The Condition Assessment Programme (CAP) was introduced by DNV in 1989. CAP is today's best quality measurement tool for older vessels focusing on technical and functional condition.

The DNV Condition Assessment Programme includes a detailed, thorough and transparent quality evaluation of ships. The DNV CAP report documents the condition by including narrative descriptions, photos and analyses, and rates the vessel in accordance with a rating scale from 1 (best) to 4 (lowest).

The main benefit of the DNV Condition Assessment Programme is to have a vessel judged based on the actual condition onboard rather than age. The DNV CAP report is mainly used as a tool for documenting the technical condition towards cargo owners, terminal owners and/or authorities in connection with renewal or entry into new charters. The DNV CAP report may serve as an important element in the vetting process with cargo owners and others, and these may have specific requirements regarding the CAP rating and other technical issues described in the CAP report.

Before the CAP inspection, the client should consider suitable objectives regarding overall and detail CAP rating. Such an evaluation could be based on stated or implied requirements from potential port owners/ charterers, the current condition of the ship, and the time/money intended invested towards upgrading of the vessel.

A DNV CAP report describes both the condition of the vessel at the time of the inspection and the condition after repairs and possible upgrading.

2 About this Guideline

2.1 Objective of the guideline

The objective of the guideline is to give the reader an overview of the CAP service and its relevance for the regulatory and commercial environment in which ships are operated. It is also intended as a practical guide on how to carry out a successful CAP project.

The CAP service is divided into two areas:
Hull
Machinery and Cargo Handling Systems

This guideline covers mainly CAP hull.

2.2 Target groups

The primary target group of this guideline is clients and potential clients of the service, typically ship-owners and their representatives. The secondary target group is anyone that may use the results and findings from the service for evaluation purposes.

2.3 How to use this guideline

To gain a quick overview: Read [Summary](#) and [What is CAP](#).

To decide on suitable targets regarding the results of the service: Read [Commercial Aspects](#).

To decide on how to best use your resources with respect to CAP: Read [Summary](#), [What is CAP](#), [Commercial Aspects](#) and [Appendix 1 - Rating Methodology](#).

For advice on how to best run a CAP project: Read [Practical CAP Project Management](#) and [About CAP](#).

To learn how CAP ratings are decided: Read [Appendix 1 - Rating Methodology](#).

3 What is CAP

3.1 The DNV Condition Assessment Programme

CAP is today's best quality measurement tool for older vessels focusing on technical and functional condition. The programme is designed for tankers and bulk carriers older than 15 years but may well be used for other types of tonnage and at any age.

The DNV Condition Assessment Programme includes a detailed, thorough and transparent quality evaluation of ships. The DNV CAP report documents the condition by including narrative descriptions, photos and analyses, and rates the vessel in accordance with a rating scale from 1 (best) to 4 (lowest). DNV uses a rating system which is criteria based, transparent and predictable.

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The main benefit of the DNV Condition Assessment Programme is to have a vessel judged based on the actual condition onboard rather than age.

The DNV CAP report is mainly used as a tool for documenting the technical condition towards ports, cargo owners or authorities in connection with renewal of or entry into new charters. The CAP report can be used for other purposes as well, such as in connection with refinancing and sale of the vessel, termination of management agreements or towards underwriters. The DNV CAP report can also be used to establish a sound basis for decisions on repair or investments in order to extend the lifetime of the vessel, and to obtain documentation on the owners/management company's own standards.



“CAP is a consultancy service and is independent, yet complementary, to classification”

3.2 Interface with classification and flag state

CAP is a consultancy service and is independent, yet complementary, to classification. The CAP-service is offered according to a contract with the client and rendered to ships with or without DNV class.

minimum. It is the client's decision to upgrade the structure beyond the minimum acceptable standard to achieve the CAP rating objective.

Class is a continuous service based on regular inspections and the issuing of class certificates with specified validity periods. A CAP declaration is issued documenting the condition of the vessel at the time of the inspection.

Class is aimed at ensuring a minimum standard for the vessel whereas the main purpose of CAP is to evaluate and report the vessel's condition above minimum class standard. The scope for CAP is more comprehensive than for class surveys with respect to extent and analysis of thickness measurements, structural strength evaluation and reporting.

Although CAP inspections may be carried out concurrently with class surveys, and a joint CAP/Class team maybe onboard, CAP is reported completely separate.

Please note that the minimum acceptance criteria are the same for Class and CAP. These acceptance criteria are clearly defined in DNV documents. The evaluation which forms the basis for the CAP rating refers to this defined

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4 Commercial Aspects

4.1 Market requirements

For clients of the CAP service it is important to recognise that it is not DNV, but the terminal owners, cargo owners or charterers etc. who ultimately decide the technical acceptance criteria for a vessel. The DNV CAP report serves as an important element in decision makings for these 3rd parties.



“.... it is not DNV, but the charterers/cargo owners who ultimately decide the technical acceptance criteria for a vessel”

It is DNV's experience that requirements change over time, and that the trend is consistent towards stricter requirements.

4.2 CAP Rating Objectives

Based on general market requirements, alternative CAP rating objectives may be:

- Alt. 1) Minimum overall CAP 2.
- Alt. 2) Minimum overall CAP 2, and
 - no substantial corrosion.
- Alt. 3) Minimum overall CAP 2, and
 - no substantial corrosion.
 - no POOR coating (coating rating 3).
- Alt. 4) Minimum overall CAP 2, and
 - no substantial corrosion.
 - no local visual or UTM rating 3.
 - no POOR coating (coating rating 3).
- Alt. 5) Overall CAP 1 (no single 3 rating of any item allowed and average of rated items is CAP 1)

When deciding on CAP rating objectives it is advisable to take into account also the technical condition of the vessel at the start of the process, as well as the time and money intended spent on possible upgrading.

It should be noted that a specific CAP rating with DNV cannot be ordered. It has to be justified based on the technical condition of the ship.

4.3 Transparency

Environmental issues and an increased demand for transparency are high on the agenda of authorities, regulators and the society at large. This is particularly true when it comes to operations that may have a large negative impact on the environment, or other serious consequences. As a response to this many companies have adopted transparency as a key component in their strategy.

The trend is also taking root within the maritime industry with the more pro-active shipping companies moving in the same direction.

DNV's CAP is a highly transparent service, and the CAP report gives a thorough and detailed picture of the vessel's condition. Clarity regarding the condition of a chartered vessel is a requirement from most charterers, and a well documented, transparent evaluation clearly enhances the commercial attractiveness of a vessel. Lack of transparency causes suspicion and uncertainty and may be a disadvantage commercially.

5 CAP Hull Methodology

5.1 General

The DNV Condition Assessment Programme Hull is based on an extensive inspection of the vessel to identify extent of local corrosion and defects. The thicknesses of all main structural elements in all spaces inspected are measured to establish the extent of general corrosion. The analysis of the thickness measurement data forms an important basis for the CAP hull rating.

The global structural strength of the ship is evaluated based on the actual measured scantlings.

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5.2 Hull rating definitions

CAP rates the vessel in accordance with a rating scale from 1 (very good) to 4 (poor). The CAP Hull ratings have the following descriptions:

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, although generally above class renewal levels, with substantial corrosion.

Below class minimum standard

4 Poor condition.

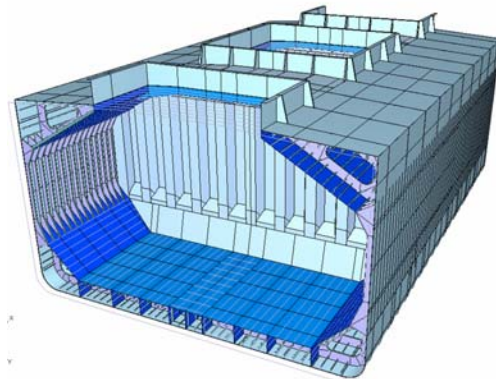
Items examined and measured either found to have deficiencies which may affect the ship’s potential to remain in class, or found to have, in some areas, thicknesses that are at or below the class renewal levels.

5.3 Rating method

DNV uses a rating methodology which is criteria based, transparent and predictable.

The items rated are:

- Ballast tanks.
- Cargo holds and void spaces.
- Hatches and coamings
- The vessel’s external structure (main deck, ship sides and bottom).
- Structural strength.



Each hold/tank rating is based on ratings of the main structural elements of the space (tank/hold), e.g. deckhead, side, bottom, inner bottom, longitudinal bulkhead, transverse bulkheads and internal structure.

The rating of each main structural element is based on:

- Visual inspection to establish extent of local corrosion and defects, and to give a visual impression of the overall condition.
- Analysis of thickness measurements (UTM) to establish extent of general corrosion
- Extent and condition of coating for ballast tanks.

An example of a rating table for a ballast tank is shown below.

Structural element	UTM	Visual	Coating	Overall
Deckhead	2	2	2	2,0
Side	2	2	2	2,0
Bottom	2	1	1	1,3
Longitudinal bulkhead	1	2	1	1,3
Transverse bulkheads	2	2	1	1,7
Internal structure	2	2	1	1,7
Tank average rating				1,7
Tank overall rating				2

The vessel’s rating is the average of the overall rating for the ballast tanks, cargo holds and voids, external structure and structural strength. This rating is not to be better than one grade above any strength rating, UTM, visual or coating rating for any structural element in any tank/space/structure.

It should be noted that the final CAP rating is decided by DNV’s CAP Rating Committee.

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For further details about the rating methodology, please see description in [Appendix 1 - Rating Methodology](#)

that it is expected that the client takes responsibility for it. DNV and the CAP surveyor will assist in every way possible in order to achieve a successful outcome of the project.

5.4 CAP Survey Documents

5.4.1 CAP Defects List

All defects which would result in Condition of Class when performing a class survey are included in the CAP Defects List. These defects must be repaired. When CAP inspections are carried out independently of class surveys, the CAP surveyor will ensure that all findings below DNV class requirements are being repaired, or formally handled by DNV as Condition of Class (CCs).



“The CAP Defects List includes findings that must be repaired”

5.4.2 CAP Upgrade Report

In addition to the defects included in the CAP Defects List, findings considered above class minimum requirements may affect the local visual, UTM and coating rating. It is up to the owner to decide if such findings are to be repaired. Various levels of upgrading above DNV class minimum requirements may be necessary in order to reach the client’s local or overall CAP rating objective. Such items requiring upgrading are described in a CAP Upgrade Report.

The level of detail in the CAP Upgrade Report will vary depending of the size of the gap between the observed condition and the client’s desired CAP rating. In cases of considerable deviation it will not include lengthy, specific repair proposals. It should be noted that upgrading is voluntary, and

“The CAP Upgrade Report includes findings that are considered above class minimum requirements”

The rating methodology involves averaging of several factors, and it may be complicated to give exact advice regarding the level of upgrading necessary to obtain a specific overall CAP

rating. The CAP Upgrade Report may therefore be seen as an overview of items that must be upgraded in order to avoid local ratings below the client’s objective, and not as a guarantee from DNV of a specific overall rating following upgrading of the described items. This is particularly the case for an overall CAP rating of 1. Achieving a CAP 2 rating overall will in most cases be obtained by repairing defects in the CAP Defects list and upgrading of findings in the CAP Upgrade report.

5.5 CAP Hull Report

The CAP hull report consists of:

- Statement of facts and particulars of the vessel.
- Summary of findings from inspection and analyses.
- CAP rating summary.
- Structural strength analysis and rating.
- Descriptions, observations and ratings for each main structural element in each space.
- Description an rating of external structure
- Descriptions and photos of defects.
- Descriptions of repairs and upgrading.
- Statistical analysis of UTM data for each main structural element in each space
- Photographic evidence of the condition in each tank /hold/ space.

5.6 Rating Committee

All reports are being assessed by a CAP Rating Committee before final issue. The Rating Committee consists of appointed senior DNV personnel representing relevant disciplines.



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The CAP Rating Committee decides the final CAP Rating.

5.7 CAP Declaration

A CAP Rating Declaration is issued at completion of the CAP project. The overall CAP Hull Rating is stated in the Declaration. The document gives no period of validity.

5.8 Supporting documents and additional information

Additional general information regarding CAP services and supporting documents for external use like DNV UTM template, DNV Thickness Measurement Specification, etc. are available at the CAP website: <http://cap.dnv.com>

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6 Practical CAP Project Management

6.1 General

A successful CAP project relies on co-operation from all the involved parties. Obtaining the desired outcome of the project may, in addition to the cost of the inspection itself, involve considerable costs in connection with repairs and upgrading of the vessel. It is therefore advisable to allocate appropriate resources towards the management of the project.

6.2 Interface with classification and flag state

It is advisable to carry out CAP inspections concurrently with class renewal survey or class intermediate survey. This will in many cases help avoid extra work and costs both with regard to inspections and repairs.

6.3 Communication, points of contact

After the signing of a CAP contract DNV will appoint a CAP Project Manager. The project manager will act as the point of contact at DNV throughout the CAP project. After notification of the intended time and place for the CAP inspection DNV will appoint a CAP surveyor responsible for the inspection.

In order to ease the communication it is beneficial if the client provides DNV with contact details of the person in charge of the CAP project.

Contact details for the ship's agent must be provided when the time and place for the CAP inspection is decided.

6.4 Planning and preparation prior to a CAP inspection

6.4.1 Notification

According to the CAP contract, the client shall notify DNV at least 3 weeks before the requested commencement of the CAP inspection and shall provide DNV with all necessary information for planning and arranging the inspection.

Early notification is essential for DNV in order to be able to prepare for the inspection and to carry

out structural strength analysis prior to the CAP Hull inspection. CAP is a specialised service with a limited number of qualified surveyors available, and early notification is required in order to arrange manning of the projects. Additional lead time may be required if special Visa requirements, or other practical limitations apply.

It is advisable to notify the ship staff at an early stage so that preparations for the upcoming inspection may be initiated (see: "Access and safety" below).



6.4.2 Time schedule

CAP involves thorough inspection of the ship structure. The time required depends on the size and arrangement of the ship, its general condition, defects found, the means of access, the level of preparations, the organisation onboard, etc. An average ship will normally take 2 surveyors at least 1 week to complete. It is important to allocate sufficient time for the inspection to be completed in a proper way.

The CAP-inspections may be divided into several visits onboard depending on schedules and

"All inspections must be finalized less than 6 months after the initial CAP hull inspection"

conditions for inspection. Ideally it should be completed in one inspection. The final CAP hull inspection is to be completed less than 6 months after the initial inspection.



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6.4.3 Ultrasonic Thickness Measurements (UTM)

The client shall arrange for thickness measurements for CAP to be carried out by an approved DNV service supplier in accordance with “DNV CAP Thickness Measurements Specification” (Ref. Appendix 3 – DNV CAP Thickness Measurement Specification). Failure to carry out thickness measurements in accordance with this specification may prevent completion of CAP. The thickness measurement data are to be reported using the DNV UTM Template. An example is given below.

“Representative thickness data for all main structural elements in all tanks/spaces inspected are required” Thickness measurements are to be carried out in the presence of a DNV surveyor,

and be verified by DNV. It is highly recommended to carry out at least part of the thickness measurements in the presence of a CAP surveyor who will be able to advise regarding extent, locations and reporting.

A preliminary electronic UTM report is to be prepared and presented to the DNV surveyor before the UTM team leaves the vessel. Additional manpower dedicated to reporting may be required in order to complete the preliminary report.

It is important for the completeness of the CAP report that representative thickness data for all main structural elements in all tanks/spaces in the cargo area are available.

The final thickness measurements report, updated after renewals, is to be delivered both in electronic format and hard copy including sketches. To avoid delay, it is advised to notify the CAP project manager (see Section 6.3 Communication, points of contact) if the UTM report is delivered to the local DNV station and not directly to the project manager. It is recommended to compress the report files, and send them by e-mail.

Thickness measurements are to be less than 12 months old at the time of the initial CAP hull inspection.

The specification, template and other supporting documents may be downloaded from <http://cap.dnv.com>

THICKNESS MEASUREMENT REPORT															
Ship's Name:		Exampleship			Id.No: 12345		Report No: 9876			Legend: Substantial corr. Below class min.					
Tank / Space	Tank/Space Reverse side	Structural Element	Element / Frame No.	Draw ref.	Orig thk. mm	Class min thk. mm	Gauged		Diminution				Renewed		Comments. Defects found
							Port mm	Stbd mm	Port		Starboard		Port mm	Stbd mm	
							mm	mm	mm	%	mm	%	mm	mm	
WT2		Longitudinal stiffener	102	1	12,50	8,00	8,30	10,00	4,20	33,6%	2,50	20,0%			
WT2		Longitudinal stiffener	103	2	12,50	8,00	9,00	11,90	3,50	28,0%	0,60	4,8%			
WT2		Longitudinal stiffener	104	3	12,50	8,00	10,00	12,00	2,50	20,0%	0,50	4,0%			
WT2		Longitudinal stiffener	105	4	12,50	8,00	10,20	12,30	2,30	18,4%	0,20	1,6%			
WT2		Longitudinal stiffener	106	5	12,50	8,00	10,00	12,40	2,50	20,0%	0,10	0,8%			
WT2	CT2	Bulkhead plating	A1	6	12,00	8,00	10,00	11,50	2,00	16,7%	0,50	4,2%			
WT2	CT2	Bulkhead plating	A1	7	12,00	8,00	11,40	11,80	0,60	5,0%	0,20	1,7%			
WT2	CT2	Bulkhead plating	A1	8	12,00	8,00	11,70	10,00	0,30	2,5%	2,00	16,7%			
WT2	CT2	Bulkhead plating	A1	9	12,00	8,00	11,80	11,50	0,20	1,7%	0,50	4,2%			
WT2	CT2	Bulkhead plating	A2	10	12,00	8,00	12,00	12,00	0,00	0,0%	0,00	0,0%			
WT2	CT2	Bulkhead plating	A2	11	12,00	8,00	12,00	12,00	0,00	0,0%	0,00	0,0%			
WT2	CT2	Bulkhead plating	A2	12	12,00	8,00	12,00	12,60	0,00	0,0%	0,00	0,0%			
WT2	CT2	Bulkhead plating	A2	13	12,00	8,00	11,80	11,80	0,20	1,7%	0,20	1,7%			
CT2	CT2	Centreline Bulkhead plating	P5	14	15,00	12,00	11,30	11,30	3,70	24,7%	3,70	24,7%			
CT2	CT2	Centreline Bulkhead plating	P6	15	15,00	12,00	13,00	13,00	2,00	13,3%	2,00	13,3%			

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6.4.4 Access and safety

According to the CAP contract, the client is responsible for providing satisfactory safety and access for the CAP surveyors. Suitable lighting, ventilation, cleanliness and means of access are to be ensured in accordance with recognised international standards and DNV instructions. Safe access for close-up inspection of all ballast tanks and access for overall inspection and/or close-up inspection of all other holds and spaces in the cargo area are required for CAP Hull inspection.



In most cases preparations for safe access and cleaning/de-scaling of the structure require preparations in advance of the CAP inspection. It should be noted that insufficient provisions for access/cleaning/de-scaling may lead to an incomplete inspection and/or a conservative CAP rating due to uncertainty of the condition. Defects may also remain undetected. If insufficient information is obtained, no overall rating of the vessel can be given.

If access by rafting is planned it should be carried out in calm waters, as even moderate ship motion may render rafting impossible. DNV's safety limit regarding peak-to-peak amplitude of the water surface is 0.5 m. Also note that the upside of the boat or raft is at no time allowed to be within 1 metre of the deepest under deck web face plate so that the survey team is not isolated from a direct escape route to the tank hatch (ref. IACS Rec. No. 39 "Safe Use of Rafts or Boats for Survey").

Deballasting restrictions in MARPOL Special Areas may be a limiting factor that should be considered. Professional standard rafts should be provided.

If the close-up survey is to take place from staging it may only commence after completion of the staging.

Required conditions and necessary preparations for the CAP hull inspection are described in the CAP Hull Inspection Planning Document in Appendix 2.

6.4.5 CAP rating objective

Before the CAP inspection, the client should evaluate suitable objectives regarding overall and detail CAP rating. Such an evaluation should be based on stated or implied requirements from potential port, cargo owner, charterer, the current condition of the ship and the time/money intended invested towards upgrading of the vessel.

At the start of the CAP inspection the objectives must be communicated to the CAP surveyor so that his feedback and reporting may be tuned with the client's objectives. For details, see Section 4.1 Market requirements.

6.5 Execution of a CAP Inspection

The CAP inspection will be started with a kick-off meeting onboard. The captain/chief officer, superintendent, UTM technician, CAP and Class surveyors should attend. The purpose of the meeting is to familiarise all parties with CAP, clarify the objectives regarding CAP rating as well as practical issues like sequence of inspections, safety, etc.

During the kick-off meeting and throughout the survey openness is encouraged. Highlighting of known defects or problem areas and the results of company internal inspections etc. should be communicated in order to make the CAP inspection more efficient.

The general scope of the CAP hull inspection is described in the CAP Hull Inspection Planning Document in Appendix 2. The extent of close-up inspection may need to be extended if defects or substantial corrosion are found.

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A closing meeting will be held onboard at the end of the CAP inspection. The captain/chief officer, superintendent, UTM technician and CAP surveyor should attend. The purpose of the meeting is to inform about the status of the inspection and thickness measurements, repairs and upgrading required to achieve CAP rating objective, and outstanding items for completion of CAP.

6.6 Completion and follow-up

A DNV CAP report describes both the condition of the vessel at the time of the inspection, defects found with photos, the repair of defects, any upgrading carried out, and the condition at the end of the process.

In order to be able to update the report after repairs and upgrading, DNV needs to re-inspect the vessel.

Repairs of items on the CAP Defects List (or corresponding CCs) may be inspected by a DNV class surveyor. Repairs and upgrading of findings above class minimum requirements based on the CAP Upgrade Report must be inspected by a CAP surveyor. The reason for this is that the latter involves re-evaluation of the local CAP rating for the upgraded area. If repairs of defects are surveyed by a non-CAP surveyor the client must ensure that the CAP project manager is being informed about the survey in advance to enable to instruct the surveyor.

Similarly, the UTM analysis and rating in the CAP report must be updated if steel renewals due to low thickness have been carried out. In such cases the UTM report is to be updated by the UTM company and re-submitted.

The final DNV CAP Hull report will be completed based on the documented condition of the ship at the end of the CAP process.





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Appendix 1 - CAP Hull Rating Methodology

1 Universal Cap Rating Principle

CAP Hull uses one universal rating principle for all items rated. The rating principle relates to two reference levels, namely:

- “New” reference level, representing As-built scantlings or DNV Newbuilding requirements.
- “Class Minimum” reference level, representing the minimum acceptable level in order to maintain DNV class for the vessel at the Hull Renewal Survey.

The difference between the two reference levels is referred to as the “Allowable Margin”.

The interpretation of the different CAP ratings for all items rated may be expressed as follows:

CAP Rating:	
1 – Very Good condition	Less than 1/3 of the allowable margin wasted / utilised
2 – Good condition	Between 1/3 and 2/3 of the allowable margin wasted / utilised
3 – Satisfactory condition	Between 2/3 and 3/3 of the allowable margin wasted / utilised
4 – Poor condition	Below the allowable margin / class minimum

2 Visual Inspection Rating

The main purpose of the visual CAP Hull inspection is to detect and report Deficiencies and local corrosion and to evaluate and report the general visual condition of the vessel.

All main structural elements in tanks and spaces are rated independently.

The following division of main structural elements cover all types of tanks/holds and spaces (not all elements are applicable to all spaces):

- Deck
- Side
- Bottom
- Inner bottom
- Longitudinal bulkheads
- Transverse bulkheads
- Internal structure (stringers, web frames, girders, swash bulkheads, etc)

Longitudinals and vertical stiffeners etc. are rated together with plating of the main structural element they are attached to.

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Example: Cargo hold

Structural element	UTM	Visual	Overall
Deckhead		3	
Side		2	
Inner Bottom		2	
Longitudinal bulkhead		1	
Transverse bulkhead		1	
Internal structure		2	
Hold average rating			
Hold overall rating			

Only visual condition as observed from inside the hold which is rated is taken into account for that hold. Visual condition from the other side of the main structural element is described and rated in connection with other spaces or with external structure.

The visual inspection rating is independent of coating condition.

The definition of the rating as described in section 5.2 “” is a qualitative definition relying on subjective evaluation. As a guide for this subjective evaluation, and in order to base the rating on DNV class requirements, the following criteria for local corrosion are used:

CAP Rating:	Allowable local corrosion:
1 – Very Good condition	Less than 1/3 of the allowable margin wasted
2 – Good condition	Between 1/3 and 2/3 of the allowable margin wasted
3 – Satisfactory condition	Between 2/3 and 3/3 of the allowable margin wasted
4 – Poor condition	Below the allowable margin

The allowable margin is defined by DNV’s minimum class requirements for ships in operation. Acceptance criteria for other Deficiencies are divided and rated in a similar manner. (Ref. Classification Notes CN72.1 Allowable thickness diminution for hull structure and Instructions to surveyors I-C5.1 Acceptance Criteria.)

Relevant Deficiencies and local corrosion evaluated are:

- Edge corrosion
- Grooving
- Pitting
- Indents
- Any other local defect

In accordance with DNV Class Rules cracks or buckles caused by in-plane stresses are not accepted. Critical cracks found in main structural elements may lead to a CAP 3 rating for that element even after repairs if no design modifications are carried out to avoid new cracks of similar type in the near future.



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3 UTM Based Rating

The main purpose of the analysis of ultrasonic thickness measurements is to establish the extent of general corrosion for each area to be rated.

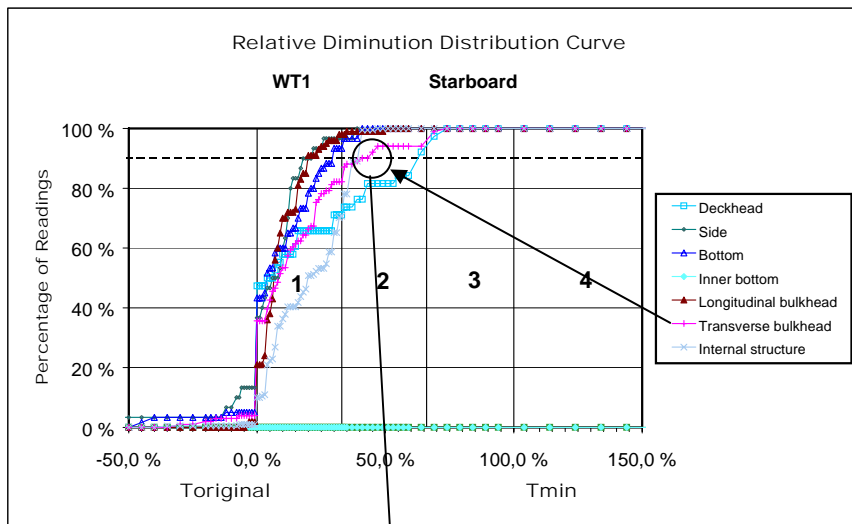
Data from Ultrasonic Thickness Measurements (UTM) form an important basis for the CAP Hull rating. Extensive UTM giving representative data for all main structural elements of all tanks/spaces is required. UTM is to be reported in a pre-defined format suitable for the statistical analysis performed. The UTM data is being presented in the CAP Hull report as cumulative distribution curves showing the distribution of steel diminution relative to DNV's allowable margin.

The diminution distribution curves are divided into 4 sectors, representing the 4 possible ratings.

CAP Rating:	Allowable general corrosion:
CAP 1 – Very Good condition	Less than 1/3 of the allowable margin wasted
CAP 2 – Good condition	Between 1/3 and 2/3 of the allowable margin wasted
CAP 3 – Satisfactory condition	Between 2/3 and 3/3 of the allowable margin wasted
CAP 4 – Poor condition	Below the allowable margin

A 10% allowance for measurements below the rating criteria is accepted, provided these readings are widely scattered. This is to allow for random single pits, inaccuracy and uncertainty in measurements, etc. The UTM based rating for each element is determined by which sector the specific element curve crosses the 90% percentile indicated by the horizontal dotted line as shown in the following example.

Example: UTM based rating of a cargo hold.



Structural element	UTM	Visual	Overall
Deckhead	2	2	2,0
Inner bottom	1	2	1,5
Longitudinal bulkheads	1	1	1,0
Transverse bulkheads	2	1	1,5
Internal structure	2	3	2,5
Hold average rating			1,7
Hold overall rating			2

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4 Evaluation of Coating and Coating Rating for Ballast Tanks

Condition of coating forms an integral part of the rating of main structural elements in ballast tanks. All main structural elements in ballast tanks are evaluated and rated independently. The coating condition rating is included in the rating table for the ballast tank.

Coating condition as defined in DNV Rules for Ships Pt. 7 Ch.2 Sec.2 A109 is applied. (DNV Recommended Practice "Corrosion Protection of Ships" with descriptions and figures may be used for guidance.)

The following table shows correlation between Class definitions of coating condition and CAP Ratings for coating.

DNV Rules Pt.7 Ch.2 Sec.2 A 109 Coating condition is defined as follows:

Condition:	CAP Rating:	Definition:
GOOD	CAP 1	Condition with only minor spot rusting.
FAIR	CAP 2	Condition with local breakdown at edges of stiffeners and weld connections and/or light rusting over 20% or more of areas under consideration, but less than as defined for POOR condition.
POOR	CAP 3	No coating or condition with general breakdown of coating over 20% or more of areas or hard scale at 10% or more of areas under consideration.
-	CAP 4	N/A

The description of coating condition is given in CAPITAL letters.

The coating condition rating is independent of the visual inspection rating.

Example: Ballast tank (recently completely recoated).

Structural element	UTM	Visual	Coating	Overall
Deckhead		2	1	
Side		3	1	
Bottom		2	1	
Longitudinal bulkhead		2	1	
Transverse bulkhead		2	1	
Internal structure		3	1	
Tank average rating				
Tank overall rating				

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5 Overall Rating for Tanks/Holds and External Structure

The overall CAP rating for each tank, hold or space comprises the UTM based rating and the visual inspection rating. For ballast tanks the coating rating is also included. These factors contribute equally towards the overall rating for each main structural element. The tank average rating is calculated as the average of the ratings for each main structural element.

Example: Ballast tanks

Structural element	UTM	Visual	Coating	Overall
Deckhead	2	2	1	1,7
Side	2	3	2	2,3
Bottom	1	2	2	1,7
Longitudinal bulkhead	1	2	1	1,3
Transverse bulkhead	2	2	1	1,7
Internal structure	2	3	1	2,0
Tank average rating				1,8
Tank overall rating				2

The following rules and limitations govern the ratings:

- The overall rating for each main structural element is specified with one decimal.
- The space average rating is specified with one decimal.
- The space overall rating is given as an integer.
- The space overall rating is 3 if substantial corrosion is found in any area of the tank.
- The space overall rating is not to be better than one grade above any UTM, visual or coating rating.
- The space overall rating is 4 if any main structural element is indicated with UTM based rating 4 or visual inspection rating 4.

If thickness measurements are missing or inadequate to provide a representative picture of the condition of a main structural element, a conservative overall rating may be given to that element based on available information.

Main deck, bottom and ship sides for the complete vessel are rated separately in a similar way as all internal spaces with equal weight on visual condition, including paint condition, and ultrasonic thickness measurements.

6 Structural Strength Rating

The hull structural strength calculations are carried out using the DNV programs Nauticus Hull Section Scantlings and PULS (Panel Ultimate Limit Strength).

The hull structural strength evaluation is carried out for a typical cross section in the midship area in an "as-measured" condition based on available thickness measurements. The rating is based on DNV newbuilding rules and DNV Ships in Operation requirements. The Ships in Operation requirements are applied as the Class minimum reference level (CAP 3).

The vessel's approved still water bending moment limits are used in the analysis.

The items rated are:

- The hull section modulus
- The global buckling capacity of panels (plate and stiffeners)



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Section modulus rating

The section modulus in deck and bottom of a representative as-measured cross section are compared to the DNV newbuilding requirements. The SiO Class Minimum requirement is defined as 90% of the DNV newbuilding requirement. The section modules are rated according to the table below:

	CAP 1	CAP 2	CAP 3	CAP 4
Section modulus	≥ 97 %	≥ 93 %	≥ 90 %	< 90 %

The lowest of the deck and bottom rating is decisive towards the rating of the section modulus.

Buckling capacity rating

The buckling capacities of panels (plate and stiffeners combined) in deck and bottom of a representative as-measured cross section are calculated using Nauticus Hull Section Scantlings and PULS. PULS is a computerized buckling code for thin-walled plate constructions and uses non-linear plate theory to calculate a stiffened plate field's ultimate buckling strength. It treats the entire stiffened plate field as an integrated unit, allowing for internal redistribution of stresses.

Rating of the buckling capacity is based on utilization factors calculated by PULS. Limits for the buckling capacity rating are given in the table below.

	CAP 1	CAP 2	CAP 3	CAP 4
Utilization factor, deck	≤ 0.90	≤ 0.95	≤ 1.0	> 1.0
Utilization factor, bottom	≤ 0.77	≤ 0.81	≤ 0.85	> 0.85

For panels with flat bars or bulb stiffeners, a 10 % higher utilization is allowed.

For bulk carriers, double hull tanker without a longitudinal bulkhead and gas carriers where double bottom stresses are considered to be critical, the rating criteria in the table below are applied:

	CAP 1	CAP 2	CAP 3	CAP 4
Utilization factor, deck	≤ 0.90	≤ 0.95	≤ 1.0	> 1.0
Utilization factor, bottom	≤ 0.72	≤ 0.76	≤ 0.80	> 0.80

For panels with flat bars or bulb stiffeners, a 10 % higher utilization is allowed. Vessels with other designs will be specially considered. The rating of the buckling capacity is governed by the lower rating of deck and bottom.

Overall strength rating

The overall CAP strength rating is governed by the lower rating of hull section modulus and buckling capacity

Structural strength rating 3 indicates that minimum class requirements for ships in operation are fulfilled. Structural strength rating 4 indicates that the vessel does not fulfil DNV ships in operation requirements.

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7 Overall CAP Hull Rating Calculation

The overall CAP Hull rating is calculated as the average of:

- Ballast tanks overall rating
- Cargo holds, voids etc. overall rating
- External structure (main deck, ship sides and bottom) overall rating
- Structural strength rating

Example: Overall rating

Ballast Tanks		Rating	Cargo Holds, voids, etc.		Rating
Forepeak		2	Cargo hold No. 1		1
Aft peak		2	Cargo hold No. 2		2
Double bottom tank 1 port		2	Cargo hold No. 3		1
Double bottom tank 1 starboard		1	Cargo hold No.4		2
Double bottom tank 2 port		1	Sloptank port		1
Double bottom tank 2 starboard		2	Sloptank starboard		1
Double bottom tank 3 port		1	Deeptank		1
Double bottom tank 3 starboard		2	Hatches and coamings		1
Double bottom tank 4 port		1			
Double bottom tank 4 starboard		2			
Top wing tank 1 port		2			
Top wing tank 1 starboard		2			
Top wing tank 2 port		2			
Top wing tank 2 starboard		1			
Top wing tank 3 port		2			
Top wing tank 3 starboard		2			
Top wing tank 4 port		2			
Top wing tank 4 starboard		2			
Ballast tanks average rating		1,7	Cargo holds, voids, etc. average rating		1,3
Ballast tanks overall rating		2	Cargo holds, voids, etc. overall rating		1

External structure		Rating
Maindeck		2
Shipside		2
Bottom		1
External structure average rating		1,7
External structure overall rating		2

Structural strength		Rating
Hull section modulus		1
Buckling capacity		2
Structural strength overall rating		2

Vessel Overall		Rating
Ballast tanks overall rating		2
Cargo holds, voids, etc. overall rating		1
External structure overall rating		2
Structural strength overall rating		2
Vessel average rating		1,8
Vessel overall rating		2



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The vessel overall rating is not to be better than one grade above any strength rating, UTM, visual or coating rating for any structural element in any tank/space/structure.

In cases where UTM or other information is missing, incomplete or considered to be unreliable, a conservative overall rating, or no rating, for that structural element or tank will be decided by the CAP Rating Committee. The same applies for the vessel's overall CAP rating.

The final rating is decided by the CAP rating committee.



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Appendix 2 - CAP Hull Inspection Planning Document

1 Objective

The purpose of this document is to provide a brief description of the objective of CAP Hull and to describe necessary preparations before the CAP surveyors come on board and required conditions for CAP inspection.

2 What is CAP?

CAP is a consultancy service independent of classification. The main purpose of CAP is to evaluate and report the vessel's condition above minimum class standard. The scope for CAP is more comprehensive than for class surveys with respect to close up inspections, extent and analysis of thickness measurements, structural strength evaluation and reporting. Although CAP inspections may be carried out concurrently with class surveys, CAP is reported separately.

3 Access Requirements

Accesses for the following areas are required:

Close-up inspection:
<ul style="list-style-type: none"> • All cargo hold hatch covers and coamings- plating and stiffeners • All Maindeck plating and underdeck structures. • All transverse shell frames in all cargo holds, including upper and lower end attachments and adjacent shell plating. • All transverse bulkheads in all cargo holds • All ballast tanks in the cargo area including aft peak tank and fore peak tank • All cofferdams in cargo area • External structure, including dry dock (or in water) inspection of bottom • Possible problem areas as identified during previous or present inspections and on vessels with similar design, or in the Hull Survey Programme
Overall inspection:
<ul style="list-style-type: none"> • All remaining tanks and holds in cargo area • Deep tanks



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4 Cleaning Requirement

Tanks, holds and spaces are to be sufficiently cleaned and free from water, corrosion scale, sediments etc. to reveal significant corrosion, deformation, cracks, damages or other structural deterioration.

5 Safety Requirements

Satisfactory measures are to be taken to ensure that safety and access during inspection are in accordance with recognised international standards (e.g. “Guidance Manual for the Inspection and Condition Assessment of Tanker Structures”, issued by International Chamber of Shipping (OCIMF)) and DNV instructions. At least one of the officers onboard must be available full-time for the CAP surveyors during the inspection.

The survey may remain incomplete in cases where the CAP Surveyor considers that safety, cleanliness and access are not in compliance with applicable requirements. In such cases the survey must be completed after corrective actions have been carried out.



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Appendix 3 - DNV CAP Thickness Measurement Specification

1. Objective

1.1 This specification describes the extent of thickness measurements required for DNV Condition Assessment Programme (CAP) Hull-BULK. Requirements to thickness measurements for class surveys are specified in DNV Rules for Classification of Ships.

1.2 DNV uses thickness measurement data for a statistical analysis of diminution as a basis for the CAP rating. *Representative data for all main structural elements in all tanks/spaces are required.* The main structural elements in a CAP context are deck, hatches, coamings, shipside, bottom, inner bottom, inner deck, longitudinal bulkhead, transverse bulkhead (i.e. tank/space boundaries with plating and stiffeners) and internal structure (i.e. webframes, stringers, girders, floors etc.)

Failure to carry out thickness measurements according to this specification may prevent completion of CAP.

2. General

2.1 Thickness measurements shall be carried out by a qualified company approved by DNV.

2.2 A DNV surveyor shall be onboard while the measurements are taken to the extent necessary to control the process.

2.3 The thickness measurements data shall be reported using the “DNV UTM Template”. All information required in the template is to be completed by the thickness measurement company. The “DNV UTM Template” is available at <http://cap.dnv.com>

2.4 One electronic version and one paper version of the thickness measurement report with sketches and relevant documentation is to be submitted to the responsible DNV unit.

2.5 Readings to be included in the thickness measurement report shall be representative for the area measured and shall normally be single point readings. If a single reading is not considered to be representative for the area it represent, additional readings may be carried out in same area and included in the report together with a comment stating that these are additional readings. Alternatively, the average value of several readings in a small area may be included in the report together with a comment stating that this is an average value. In such cases all the readings to be averaged are to be taken within the affected area. Low readings shall not be averaged out by several readings in adjacent uncorroded areas.

2.6 Pits, grooves and local corrosion are to be measured and included in the report with a suitable comment.

2.7 Cracks, buckling and other deficiencies identified are to be reported to the attending CAP surveyor and included as comments/sketches in the thickness measurement report.

3. Standard Extent of Thickness Measurements

3.1 The standard extent of measurements is described in this section. Reductions in the standard extent of measurements are only accepted in accordance with criteria listed in Section 4.

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3.2 The following structure is to be completely measured with 5 points per plate:

Exposed main deck plating

Bottom plating

Wind and water strakes

Inner bottom plating

Continuous longitudinal stringers and inner deck plating

3.3 Three transverse sections in the cargo area are to be chosen where the largest reductions are suspected to occur or are revealed from deck plating measurements. The transverse sections are normally to be located outside the line of cargo hatch openings if fitted. The complete section is to be measured, including:

Within 0.15D (where D is the moulded depth of the ship) from deck and bottom every longitudinal and girder shall be measured on the web and flange and every plate shall be measured one point between each longitudinal.

Between deck and bottom transverse frames are to be measured with 1 point per metre on both web and flange including 1 reading per metre of the adjacent plate. Upper and lower end connections are also to be measured.

Between deck and bottom area every longitudinal and girder shall be measured on the web and flange and every plate strake at least one point per plate.

3.4 All tanks and holds in the cargo area are to be measured in three transverse belts for each tank/ hold, normally located in the forward, middle and aft parts of the tank/ hold. Measurements in two transverse belts are sufficient for tanks/holds of less than 15 metres length. All structure in and adjacent to these belts are to be measured, including:

Longitudinals and other stiffeners with one representative measurement on both web and flange.

Transverse frames with 1 point on both web and flange per metre including end connections.

Ship side (outside wind and water strakes) and longitudinal bulkhead plates (2 points per plate strake).

Stringer platforms with associated structure (2 points per plate).

Transverse bulkheads including swash bulkheads with associated structure (plates and stiffeners at three horizontal levels).

Web frames with flanges, stiffeners and brackets.

3.5 For single skin bulk carriers required to comply with DNV Rules for Ships Pt.7 Ch. 2 Sec. 1A and 1F special requirements applies (Regarding Transverse corrugated bulkhead between 1st and 2nd hold and side frames in cargo holds (Tcoat)).

3.6 The following structure is to be measured in fore and aft peak tanks:

All transverse webs with associated plating and longitudinals.

Transverse bulkhead complete with associated structure.

Deckhead (tanktop) and stringers with associated structure.

Bottom and shipside with stiffeners.

3.7 Any other ballast tanks outside of cargo area are to be measured as described in Section 3.4.

3.8 For cofferdams, voids and other spaces in the cargo area, representative thickness data for all main structural elements are required.

3.9 Cargo hatches with coamings and associated structure are to be measured for all holds.

3.10 Additional measurements are to be carried out if one or more readings indicate corrosion exceeding requirement to CAP 2 (67 % of allowable margin). "Requirements for extent of thickness measurements at those areas of substantial corrosion" in DNV Rules for Classification of Ships should be used for guidance.

3.11 Extent of measurements may be increased as considered necessary by the attending CAP surveyor.

4. Reduced Extent of Measurements

4.1 Extent of measurements in shell plating (ref. Section 3.2) and in three transverse sections in cargo area (ref. Section 3.3) is not to be reduced.

4.2 The number of readings may only be reduced if the structure in question is:

made of solid stainless steel, or coated with original coating still intact on both sides of the structure, or located within fuel or cargo tank(s) and representative thickness measurements reveal no or negligible steel loss, well within the requirements for CAP 1 (33 % of allowable margin). The representative measurements are to be taken in areas expected to represent worst case corrosion.



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Where the number of thickness measurements is reduced, it is to be ensured that representative measurements are obtained for all main structural elements (ref. Section 1.2) in all tanks/spaces. An absolute minimum of 10 representative readings for each main structural element in all tanks/spaces are required. If measurements reveal that the conditions given in Section 4.2 are not met, the standard extent of measurements as described in Section 3 is to be carried out.

4.3 No reduction in extent of measurements is to be applied unless accepted by the attending CAP surveyor.

For further information, please contact DNV's section for Condition Assessment and Emergency Response.

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