BUREAU VERITAS MARINE & OFFSHORE

GUIDANCE NOTE

CONDITION ASSESSMENT PROGRAMME (CAP)

NI465 R02

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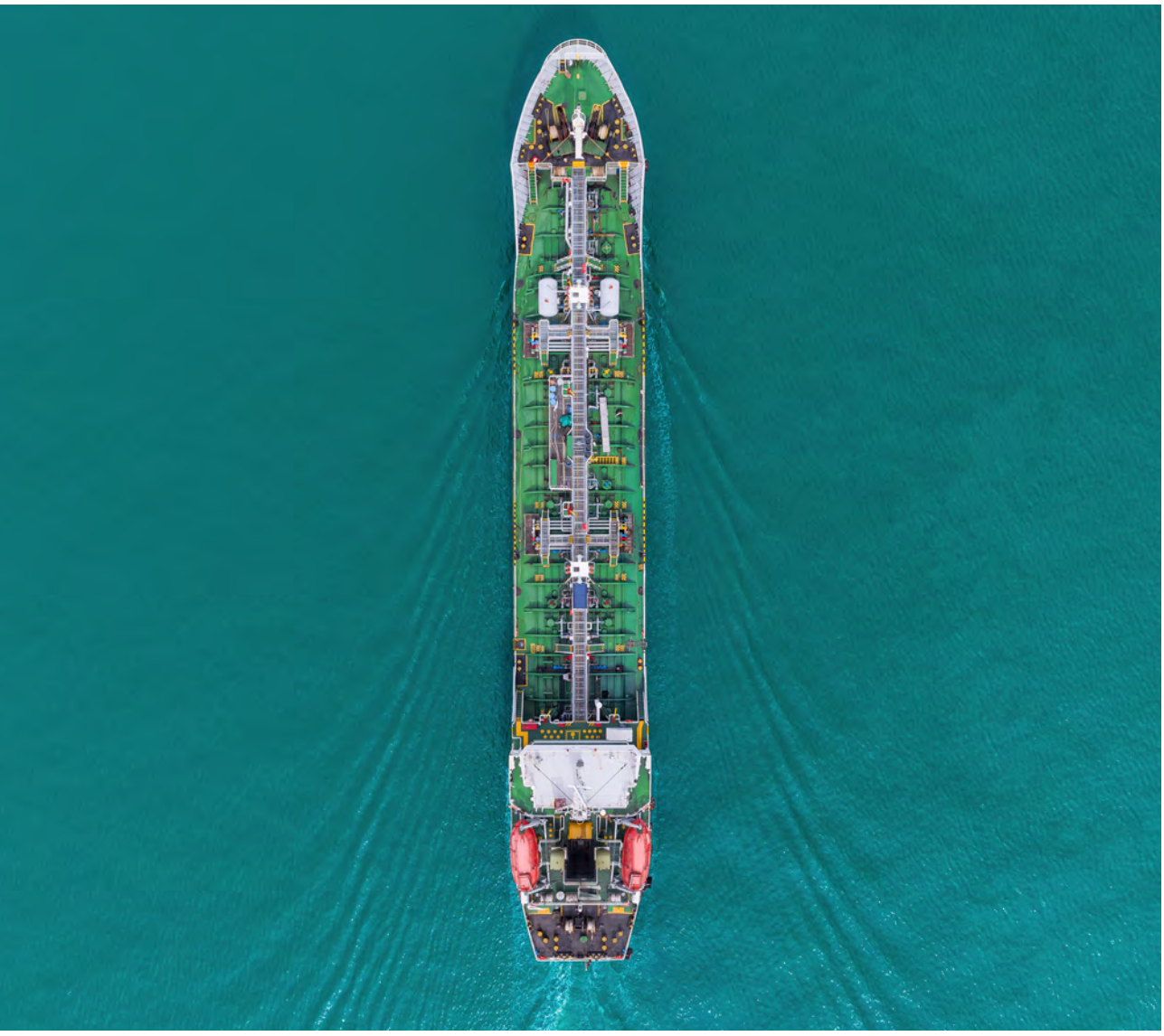

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These rules are provided within the scope of the Bureau Veritas Marine & Offshore General Conditions, enclosed at the end of Part A of NR467, Rules for the Classification of Steel Ships. The latest version of these General Conditions is available on the Bureau Veritas Marine & Offshore website.

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Guidance Note
NI465

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October 2026

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Section 1 General Principles

Symbols

AUC : Area Under Consideration
CAP : Condition Assessment Programme
CCS : Cargo Containment Systems
CVI : Close Visual Inspection
DP : Dynamic Positioning
FO : Fuel Oil
FW : Fresh Water
GTT : Gaztransport et Technigaz
GVI : General Visual Inspection
IACS : International Association of Classification Societies
IUC : Item Under Consideration
IWS : In Water Survey
LNG : Liquefied Natural Gas
LO : Lube Oil
LDPT : Low Differential Pressure Test
LEL : Low Explosive Limit
LPG : Liquefied Petroleum Gas
PUF : Polyurethane Foam
NDT : Non Destructive Testing
OSV : Offshore Support Vessel
PBGT : Primary Barrier Global Test
PGVT : Primary Global Vacuum Test
RIT : Remote Inspection Techniques
SHR : Structural History Review
SFA : Structural and Fatigue Analysis
TAMI : Thermal Assessment of Membrane Integrity
UTM : Ultrasonic Thickness Measurements.

1 General

1.1 Introduction

1.1.1 The aim of this Guidance Note is to detail the methodology and criteria applied by Bureau Veritas (BV), acting within the scope of the Marine and Offshore General Conditions, to perform services under a Condition Assessment Programme (CAP).

The purpose of our CAP services is to assist the ship operator to comply with the requirements from charterers, vetting agencies, terminal/ port authorities and other third parties, and their specific CAP prerequisites.

In addition, BV CAP services are designed to provide the client with a clear and transparent understanding of a vessel's condition through a detailed and illustrated report which, if the assessment is planned early enough, may assist in preparing a repair plan prior to entering the repair yard.

1.1.2 On completion of a CAP, a certificate with ratings reflecting the condition of the hull structure, equipment and systems covered by the assessment programme is issued.

A CAP report should normally be completed and submitted within a time period not exceeding two months after the actual end date of the survey, however different approaches may be considered on a case by case basis.

A CAP inspection should normally be completed within a time period not exceeding six months, however different approaches may be considered on a case by case basis.

A CAP inspection may be carried out either in dry-dock or with the vessel afloat (In-Water Survey, IWS) as per the client request, and as far as practicable.

1.2 Application

1.2.1 This Guidance Note may be applied to:

- Oil tankers
- Product tankers
- Chemical tankers
- Offshore support vessels (OSV)
- Offshore floating storage units
- Bulk carriers
- Liquefied Petroleum Gas (LPG) carriers
- Liquefied Natural Gas (LNG) carriers.

The core principles and programme outlined in the main Sections serve as a basis for all these vessel types. The Guidance Note also includes dedicated Sections that provide specific details on CAP survey for LNG carriers (Sec 4), and OSV (Sec 5).

1.3 Assessment scope and methodology

1.3.1 The client defines the scope by selecting a list of modules to be assessed from the following menu:

- Hull structure
- Hull and cargo equipment and systems
- Hull equipment and systems, for OSVs only
- Propulsion and auxiliary systems
- Cargo containment systems (CCS) for LPG and LNG carriers only
- Bridge, navigation and radio equipment.

The recommended scope of inspection based on ship type is highlighted as per the Tab 1.

Table 1 : Recommended scope of inspection per ship type

CAP modules / Ship type	Hull structure	Hull equipment and systems	Hull and cargo equipment and systems	Propulsion and auxiliary systems	CCS **(1)**	Bridge, navigation and radio equipment
Oil tankers	X		X	X		X
Product tankers	X		X	X		X
Chemical tankers	X		X	X		X
OSV	X	X		X		X
Bulk carriers	X		X	X		X
LPG carriers	X		X	X	X	X
LNG carriers	X		X	X	X	X
Offshore units	X		X	Unit base		X

(1) Cargo containment systems: For LPG and LNG carriers only

Note 1: This Table serves as a recommended scope for the owners and might differs based on client's needs and charterers requirements

1.3.2 Refers to Tab 2 for an overview of CAP module methodology per Section.

- The methodology used to assess the hull structure is detailed within Sec 2.

  Within the scope of the hull structure assessment, a Structural and Fatigue Analysis (SFA) may be included to identify some areas and structural details for specific close visual inspection and to comply with vetting and charterers requirements. The content of such analysis is detailed in Sec 2, [2.4].

- The methodology used to assess the hull and cargo equipment and systems, the propulsion and auxiliary systems or bridge, navigation and radio equipment, is detailed in Sec 3, [3], using the methodology and criteria applicable to the equipment, fittings, piping, machinery and their appurtenances, as explained in Sec 3, [4] and Sec 3, [7].
- The methodology used to assess the CCS of LNG carriers is detailed within Sec 4.
- The methodology used to assess the hull, equipment & systems of OSV is detailed within Sec 5.

Table 2 : Methodology of modules per Section

	Hull structure	Hull equipment and systems	Hull and cargo equipment and systems	Propulsion and auxiliary systems	CCS **(1)**	Bridge, navigation and radio equipment
Section 2	X					
Section 3			X	X		X
Section 4					X	
Section 5		X	X	X		
(1) Cargo containment systems: for LPG and LNG carriers only						

1.4 CAP project preparation

1.4.1 The extent of inspection to be carried out and the subsequent reporting requirements are to be discussed and agreed with the client prior to starting the project.

Whatever the scope, the following information should be clarified and agreed within either the contract or the planning document:

- modules included in the CAP scope
- expected rating to be achieved for each module
- specific requirements or objectives to be met, in particular the compliance with specific charterer's or other third party requirements
- places and approximate dates of inspection
- inspections condition - attendance during voyage / afloat / at yard / at terminal
- safety procedures
- means of access.

The specific information expected to be clarified and agreed for each module will be detailed under the relevant Sections.

1.5 Assessment process

1.5.1 Once the CAP scope and objectives have been defined, the assessment is carried out through the following steps:

- collection of records to perform the Structural History Review (SHR)
- collection of drawings required to perform the SFA, if required
- planning preparation
- planning validation with the Owner's representative
- on-board inspection(s) for preliminary assessment
- preparation of a list of up-grades to be undertaken, if needed, to achieve the expected ratings and requirements
- on-board inspection(s) to assess the up-graded condition, further to repair and maintenance
- completion of the CAP report
- issuance of the CAP report and the CAP certificate.

Note 1: A CAP attestation, reflecting the condition of the vessel, limited to the scope already assessed, and based on the preliminary results of inspections and testing, may be delivered upon the Client's request at any stage of the inspection. The provisional ratings recorded within a CAP attestation do not reflect the final condition assessment results and may be modified on completion of the project. The CAP attestation does not represent the final condition assessment results, which will be detailed in the CAP certificate issued at the end of the assessment process.

1.6 CAP certificate and CAP rating

1.6.1 On completion of the assessment, a CAP certificate is issued detailing the following information:

- final rating assigned to each module included in the scope of the CAP,
- dates and place(s) of the inspection(s),
- date and place of issue,
- name and endorsement of the BV representative responsible for managing the CAP project.

A CAP rating has no validity date, but only reflects the condition of the vessel on the date of completion of the on-board inspection. Each charterer defines the time validity of a CAP certificate within its own vetting and marine assurance procedures.

The BV CAP ratings are defined in Tab 3.

The BV condition of the criteria specific to items and documentation is defined in Tab 4.

Table 3 : CAP ratings definition

1	Superior condition	• Examination and/or measurements carried out with the results showing either minimal or no deterioration from the 'as new' condition. • Superior maintenance condition exists. • No preventive or corrective maintenance is required.
2	Good condition	• Examination and/or measurements carried out with the results showing a level of deterioration from the 'as new' condition. • No requirement for preventive or corrective maintenance.
3	Acceptable condition	• Examination and/or measurements carried out with the results showing that condition would be acceptable for class rules requirements. • No imminent corrective maintenance is required. • Preventive maintenance may be required to halt deterioration.
4	Poor condition	• Examination and/or measurements carried out with the results showing defects, deficiencies or condition, below what would be acceptable for class rules requirements. • Imminent corrective maintenance is required.

Table 4 : Items - General quality rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
Items and systems examined and function tested, only superficial reductions from as new or current rule scantlings, found with no deficiencies affecting safe operation and/or performance.	Items and systems examined and function tested, found with some minor deficiencies which do not affect the safe operation and/or normal performance, thickness' significantly above class limits.	Items and systems examined and function tested, found with deficiencies not affecting safe operation and/or performance, thickness' whist generally above class renewal limits found with substantial corrosion.	Items and systems examined and function tested, found with deficiencies significantly affecting operation and/or performance, thickness' at or below class limits.
Documentation and maintenance practices are considered good. No maintenance or repairs required.	Documentation and maintenance practices are considered adequate. No immediate maintenance or repair considered necessary.	Documentation and maintenance practices are considered to be of a minimum standard. Some maintenance and repair may be considered necessary.	Documentation and maintenance practices are considered inadequate. Maintenance and repair required to re-instate serviceability.

1.7 Safety during inspection

1.7.1 The establishment of proper preparation and close co-operation between the attending surveyor(s) and the company's representatives on-board, prior to and during the survey, are essential to conducting the survey in a safe and efficient manner.

1.7.2 Applicable safety procedures and responsibilities are to be discussed and agreed to ensure that the survey is carried out under controlled conditions.

1.7.3 Safety meetings are to be held prior to starting and regularly during the inspection on board.

1.7.4 The following guidelines in particular should be followed as applicable in accordance with Tab 5.

Table 5 : IACS Safety Guidelines relevant for CAP survey

Safety Guidelines	Related Topic	Revision in force
IACS Procedural Requirement No. 37	Procedural requirement for confined space entry	Revision 3, August 2023
IACS Recommendation No.39	Safe Use of Rafts Or Boats For Survey	Revision 3, March 2009
IACS Recommendation No.44	Survey Guidelines for tanks in which soft coatings have been applied	Correction 1, December 2007
IACS Recommendation No.72	Confined Space Safe Practice	Revision 4, January 2025
IACS Recommendation No. 78	Safe Use of Portable Ladders for Close-up Surveys	September 2002
IACS Recommendation No.90	Ship Structure Access Manual	Revision 2, November 2024
IACS Recommendation No.91	Guidelines for Approval/Acceptance of Alternative Means of Access	Revision 3, April 2019
IACS Recommendation No.136	Guidelines for Working at Height	June, 2014
IACS Recommendation No.140	Recommendation for safe precautions during Survey and Testing of Pressurized system	Revision 1, March 2019
IACS Recommendation No.184	Guidelines on safety standards for work	New, January 2025

Section 2 Hull Structure Assessment

1 Introduction

1.1 Scope

1.1.1 The purpose of this Section is to detail the methodology used by BV Marine & Offshore to carry out a condition assessment of the hull structure.

2 Hull structure assessment preparation

2.1 Basic information

2.1.1 The extent of inspection and the subsequent reporting requirements are to be discussed and agreed with the client prior to starting the on-board assessment.

A planning document should be prepared and agreed prior to starting the inspection.

The first step to prepare the assessment is to discuss and agree with the client the information detailed in Sec 1, [1.4].

Subsequently, the following additional specific details should be clarified and agreed:

- availability of records required for the structural history review
- preparation of a SFA, if required by the assessment scope
- scope of inspection: general/close-up visual inspections, Ultrasonic Thickness Measurements (UTM), tank testing
- acceptance of UTM report prepared prior to the assessment
- permissible thickness diminution criteria used to carry out the assessment
- use of the BV UTM Data Platform by Service Suppliers to report the measurements, prepare the UTM report and compile S-curves
- bottom assessment of the vessel may be conducted either in dry-dock or afloat, In-Water Survey (IWS). The In-Water Survey is to provide the information normally obtained from a bottom survey in dry condition.

Note 1: The use of RIT is acceptable and should be in accordance with the applicable requirements, including the IACS Recommendation No. 42, Guidelines for Use of Remote Inspection Techniques for surveys, Rev.2 June 2016.

Note 2: In the case the CAP is conducted on a non-BV vessel, the BV UTM Data Platform has to be used by certified third-party service suppliers to prepare the UTM report.

2.2 Structural History Review (SHR)

2.2.1 Investigation into the vessel's history is an important part of any Condition Assessment Programme and shall be performed prior to the commencement of the physical on board condition assessment.

The aim is to provide information on structural areas and items that may require specific CVI during the assessment.

The ship’s history may also identify instances of repairs and/or modifications that have been carried out and which may affect the outcome of any SFA.

The vessels' previous ten years class history record and repair history should be reviewed.

For non-BV classed vessels the client is expected to provide the CAP Manager / CAP surveyor with access to the class reports and vessel records covering this time period.

The following documents should be provided and prepared to compile the SHR:

- Class hull condition evaluation reports, where applicable, or copies of the vessels structural history based on previous class reports as well as memorandum, visas, recommendations, conditions of class for the time-frame being evaluated
- List of class record
- Class hull survey planning document and/ or clients records
- Class ballast tanks protection report and/ or clients records

- Longitudinal strength evaluation report, where applicable
- Enhance Survey Program (ESP) vessel questionnaire documents, where applicable
- Previous vessel structural and condition assessments programme carried out from non-BV sources.

As far as possible, full or relevant extracts of the reviewed documents are to be filled in annexes to the CAP report.

On completion of the SHR, a list of structural items is included within the planning document for CVI, as necessary. For each item, the on-board location with a description of the previous damages and repairs history are detailed. A reference to the relevant source of information should be documented.

Note 1: The preparation and the completion of the SHR prior the start of the CAP Survey is a key requirement and a mandatory part of the CAP process for charterers. Providing an incomplete/ non documented SHR in the CAP report might result in a rejection from charterers.

2.3 CAP declaration form

2.3.1

As part of the vessel's investigation, a global dedicated form is to be fully completed and well detailed in the report. This form represents a statement of the vessel at the current inspection time based on previous life and structural history.

This form is composed of three main sections:

a) General considerations,

b) Fatigue and fracture,

c) Damage and repairs.

Additionally, this form provides a comprehensive overview of the vessel's global structural condition to charterers. The completion of the CAP declaration form is required as part of the CAP process.

The information provided in the CAP declaration form has no impact on the CAP rating assigned to the vessel's structure.

Note 1: The completion and review of the CAP declaration form is a key requirement driven by charterers, who rely on the comprehensive structural overview and current state of the vessel it provides to make informed decisions regarding the vessel's suitability and condition.

2.4 Structural and fatigue analysis

2.4.1 A structural and fatigue analysis may be carried out prior to the inspection on-board at the request of the Owner.

The aim is to identify any potential hot spots and areas critical for fatigue for inclusion within the CVI plan. The results of the analyses are used to fine-tune the inspection plan, but have no impact on the CAP rating assigned to the vessel's structure.

If a SFA 2D/3D is to be carried out, this shall normally be completed prior to commencing the surveys such that potential fatigue 'hot spots' are closely surveyed and UT gauged as necessary.

The Owner is to advise the extent of the structural and fatigue analysis from the below options:

- 2D structural and fatigue analysis,
- 2D and 3D structural and fatigue analysis.

Note 1: Most charterers and vetting departments request a 2D structural and fatigue analysis to be carried out within the scope of a CAP for hull structure. Please contact your local BV office for more advice, if needed.

Note 2: Bureau Veritas recommends that a 2D/3D structural and fatigue analysis be carried out for vessels of panama size and above.

The reference standards used to carry out the analysis are the latest version of the BV classification rules applicable to the relevant ship type, always assuming the vessel is operated under worldwide sea going conditions. The latest BV software in force should be used to carry out the analysis.

On completion of the analysis, a list of structural items, identified as potential hot spots or with an estimated fatigue life less than the vessel's age plus 5 years, is included within the planning document for CVI. The inspection method based on estimated fatigue life of structural details is shown in Tab 1.

Note 3: Some charterers and vetting departments may reject a vessel for which a structural item with a shorter estimated fatigue life has not been modified/ reinforced further to a structural failure (crack…). We strongly recommend the Owner to discuss any repair with the CAP Surveyor for fatigue cracks, especially if the estimated fatigue life is less than the remaining operating life of the vessel.

Note 4: Some charterers may reject a CAP report for which the SFA has been carried out following the start of the CAP survey. Therefore, we strongly recommend the Owner to discuss about the SFA scope expectation and provide all documents to the BV Office in charge of the analysis.

Table 1 : Inspection method based on estimated fatigue life of structural details

Criteria	Inspection method
FL > Y + 5	Overall inspection
FL ≤ Y + 5	Close visual inspection (CVI)
Note 1: FL : Estimated fatigue life of a structural detail Y : Ship's age at the date of the expected CAP Survey or, where not specified, at the date of the analysis.	

As per the analysis and the inspection results, a specific methodology detailed in Tab 2 should be followed by the CAP Surveyor.

Table 2 : Repair Method based on estimated fatigue life and inspection results

Criteria	Inspection Method	Detection results	Treatment
FL > Y + 5	Overall inspection	No crack	No repairs
		Cracks	Repair as per original drawings
FL ≤ Y + 5	Close visual inspection (CVI)	No crack	Monitoring
		Cracks	Renewal or reinforcement
Note 1: FL : Estimated fatigue life of a structural detail Y : Ship's age at the date of the expected CAP survey or, where not specified, at the date of the analysis.			

2.5 Acceptance of UTM reports prepared prior to the assessment

2.5.1 Where possible the Owner should arrange for thickness measurements to be carried out in the presence of the CAP Surveyor and reported using the BV UTM Data Platform (available free of charge in website https://move.bureauveritas.com).

Where the CAP Surveyor does not attend the measurements, the measurements used for CAP must be approved by a Classification Society member of IACS and endorsed accordingly.

Where the CAP Surveyor attends the measurements, but the measurements are not endorsed by a Classification Society member of IACS, the UTM report may be accepted by the CAP Surveyor on a case by case basis.

The thickness measurements should be conducted within 12 months prior to the CAP inspections start date.

Where the thickness measurements are conducted more than 12 months prior to the CAP inspection start date, the decision to use the results is made on a case by case basis. Additional measurements may be required to randomly verify that the UTM report data still properly reflects the actual condition of the vessel.

Clear references to the UTM reports used within the scope of the structure assessment are to be indicated in the executive summary and the global UTM assessment.

In addition, should any UTM report completed prior to the CAP inspection and not witnessed by the CAP Surveyor, be used, the information is to be highlighted within the planning document.

3 Scope of inspection

3.1 General

3.1.1 The extent of inspection, which varies depending on the vessel's age and findings identified at the preparation stage, is to be defined and agreed before starting the inspection.

The assessment is always carried out through the following:

- A General Visual Inspection (GVI)
- A Close Visual Inspection (CVI)
- Ultrasonic Thickness Measurements (UTM).

The purpose of the inspection is to assess the visual structure and coating conditions through the identification of visual defects such as corrosion, diminution, deformation, indents, buckling, cracks, leakages, pitting, grooving, erosion, coatings breakdown, anodes wastage.

Note 1: It is strongly recommended that the Owner discuss any planned structural repairs with the CAP Surveyor and share the repair planning schedule prior to the next revisit date. Following the completion of repairs that have been discussed and agreed upon with the Client, a new assessment and rating will be given to the structural item.

3.2 Scope of General Visual Inspection (GVI)

3.2.1 The scope of the GVI is to include the overall inspection of the following compartments and structural Items:

- external structure: main deck, exposed decks and superstructures, side shell, bottom
- all the compartments within the cargo area, including internal structure
- selected structural compartments outside the cargo area - void spaces, stools, Fuel Oil (FO)/ Lube Oil (LO) tanks, Fresh Water (FW) tanks…
- aft peak(s) and fore peak(s).

3.3 Scope of Close Visual Inspection (CVI)

3.3.1 The scope of the CVI is to be defined in accordance with Tab 3.

Table 3 : Structural AUCs subject to CVIs

Structural AUCs	Age of ship	
	10 < age ≤ 15	age > 15
Specific AUCs	AUCs identified as requiring a CVI from either the history review or the structural and fatigue analysis, if any	
Web frame(s) in ballast tanks	All web frames in all ballast tanks	
Web frame(s) in cargo tanks	All web frames in a cargo tank	
	One web frame in each remaining cargo tank	
Transverse bulkhead(s) in ballast tanks	All transverse bulkheads	
Transverse bulkhead(s) in cargo tanks	All transverse bulkheads	

3.4 Scope of Ultrasonic Thickness Measurements (UTM)

3.4.1 The extent of UTM is to be defined in accordance with Tab 4.

Table 4 : Structural AUCs subject to UTM

Structural AUCs		Age of ship	
		10 < age ≤ 15	age > 15
AUCs subject to CVI		All AUCs subject to CVI, except the specific AUCS	
Main deck plates	Within 0,5 L amidships	All	All
	Outside 0,5 L amidships	All	All
Bottom plates	Within 0,5 L amidships	All	All
	Outside 0,5 L amidships	Selected	All
Wind and water strakes	Within 0,5 L amidships	All	All
	Outside 0,5 L amidships	Selected	All
Transverse belts **(1)**		2 transverse belts	3 transverse belts
Superstructures		Poop, bridge and forecastle decks	
Bulkheads outside cargo areas		Collision bulkheads, forward machinery space bulkhead, aft peak bulkhead	All transverse and longitudinal bulkheads
Peak tanks		All internals in fore peak and aft peak tanks	
Shell plating		Plating of sea chests Shell plating in way of overboard discharges	
(1) In way of different cargo spaces			

4 Methodology for calculating the CAP rating

4.1 General

4.1.1 The final CAP rating assigned to the hull structure is determined further to the calculation of the two following ratings:

- the overall structural condition rating and,
- the global UTM rating.

The overall structural condition rating, which is calculated through the methodology described in Article [5], reflects the condition of the vessel's structure through an assessment of the visual condition, protective coating condition and extent of corrosion of each structural AUC of the vessel.

The global UTM rating, which is calculated through the methodology described in Article [7], reflects the condition of the vessel's structure through an assessment of the extent of corrosion of groups of structural AUCs.

The final CAP rating assigned to the hull structure is the lesser of the ratings assigned to the overall structural condition and the global UTM assessments.

5 Overall structural condition assessment methodology

5.1 General

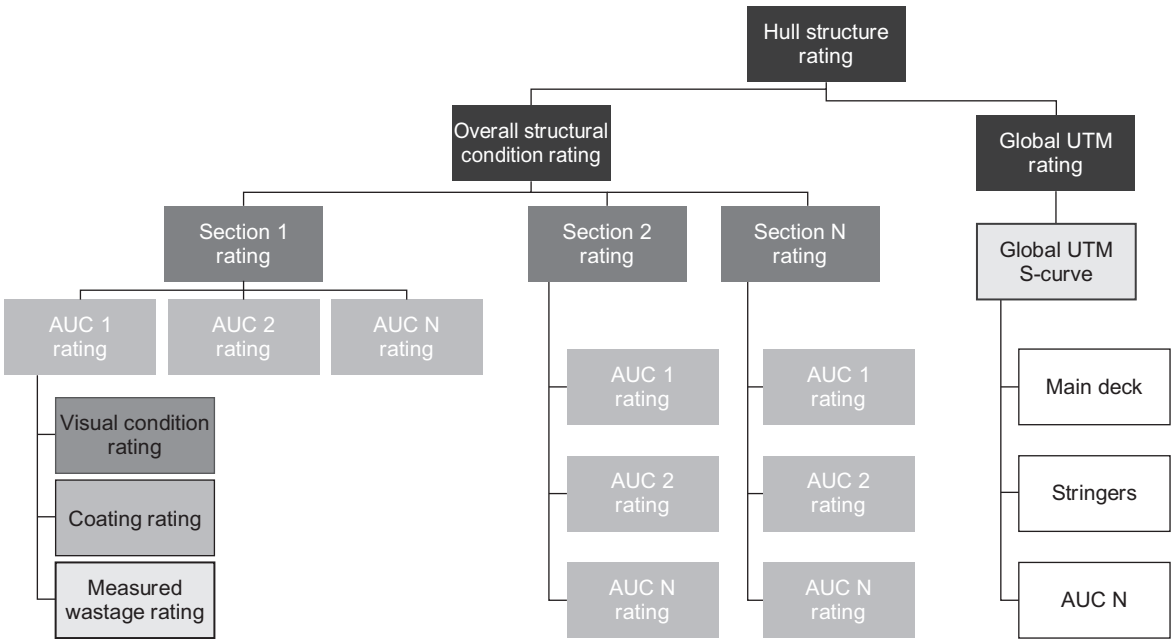
5.1.1 The Overall structural condition rating is calculated through a bottom-up approach shown in Fig 1 which consists of:

- breaking down the ship's structure firstly into sections and subsequently into structural AUCs
- assessing each AUC against a set of criteria - visual condition / coating condition / measured wastage
- assessing each section from the ratings assigned to the structural AUCs
- assessing the overall structure from the ratings assigned to the sections.

The AUCs are assessed through the following technical criteria:

- visual inspection of structure for any damage, deformation, indents, buckling, cracks, leakages, pitting, grooving, erosion, etc
- visual inspection of protective coatings for any coating breakdown, cracking, flaking, blistering, detachment etc
- wastage of structure: assessment based on UTM and the percentage of diminution of structure due to corrosion
- anodes condition (for information only).

Figure 1 : Scheme of the structural condition assessment methodology based on bottom-up approach



This figure provides an illustrative example of the methodology for hull structure rating based on the bottom-up approach. It is important to note that the number of AUCs, sections and S-curve items depicted above is not representative of a real project assessment.

5.2 Categorization of the ship's structure

5.2.1 To facilitate the assessment, review and reporting of the vessel's structural condition, the hull structure is first broken-down into sections, which are groups of structural AUCs, as follows:

- main deck & superstructure decks
- side shell
- bottom
- individual cargo tanks and slop tanks
- individual ballast tanks
- individual cargo holds (LPG vessels)
- individual void spaces and cofferdams contributing significantly to the structural strength; (spaces with significant volume within the cargo area)
- individual aft peak(s) and fore peak(s)
- group of void spaces, stools and cofferdams assessed during the inspection
- group of lub oil and fuel oil tanks assessed during the inspection
- group of fresh water tanks assessed during the inspection.

Subsequently, the sections are split into structural AUCs, based on the list of AUCs available in Tab 5.

Note 1: On LPG vessels, individual compartments such as cargo tanks may be requested for internal inspection. However, since these individual compartments do not contribute to the structural strength of the vessel, the internal inspection of these compartments is not mandatory. Nevertheless, the vessel's Owner should provide the previous inspection report of tanks and enclosed areas to determine specific ratings or tanks if it is included within the CAP scope of the survey.

Table 5 : Structural AUCs per section

Section	Structural AUCs
Main deck & superstructure decks	• Main deck forward PS & SB area • Main deck midship (± 0.5L amidships) PS & SB area • Main deck aft PS & SB area • Forecastle deck • Poop deck • Trunk deck
Side shell	• Side shell forward PS & SB area • Side shell midship (± 0.5L amidships) PS & SB area • Side shell aft PS & SB area • Plating of sea chests • Shell plating in way of overboard discharges
Bottom	• Bottom forward PS & SB area • Bottom midship (± 0.5L amidships) PS & SB area • Bottom aft PS & SB area
Individual compartment: a) Cargo tanks & slop tanks b) Ballast tanks & emergency water ballast tanks c) Cargo holds (LPG vessels / bulk carriers) d) Aft peak(s) and fore peak(s)	• Plating (plates + attached stiffeners **(1)** - Main deck / under-deck - Side shell PS & SB - Longitudinal bulkheads (outer / inner) PS & SB & CL - Inner bottom - Transverse bulkheads **(2)** - Topside tank sloping plate **(3)** - Hopper plate **(4)** - Inner deck • Internal structure - Stringers - Transverse structural members **(5)**
Group of compartments: a) Void spaces, stool and cofferdams b) Lube oil and fuel oil tanks c) Fresh water tanks	Each individual compartment listed in the group
(1) Attached stiffeners include longitudinals and girders **(2)** Including upper/ lower stools, vertical webs and transverse bulkhead stringers, if fitted **(3)** Topside tank sloping plate is not assessed as a structural AUC if part of a longitudinal bulkhead **(4)** Hopper plate is not assessed as a structural AUC if part of a longitudinal bulkhead **(5)** Transverse structural members include web frames, web rings, deck transverse, bottom transverse, floors	

5.3 Structural AUC rating calculation

5.3.1 Each structural AUC is assigned a rating to assess the condition of the following set of criteria:

- Visual structure
- Protective coating
- Measured wastage/ extent of corrosion
- Anodes condition (for information only).

The ratings are assigned based on the rating rules defined in Article [6].

An average rating is then calculated and rounded to the first digit from the average of the ratings assigned for the visual structure, protective coating and measured wastage assessments.

If the second digit ranges from 0 to 4, the first digit is rounded to the lower value. Otherwise, the first digit is rounded to the upper value.

If an AUC is rated 4 for “Visual structure” or “Measured wastage”, the AUC average rating cannot be better than 4.

Specific rating rules might be applied on AUC defined in Tab 6.

Table 6 : Specific rating rules for AUC

Rating	Equivalent Rating	Specification
Not Inspected (NI)	3	No recommendation or condition of classification has been endorsed by the vessel’s Classification Society for this AUC
Not Coated (NC)	Not taken into account in the calculation	
Not applicable (NA)	Not taken into account in the calculation	
Anodes	Information only	

5.4 Section rating calculation

5.4.1 The section rating is the average of all the AUC average ratings assigned to the section’s AUCs, rounded to the first integer.

If the first digit ranges from 0 to 4, the rating is rounded to the lower value (or better rating). Otherwise, the rating is rounded to the upper value (worse rating).

If an AUC average rating is 4, the section rating cannot be better than 4.

If an AUC rating assigned for any assessment criteria is 3, the section rating cannot be better than 2.

The section rating cannot be better than the worst rating assigned to the AUCs "Main deck", "Under deck" or "Bottom" for assessing the criteria “Visual condition” or “Measured wastage”.

5.5 Overall structural condition rating calculation

5.5.1 The overall structural condition rating is the average of all the section ratings, rounded to the first integer.

If the first digit ranges from 0 to 4, the rating is rounded to the lower value (or better rating). Otherwise, the rating is rounded to the upper value (worse rating).

If a section rating is 4, the overall structural condition rating cannot be better than 4.

If a section rating is 3, the overall structural condition rating cannot be better than 2.

The overall structural condition rating cannot be better than the worst rating assigned to any AUCs "Main deck", "Under deck" or "Bottom" for assessing the criteria “Visual condition” or “Measured wastage”.

6 Structural AUCs rating rules

6.1 Visual condition

6.1.1 The visual condition is assessed against the criteria in the Tab 7.

Table 7 : Visual condition rating criteria for hull structure

Rating	Visual condition rating criteria	
1	Cracks/ Fractures	None
	Deformations	Slight indent or deformation detected
	General corrosion	• Spot rusting on less than 3% AND • Rusting at edges or welds on less than 20% of edges or weld lines
	Localised corrosion: Pitting/ grooving/bacterial	Intensity less than 5% with an average depth less than 25% of the original plate thickness
2	Cracks/ Fractures	None
	Deformations	Indent or deformation detected
	General corrosion	• Rust penetration on less than 20% AND • Hard rust scale rust penetration on less than 10% AND • Rusting at edges or welds on less than 50 % of edges or weld lines
	Localised corrosion: Pitting/ grooving/Bacterial	Intensity less than 20% with an average depth less than 25% of the original plate thickness
3	Cracks/ Fractures	None
	Deformations	• Indent or deformation detected AND • within the Class acceptance criteria, but which should be included in a monitoring plan for future inspection
	General corrosion	• Rust penetration on more than 20% OR • Hard rust scale on more than 10% OR • Rusting at edges or welds on more than 50 % of edges or weld lines
	Localised corrosion: Pitting / grooving/ bacterial	• Intensity over 20% within Class acceptance criteria OR • Intensity less than 20% with an average depth more than 25% of the original plate thickness, but within Class acceptance criteria
4	Any defect which does not meet the rating 3 criteria	
NI	The structural AUC should have been inspected, as per the agreed planning, but has not been inspected	
NA	The structural AUC is not expected to be assessed within the scope of the CAP inspection	

6.2 Coating assessment criteria

6.2.1 For each AUC, the coating condition is assessed against the criteria in the Tab 8.

Table 8 : Coating condition rating criteria for hull structure

Rating	Coating condition rating criteria	IACS/ IMO Condition equivalent
1	• Spot rusting on less than 3% without breakdown of coating AND • Rusting at edges or welds on less than 20% of edges or weld lines AND • Blistering on 20% or less	GOOD
2	• Breakdown of coating or rust penetration on less than 20% AND • Hard rust scale rust penetration on less than 10% AND • Rusting at edges or welds on less than 50% of edges or weld lines	FAIR
3	• Breakdown of coating or rust penetration on more than 20% OR • Hard rust scale on more than 10% OR • Rusting at edges or welds on more than 50% of edges or weld lines	POOR
NC	No protective coatings fitted, as per design.	
NI	The AUC should have been inspected, as per the agreed planning, but has not been inspected.	
NA	The AUC is not expected to be assessed within the scope of the CAP inspection.	

Note 1:
- Soft coatings or semi hard coating are not rated in the scope.
- Spot rusting is rusting in spots without visible failure of coating.
- Blistering is identified as coating failure according to IACS Rec. 87. Appendix A, Rev 2, May 2015.

Where blistering is on more than 20% of the AUC, the rating assigned to the AUC cannot be better than 2.

6.3 UTM assessment criteria

6.3.1 Criteria definition

Wastage of structure ratings are assigned by reviewing the UTM readings against permissible diminution of structure.

Except if otherwise requested by the client, the permissible diminution criteria, as given in the tables of acceptance criteria provided in the latest applicable BV classification rules, which are used to carry out the assessment.

Should the Owner wish to use the permissible diminution criteria as defined by the vessel's current Classification Society, it is to be indicated in the planning document and the executive summary.

To assign a rating to an AUC, the criteria defined in Tab 9 are applied.

Table 9 : Measured wastage rating criteria for hull structure

Rating	Measured wastage rating criteria
1	• More than 90% of measurements are found with a remaining permissible diminution over 66% AND • No measurement shows excessive corrosion.
2	• More than 90% of measurements are found with a remaining permissible diminution over 33% AND • No measurement shows excessive corrosion.
3	• Less than 90% measurements are found with a remaining permissible diminution less than 33% AND • No measurement shows excessive corrosion.
4	At least one measurement shows excessive corrosion.
NI	The AUC should have been inspected, as per the agreed planning, but has not been inspected.
NA	The AUC is not expected to be assessed within the scope of the CAP inspection.

6.3.2 Using the S-curves to assign the “Measured wastage” rating

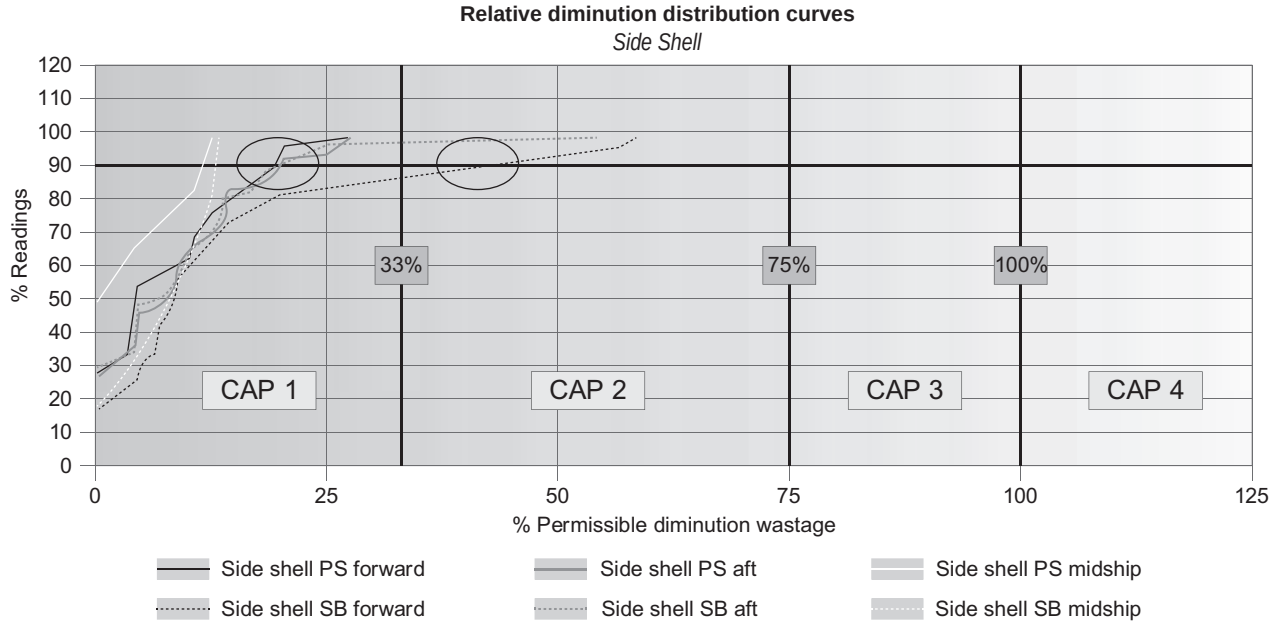
The BV UTM Data Platform compiles a set of 'thickness diminution distribution curves' - commonly named S-curves - illustrated in Fig 2 and as follows:

- One diagram per compartment/structural section showing one S-curve per AUC
- One diagram for the Global UTM assessment showing one S-curve per group of Structural AUCs.

The curves represent the cumulative percentage of readings with a certain percentage of wastage compared to the permissible thickness diminution.

If a curve crosses the horizontal blue 90% line before crossing a vertical boundary line, the corresponding 'AUC' or 'Group of Structural AUCs' is assigned the rating indicated on the left side of the vertical boundary line. Otherwise, it is assigned the rating indicated on the right side of the vertical boundary line.

Figure 2 : How to read the rating on a S-curves diagram



6.4 Anodes condition assessment criteria

6.4.1 Although it is not a Class requirement that anodes are fitted in ballast tanks and other areas of the vessel hull, some clients and charterers require that the condition of anodes be reported upon. Therefore during overall and close up surveys corrosion protective anodes (if fitted) should be assessed, according to each 'AUC' where these are fitted, and given a rating depending on the amount of wastage of anode found.

Refer to Tab 10 for the rating criteria for anodes.

Note 1: This rating is given for information purposes. The existence of, or lack of, anodes does not affect the overall CAP rating of the vessel.

Table 10 : Anodes rating criteria for hull structure

Rating	Anodes condition rating criteria
1	Up to 25% wastage
2	From 25% to 50% wastage
3	From 50% to 75% wastage
4	From 75% to 100% wastage
NF	Not fitted
NA	Not applicable

7 Global UTM assessment methodology

7.1 Global UTM rating calculation

7.1.1 The purpose of the global UTM assessment is to carry out an assessment of the structure through an assessment of the global extent of corrosion.

The structure is broken down into group of structural items, as below:

- main deck
- superstructure decks
- side shell
- bottom
- wind and water strakes
- transverse belts (one group per belt, including the frame number)
- transverse bulkheads (including BKD Stringers)
- longitudinal bulkheads
- inner bottom
- inner deck
- hopper plates
- topside tank sloping plates
- transverse structural members
- stringers
- exposed deck (excluding main deck)
- fore peak internal structure
- aft peak internal structure.

A rating is assigned to each group of structural items through the following methodology detailed in [7.2], including the UTM results which have been prepared with the BV UTM Data Platform.

The global UTM rating is the average of all the ratings.

If the first digit ranges from 0 to 4, the rating is rounded to the lower value (or better rating). Otherwise, the rating is rounded to the upper value (worse rating).

If a group of structural items rating is 4, the global UTM rating is 4.

If a group of structural items rating is 3, the global UTM rating cannot be better than 2.

The global UTM rating cannot be better than the rating assigned to the group 'Main deck' or the group 'Bottom'.

7.2 Assessment of structural sections using the BV UTM Data Platform

7.2.1 A group of structural items is assigned the rating associated with its relevant S-curve, directly available in the associated S-curve diagram. Please refer to [6.3.2] for more details.

Section 3 Machinery and Systems Assessment

1 Introduction

1.1 Scope

1.1.1 The purpose of this Section is to detail the methodology used by Bureau Veritas Marine & Offshore to carry out a condition assessment of the following modules:

- hull and cargo equipment and systems
- propulsion and auxiliary systems
- bridge, navigation and radio equipment.

Note 1: For Offshore Support Vessels, the standard "Hull and cargo equipment and systems" module is replaced by the dedicated "Hull equipment and systems" module described in Sec 5 of this guidance note. This module has been specifically developed to reflect the operational profile and equipment fitted on OSVs.

2 Assessment preparation

2.1 General

2.1.1 The extent of inspection and the subsequent reporting requirements should be discussed and agreed with the client prior to starting the on-board assessment.

A planning document should in particular be prepared and agreed prior to starting the inspection.

The first step to prepare the assessment is to discuss and agree with the client the information detailed in Sec 1, [1.4].

Subsequently, the following additional specific details should be clarified and agreed:

- Availability of records of planned maintenance systems (PMS)
- Availability of latest records of vibration analysis, lubrication oil analysis, ultrasonic measurements, insulation tests, if carried out
- Analysis and tests planned to be carried out.

The operation and the maintenance programme declared by the clients should be in conformity with the guidance provided by the manufacturers of the equipment.

3 Scope of inspection

3.1 Hull and cargo equipment and systems assessment scope

3.1.1 The scope of inspection covers the assessment of the equipment, fittings, piping, machinery and systems which are part of the following groups of items:

- Anchoring and mooring installation and equipment
- Steering & rudders
- Hull machinery
- Hull electrical equipment and cabling
- Hull fittings
- Closing appliances
- Hull piping and valves
- Sea connections and valves
- Hull miscellaneous
- Fire/ Smoke/ Gas detection and firefighting systems
- Life saving equipment and fittings
- Environmental management
- Cargo systems machinery

- Cargo systems electrical equipment and cabling
- Cargo systems fittings
- Cargo systems piping and valves.

The assessment is carried out through the following:

- A visual inspection to assess the visual condition
- A function test, if applicable
- Additional criteria specific to the item (vibration measurements, insulation tests, UTM).

3.2 Propulsion and auxiliary systems

3.2.1 The scope of inspection covers the assessment of the equipment, fittings, piping, machinery and systems which are part of the following groups of items:

- Engine room, auxiliary machinery spaces and engine store rooms
- Main propulsion installations
- Shafting, stern tube and propeller systems
- Auxiliary engines
- Oil pumps and purifiers
- Fresh and sea water pumps
- Compressors
- Ventilation fans
- Piping and valves
- Boilers, economizers and thermal oil heaters
- Heat exchangers (others)
- Miscellaneous equipment
- Communication, order transmission and remote/ emergency stop systems
- Generators and switchboards
- Motors and associated starters
- Electrical installations (others)
- Automated installation
- Fire/ Smoke/ Gas detection and firefighting systems
- Environmental management

The assessment is carried out through the following:

- A visual inspection to assess the visual condition
- A function test, if applicable
- Additional criteria specific to the item (vibration measurements, insulation tests, UTM).

3.3 Bridge, navigation and radio equipment

3.3.1 The scope of inspection covers the assessment of the equipment, fittings, piping, machinery and systems which are part of the following groups of items:

- Navigation equipment
- Bridge equipment
- Radio equipment.

The assessment is carried out through the following:

- A visual inspection to assess the visual condition,
- A function test, if applicable.

4 Methodology for calculating the CAP rating

4.1 General

4.1.1 The final CAP rating assigned to the module is determined further to the calculation of the two following ratings:

- the overall operational condition rating and,
- the global rating for maintenance.

The overall operational condition rating, which is calculated through the methodology described in Article [5], reflects the condition of the equipment and systems through an assessment of the visual condition, the result of a function test and, for some equipment, some additional criteria specific to the Items.

The global rating for maintenance, which is calculated through the methodology described in Article [6], reflects the condition of the maintenance of the machinery and systems, through an assessment of PMS and results of lubricating and hydraulic oil analysis.

The final CAP rating assigned to the module is the lower of the ratings assigned to the overall operational condition and the global rating for maintenance.

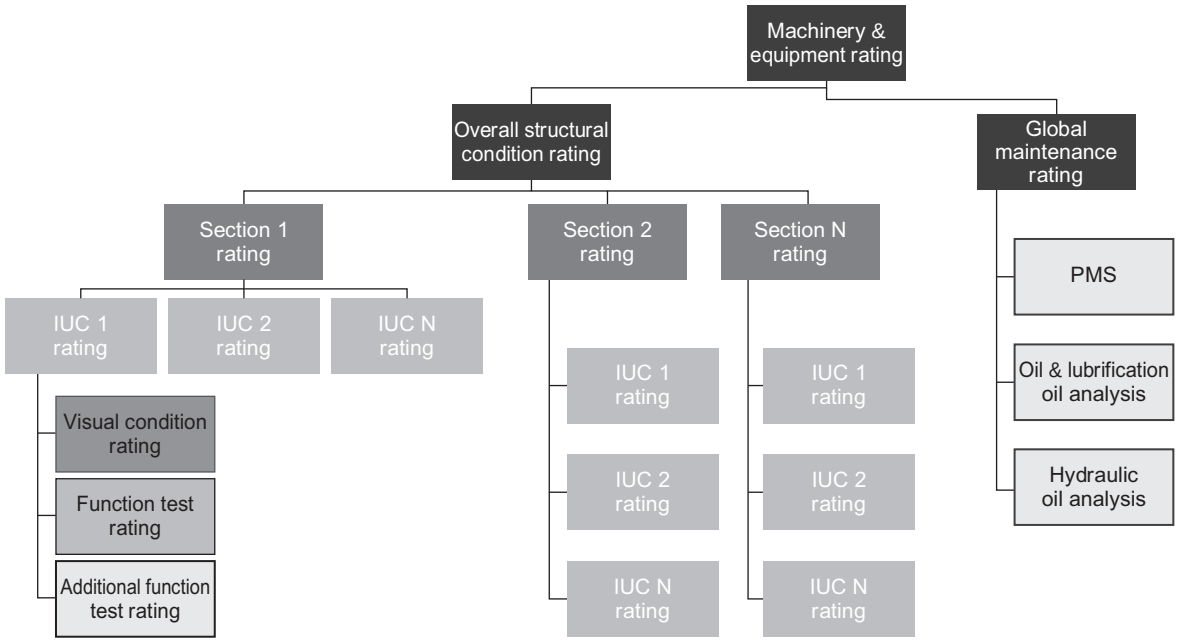
5 Overall operational condition assessment methodology

5.1 Categorization of equipment and systems

5.1.1 The overall operational condition rating is calculated through a bottom-up approach shown in Fig 1 which consists of breaking down the module firstly into sections and subsequently into items:

- assessing each item against a set of criteria - visual condition/ function test/ additional criteria specific to the item,
- assessing each section from the ratings assigned to the items,
- assessing the overall operational condition from the ratings assigned to the sections.

Figure 1 : Operational condition assessment methodology based on bottom-up approach



This figure provides an illustrative example of the methodology for operational rating based on the bottom-up approach. It is important to note that the number of IUCs, and sections depicted above are not representative of a real project assessment.

5.2 Item rating calculation

5.2.1 General calculation rules

Each item is assigned a rating to assess the condition of the following set of criteria:

- Visual condition
- Function test
- Additional criteria specific to the item.

The ratings are assigned based on the rating rules defined in Article [7].

An average rating is then calculated and rounded to the first digit from the average of the ratings assigned for the “Visual condition”, “Function test” and the additional criteria, if applicable.

If the second digit ranges from 0 to 4, the first digit is rounded to the lower value. Otherwise, the first digit is rounded to the upper value.

If an item is rated 4 for “Visual condition” or “Function test”, the item average rating cannot be better than 4.

Specific rating rules might be applied on IUC defined in Tab 1.

Table 1 : Specific rating rule for IUC

Rating	Equivalent Rating	Specification
Not Surveyed (NS)	3	No recommendation or condition of classification has been endorsed by the vessel’s classification society for this Item.
Not Tested (NT)		
NA	Not taken into account in the calculation	

5.2.2 Specific calculation rules

a) The average rating of reciprocating or rotating machinery over 50 kW cannot be better than 2, except if:
- The item has been overhauled or replaced within the last 6 months, OR
- The item is maintained under a condition based monitoring regime, OR
- Vibration analysis is carried out and up-grades the average rating.

b) Electrical equipment
- The average rating of an item of electrical equipment cannot be better than 2, if no insulation test has been carried out within the last 6 months.

c) Piping
- The average rating of the other piping may be up-graded if voluntary UTM shows that the piping material wastage is null or very low.

Note 1: The general calculation rules always supersede the specific calculation rules as per [5.2.1]

In general, for condition assessment of machinery and systems, the CAP Surveyor will not request the opening up of component parts; It should be noted however, that where any machinery (or system) has not been dismantled for inspection, then the best rating that can be applied will be a 2 for that item, unless a supplementary condition assessment report is provided whereby the average rating may be amended, such as where:

- replacement/ remedial work has been carried out,
- vibration analysis is carried out for an Item of rotating machinery,
- insulation test reports are provided for electrical equipment,
- hydraulic oil or lubricating oil analysis is carried out, for system or equipment which would normally be expected to have such analysis,
- Where infra-red thermography is provided,
- Where condition based monitoring reports are provided.

5.3 Section rating calculation

5.3.1 The section rating is the average of all the item average ratings assigned to the section’s items rounded to the first integer.

If the first digit ranges from 0 to 4, the rating is rounded to the lower value (or better rating). Otherwise, the rating is rounded to the upper value (worse rating).

If an item average rating is 4, the section rating cannot be better than 4.

If an item rating assigned for any assessment criteria is 3, the section rating cannot be better than 2.

5.4 Overall operational condition rating calculation

5.4.1 The overall operational condition rating is the average of all the section ratings, rounded to the first integer.

If the first digit ranges from 0 to 4, the rating is rounded to the lower value (or better rating). Otherwise, the rating is rounded to the upper value (worse rating).

If a section rating is 4, the overall operational condition rating cannot be better than 4.

If a section has been rated 3, the overall operational condition rating cannot be better than 2.

The final CAP rating of the “Main propulsion installations” cannot be better than the rating applied to the main engine function test.

The final CAP rating of the “Propulsion and auxiliaries systems” cannot be better than the rating applied to the “Main propulsion installations”.

6 Global rating for maintenance

6.1 Global rating for maintenance calculation

6.1.1 "Global rating for maintenance" is awarded based on the results of:

- an audit of the vessel's planned maintenance system (PMS rating)
- an assessment of the records of the lubricating and hydraulic oil analysis (lub/ hydraulic oil rating).

The global rating for maintenance is the lower of the ratings assigned to the PMS assessment and the lubricating and hydraulic oil analysis assessment.

6.2 Audit of the vessel's planned maintenance system

6.2.1 The audit is limited to that part of the PMS system that specifically applies to the relevant systems of the module.

The audit will cover the equipment identified in the PMS system of the vessel and the CAP Surveyor will not make any assessment whether the PMS system covers every item of critical equipment.

The audit is to cover the timely implementation, frequency, scope and results of the maintenance. Additionally, it should include the requirements for periodic examinations and testing on item, if applicable.

Postponements and overdue items should be included in the audit and reporting and follow up actions should be identified and reviewed.

For each module, a rating is assigned to each section, as defined in [3.3.1], [3.3.2] or [3.3.3], using the PMS assessment criteria in Table 14.

The PMS rating is the average of all the section ratings.

If the first digit ranges from 0 to 4, the rating is rounded to the lower value (or better rating). Otherwise, the rating is rounded to the upper value (worse rating).

If a section rating is 4, the global UTM rating is 4.

If a section rating is 3, the global UTM rating cannot be better than 2.

6.3 Assessment of the records of the lubricating and hydraulic oil analysis

6.3.1 The proper monitoring and maintenance of the lubricating and hydraulic oil used to run the machinery and equipment is a key component of their maintenance.

The purpose is to assess that oil samples are collected from respective systems in a timely and appropriate manner, as per manufacturer's recommendations, and that the results show no evidence of deterioration of the oil or of equipment parts and demonstrate suitability of the oil for continued use.

Oil sample reports from laboratory testing and on-board testing may be taken into consideration if carried out within 6 months prior to the completion date of the CAP assessment.

Where appropriate, lubricating and hydraulic oil samples are collected from respective systems and are to be tested for evidence of deterioration of the oil or of equipment parts and for suitability of the oil for continued use.

6.3.2 Additionally, vessels may be equipped with monitoring equipment to collect and analyse oil/ lube oil data. It is essential to inspect these equipment to ensure they are functioning correctly and are properly maintained. It should includes:

- Functionality check to ensure that the specific system is operating as intended and providing accurate data.
- Calibration check to ensure that the equipment is properly calibrated according to the manufacturer's specifications.
- Maintenance record to ensure and confirm that the equipment have been regularly serviced and that no issues have been identified.

6.3.3 If the assessment has been conducted by IWS, systems and equipment that would normally be expected to be inspected should be included within the oil and hydraulic sample analysis report.

Systems and equipment that would normally be expected to have oil analysis carried out are usually fitted with sumps or "top up" or "header" tanks.

The following systems should, at least, be included within the scope of the assessment of the hull and cargo equipment and systems:

- Cargo systems hydraulic
- Deck hydraulics
- Deck gear drives
- Steering gear hydraulics and bearing.

The following systems should, at least be included within the scope of the assessment of the propulsion and auxiliary systems:

- Main diesel engine
- Auxiliary engines
- Gas turbines
- Reduction gears
- Sump system
- Cam shaft systems
- Shaft/ intermediate shaft
- Pod systems if applicable
- Propeller
- Thrusters
- Stern tubes.

A rating is assigned to each system using the Tab 8.

The lube/ hydraulic oil rating is the average of all the systems ratings.

If the first digit ranges from 0 to 4, the rating is rounded to the lower value (or better rating). Otherwise, the rating is rounded to the upper value (worse rating).

If a section rating is 4, the lub/ hydraulic oil rating is 4.

If a section rating is 3, the lub/ hydraulic oil rating cannot be better than 2.

Should oil analysis not be carried out, for a system which would normally be expected to have such analysis undertaken, then the rating NT, equivalent to rating 3, is assigned.

7 Items rating rules

7.1 Visual condition

7.1.1 The visual condition rating is assigned through a visual inspection carried out to assess the overall condition of equipment together with its appurtenances, bedplates and supports. (See Tab 2).

Table 2 : Visual condition rating criteria for machinery and equipment

	Rating 1	Rating 2	Rating 3	Rating 4
All items **(1)**	Minimal or no apparent deterioration	A slight level of deterioration	A level of apparent deterioration but within the vessel's Class society requirement	Significant apparent deterioration
	Good cosmetic condition	Fair cosmetic condition	Poor cosmetic condition	
	No system leakages			System leakages
Bearings clearance	Measurements are within 0-25% of allowable tolerances and/or recommendations	Measurements are within 25-75% of allowable tolerances and/or recommendations	Measurements are within 75-100% of allowable tolerances and/or recommendations	Measurements exceed tolerances and/or recommendations
(1) Items mean the equipment and where applicable, the attached valves, operating devices, locking devices, fittings, instrumentation, etc.				

7.2 Function tests

7.2.1 Function tests are carried out on equipment under working conditions with the results assessed against the manufacturers operational criteria. e.g. pumps and compressors should be run tested and their performance assessed, closing appliances should be tested for full range of movement, machinery safety devices should be tested and proved, alarms and instrumentation are to be actuated and inspected, pipelines are to be pressure tested etc,.

All machinery, fittings and systems' equipment should be required to be function tested. It is recognized that some vessel's systems such as CO_2 flooding, bulk foam systems, etc,. will not be able to have their performance tested; however these can be assessed by supplemental means such as simulation, level testing and chemical analysis. (See Tab 3).

Table 3 : Function test rating criteria

	Rating 1	Rating 2	Rating 3	Rating 4
All items (1)				
Function test	Results reaching rated values and/or full operation with either minimal or no deterioration from the 'as new' condition.	Results showing a level of deterioration in rated values and/ or full operation from the 'as new' condition without affecting safe operation.	Results showing deterioration in rated values and/or full operation from the 'as new' condition but within that acceptable according to maker's and IACS unified requirements specific to the equipment.	Results showing significant deterioration from the 'as new' condition below that acceptable according to maker's and IACS unifed requirements specific to the equipment.
Operating temperatures	Well within tolerances.	Within tolerances.	Within tolerance but approaching limits of tolerances or nearing alarm condition.	Exceed tolerances or are in alarm condition.
Attached safety devices, alarms, trips, etc	Tested and proved 100% operational.			Tested and showing defects or deficiencies.
Main engine				
Power output **(2)**	May be run at 86% or more of the rated Maximum Continuous Rating (MCR) power, as per IAPP Certificate.	May be run within 81-86% of the rated Maximum Continuous (MCR) power, as per IAPP Certificate.	May be run within 76-81% of the rated Maximum Continuous (MCR) power, as per IAPP Certificate.	Not able to maintain at least 75% of the rated Maximum Continuous Rating (MCR) power, as per IAPP Certificate.
Piping				
Pressure test	Reach required test pressure without leakages or pressure drop-off. The system's tightness is in perfect condition.			Do not reach required test pressure and/ or leakages or pressure drop-off exists and the system's tightness is compromised.

(1) Items mean the equipment and where applicable, the attached valves, operating devices, locking devices, fittings, instrumentation, etc.

(2) To be complemented with Note 2, and Note 3.

Note 1: To ensure the main engine (ME) operates within the specified Maximum Continuous Rating (MCR) range, the following methodology is employed:

- Performance test at loading condition: If feasible, the surveyor will witness a performance test where the ME operates at the target power output range. This direct observation ensures the engine meets the specified MCR.
- Estimation and interpolation: If a direct performance test is not feasible, the CAP Surveyor will estimate and interpolate the power at specific load points (e.g., 81% to 86%). Compare the measured power output from the shop test with the calculated values to verify compliance with the specified MCR range.

The second method, estimation, is inherently less precise but provides a practical alternative when direct testing is not possible.

Note 2: In case the vessel is equipped with an Engine Power Limitation (EPL) or Shaft Power Limitation (ShaPoLi) systems type approved, the MCR power used for the assessment rating should be the new MCR power attained following the installation of these systems. This ensures that the assessment reflects the updated performance capabilities of the vessel's main engine. The reference of this new MCR power is reflected and defined on the Energy Efficiency Existing Ship Index (EEXI) certificate.

Note 3: In case the vessel is equipped with a specific main engine such as DF engine, the MRC in gas mode might be lower than the approved MCR of the engine (i.e. in oil fuel mode, depending on the gas composition and its quality or the engine design. To assess this, refer to the manufacturer's operational criteria, which should detail the expected performance.

7.3 Vibration analysis

7.3.1 Vibration measurements should be made on rotating and reciprocating machinery with a power over 50kW.

7.3.2 Availability of records from the “as new” condition

Where records of vibration measurements at vessel's delivery are available, the ratings may be assigned by comparing the latest measurements to the 'as new' condition, as per Tab 4.

The measurements are normally performed under the same operating and loading conditions as the original readings and a comparison made of changes in the vibration patterns.

If there are important changes in vibration levels that infer significant deterioration of equipment then the unit should be opened up for examination of the rotating components.

7.3.3 No availability of previous records

Where no vibration history is available, the ratings may be assigned in accordance with the requirements of the ISO 20816, as applicable, or the ISO 8528-9- 2017 for auxiliary diesel engines.

A similar methodology to ISO standard may be considered on a case by case basis.

In general vibration analysis reports may be accepted if carried out within three months prior to the start date of CAP surveys. The CAP Surveyor may request re-measurement for any unit should vibration levels appear higher than expected during function tests.

Table 4 : Vibration analysis rating criteria based on measurements records comparison

Rating 1	Rating 2	Rating 3	Rating 4
- Analysis results close to the 'as new' condition according to vibration records.	- Analysis results within 25% to 74% of the allowable tolerance.	- Analysis results within 75% to 100% of the allowable tolerance.	- Analysis results outside the tolerance.

7.4 Ultrasonic thickness measurements

7.4.1 Ultrasonic thickness measurements (UTM) are expected to be taken on main fire line, cargo, vapour, cargo stripping, ballast piping, inert gas, COW and on high pressure hydraulic lines.

The CAP Surveyor may extend the scope of the UTM measurements to other piping systems or hull machinery items that show evidence of deterioration during visual examination or are subject to leaks during pressure testing.

Where the CAP Surveyor attends the measurements, a UTM report not yet endorsed by an IACS member classification society may be considered for CAP assessment on a case-by-case basis; however, final acceptance remains subject to endorsement by an IACS member classification society.

The thickness measurements should be conducted within 12 months prior to the CAP inspections.

Where the thickness measurements are conducted more than 12 months prior to the CAP inspection, the decision to use the results is made on a case by case basis. Additional measurements may be required to randomly verify that the UTM report data still properly reflects the actual condition of the vessel.

The CAP surveyor may also request that piping sections or machinery items be disassembled for internal visual inspection depending on measurement results.

Where possible the client should arrange for thickness measurements to be carried out in the presence of the CAP Surveyor. Otherwise, please refer to Sec 2, [2.5].

Refer to Tab 5 for the “Measured wastage” rating criteria for machinery and systems.

Table 5 : Measured wastage rating criteria for machinery and systems

Rating 1	Rating 2	Rating 3	Rating 4
- Measurements show either minimal or no deterioration from the 'as new' condition. i.e. reduction in thickness of between 0%-33% of permissible diminution.	- Measurements show deterioration from the 'as new' condition of between 33%-75% of permissible diminution.	- Measurements show deterioration from the 'as new' condition of between 75%-100% of permissible diminution.	- Measurements show deterioration or wastage above the permissible diminution.

7.5 Insulation testing

7.5.1 Insulation 'Megger' testing is to be carried out in accordance with Class requirements and the rating criteria in Tab 6 should be applied.

Table 6 : Insulation "Megger" - Testing rating criteria for electrical equipment

Rating 1	Rating 2	Rating 3	Rating 4
- Over 100 Meg ohms.	- 20-100 Meg ohms.	- Below 20 Meg ohms but above Class minimum requirements	- Below Class minimum requirements.

7.6 PMS assessment

7.6.1 The PMS assessment should be carried out in accordance with the criteria in Tab 7. The vessel's Planned Maintenance System is to be audited. The audit should cover the timely implementation, frequency, scope and results of the maintenance. Postponements and overdue items are to be included in the audit and reporting and follow up actions are to be reviewed.

Note 1: The PMS is not restricted to the machinery but shall include hull fittings, cargo installation, navigation equipment, etc.

The machine rating will not normally be higher than the rating applied to the vessel's Planned Maintenance System. However, for borderline cases where the PMS system rating is not significantly different from the rating given to the machinery installation in general, and vice versa, then the higher rating may be applied at the CAP Surveyor's discretion.

Table 7 : Planned Maintenance System (PMS) - Global criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Maintenance performed in a timely manner. - Overdue or postponed items, few in number or of minor importance, not affecting class and documented. - No items postponed to drydock unless the docking is imminent and these are planned in the repair specification. - No items subject to class recommendations. - No ISM non conformities against maintenance.	- Maintenance performed in a timely manner. - Overdue or postponed items, few in number, or of minor importance, not affecting class and documented. - Items postponed for docking due within 3 months and clearly planned in the repair specification. - No items subject to Class recommendations. - No ISM non conformities against maintenance.	- Maintenance performed generally in a timely manner with some overdue and postponed items not affecting class. - Items postponed for docking due within 3 months and clearly planned in the repair specification. - Items subject to class recommendations but within the limit date. - Pending ISM non conformities against maintenance.	- Maintenance generally performed with overdue items and postponed items some of which affect Class. - Overdue Class recommendations and ISM non conformities against maintenance.

7.7 Lubrication Oil/ Hydraulic oil analysis

7.7.1 The lubricating and hydraulic oil assessment is to be carried out in accordance with the criteria in Tab 8.

Table 8 : Lubricating / Hydraulic oil analysis rating rules - Rating definition

Rating 1	Analysis records are less than 6 months and results are within the acceptable range.
Rating 4	Results are not within the acceptable range.
NT	Analysis records are over 6 months or not available.
NA	Not applicable.

8 Specific survey requirements per module

8.1 Hull & Cargo machinery fittings and systems

8.1.1 Heat exchanger

The condenser should be opened for the CAP Survey. The steam space is to be xamined for signs of corrosion, vibrations of the tubes in the supports baffles and signs of erosion.

Rating criteria - Refers to Tab 9

Maintenance records should be reviewed for plugging of tubes.

For tube type coolers the main condenser rating criteria (see Tab 9) should be applied for the percentage of plugged tubes.

For the others the general rating criteria should be applied.

For heaters, the safety devices should be visually inspected and dismantled, if deemed necessary.

Table 9 : Tube type heat exchanger - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Shell and water boxes free from leaks. - No tubes plugged. - Steam dump pipe and baffle without signs of corrosion and erosion.	- Shell and water boxes free from leaks. ns of corrosion and erosion. - Less than 5% tubes plugged. - Steam dump pipe and baffle showing slight signs of corrosion and erosion.	- Shell and water boxes free from leaks, with permanent repairs. - Less than 10% tubes plugged. - Steam dump pipe and baffle corroded and eroded but still acceptable.	- Leaks in shell and water boxes, not permanently repaired. - More than 10% of the tubes plugged. - Steam dump pipe and/or baffle are corroded and eroded and not acceptable.

8.1.2 Deaerator

The deaerator should be opened for internal examination of the shell and nozzles

Rating criteria - Refer to Tab 10.

Table 10 : Deaerator - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Shell external and internal free from corrosion and pitting. - Spray nozzles intact and showing no evidence of erosion.	- Shell external and internal showing slight corrosion and pitting with less than 75% of the corrosion allowance. - Spray nozzles intact but with eorsion not affecting the operation.	- Shell external and internal showing corrosion over 75% of the corrosion alllowance but less than 100%. - Spray nozzles intact with erosion affecting serioulsy the operation.	- Shell external and internal showing corrosion over 100§ of the corrosion allowance. - Spray nozzles missing or eroded seriously affecting the operation.

8.2 Pumps

8.2.1 It will not be necessary to open the pumps for the CAP Survey, if a functional test is conducted and the pump is capable of meeting the flow and pressure requirements. Shaft seals should be free from leakage and the pump should operate without undue vibration. The foundations and holding down bolts should be checked.

The motors need not be opened unless the loading and operation is questionable, however the rotating pumps are to be subject to vibration measurement, refer Tab 4.

Where the pumps incorporate an auto change over arrangement this is to be tested as well as low pressure alarms.

Maintenance should be in-accordance with the maintenance system. Records should be reviewed and taken into consideration in determining the rating.

There are various types of pumps involved and inspected and tested accordingly.

8.3 Cargo handling system

8.3.1 The electrical bonding of cargo tanks and cargo piping should be checked and should be repaired as necessary.

The CAP Surveyor may require opening up and overhaul of the electrical equipment.

Defective wiring is to be renewed in its entirety. If junction boxes are used these should be of the required safety type appropriate to the zone. Splicing kits are not accepted in gas dangerous zones and should be kept in designated safe storage areas outside such zones.

Rating criteria - Refer to Tab 17.

9 Propulsion & Auxiliary machinery fittings and systems

9.1 Propeller shaft and bearing

9.1.1 It is not necessary to dismantle the propeller shaft unless it is due for Class survey. However, as the CAP survey is done in drydock, shaft clearances should be measured and compared with previous results. If it is not dismantled, the rating is based on the measured clearance and the oil consumption. Where the shaft is dismantled or a partial survey conducted, the rating is to take into account the condition of the taper, keyway, journals and bearing.

A lube oil analysis, recently conducted, should be provided and compared with the results of the analyses taken since the last tail shaft removal. The comparison should be made in conjunction with a check on the lube oil consumption.

Rating criteria - Refer to Tab 11.

Table 11 : Propeller shaft and bearing - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Shaft and stern tube bearing free from grooving. Liner seal free from grooving and original size. - Stern tube clearance within 25% of the allowable tolerance. - No evidence of removal of cracks by grinding.	- Shaft and stern tube bearing free from grooving. Liner seal free from grooving. - Stern tube clearance between 25 - 75% of the allowable tolerance. - No evidence of removal of cracks by grinding.	- Shaft and stern tube bearing with slight grooving. Liner seal free from serious grooving. - Stern tube clearance between 75 - 100% of the allowable tolerance.	- Shaft and stern tube bearing with grooving. Liner seal with grooving and close to minimum dimensions. - Stern tube clearance over 100% of the allowable tolerance.

9.2 Main thrust block and plummer blocks

9.2.1 The main thrust block and plummer blocks need not be opened for survey unless they are required to be opened for Class. However where these are opened up then bearing clearances and the fore and aft thrust clearances should be measured. The rating is based on the bearing wear, the fore and aft movement and the condition of the collar, journals, pads and bearings.

Rating criteria - Refer to Sec 4, Tab 5.

9.3 Reduction Gearboxes

9.3.1 Reduction gearboxes need not be opened for examination provided that the results of a vibration analysis show that the vibration has not deteriorated, however the inspection doors are to be removed for inspection. Photographs should be taken of representative teeth of the accessible wheels for records, especially where the teeth have been tested for contact using a marker dye. Attention should be paid to the teeth for evidence of cracking.

Flaking and pitting can occur, where this is found a more detailed examination would be required, particularly where the pitting is progressive.

In addition, a lube oil analysis should be conducted and compared with the results from the last two or more previous results. Lube oil rating criteria refer to Tab 8.

The lube oil pump should be started to verify the condition of the nozzles, where possible.

Rating criteria - Refer to Tab 12.

Table 12 : Reduction gear box - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Vibration analysis with results close to the as new condition.	- Vibration analysis with satisfactory results within the tolerance.	- Vibration analysis still within the tolerance.	- Vibration analysis outside the tolerance.
- Tooth contact along the length with no evidence of tooth damage. Lub oil analysis free of metal particles.	- Tooth contact along the length. Slight evidence of arrested pitting. Lub oil analysis free of metal particles.	- Tooth contact along the length. Extensive evidence of arrested pitting. Lub oil analysis free of metal particles.	- Tooth contact over partial length. Evidence of tooth damage and progressive pitting or flaking and spalling.

9.4 Turbo generators

9.4.1 The turbo generators need not be opened for examination, but must be operationally tested to the rated electrical load including testing of the ancillary equipment. The readings, taken at the last overhaul should be reviewed in conjunction with readings, if any, taken during the CAP survey. Vibration measurements should be taken. Fabricated bedplates and casings should be examined for evidence of defects.

A lube oil analysis, recently conducted, is to be provided and compared with the results of the last two analyses.

Rating criteria - Refer to Tab 13.

Table 13 : Turbo generator drive side - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Vibration measurement results as original readings. - Readings taken at last overhaul are within 25% of the allowable tolerance.	- Vibration measurements and readings taken at the last overhaul are between 25 - 75% of the allowable tolerances.	- Vibration measurements and readings taken at the last overhaul are between 75 - 100% of the allowable tolerances.	- Vibration measurements and readings taken at the last overhaul are over 100% of the allowable tolerances.
- Trips operational. Insulation without damage. No leakage observed.	- Trips operational. Insulation without damage. No leakages observed.	- Trips operational - Insulation without significant damage. Minor leakages observed.	- Some trips not operational. Insulation with significant damage. Leakages observed.
- Generator able to hold the rated electrical load.	- Generator able to hold the rated electrical load.	- Generator able to hold at least 90% of the rated electrical load.	- Generator not able to hold at least 90% of the rated electrical load.

9.5 Evaporator

9.5.1 The evaporators need not be opened for inspection. The maintenance records should be reviewed and the log of the condition of the water produced is to be reviewed. The general rating criteria (see [5.2.1]) should be applied taking into account the condition of the water produced.

9.6 Diesel generator

9.6.1 The diesel generators need not be opened for examination but should be operationally tested to the rated load and results compared with original figures from Manufacturers. The test includes testing of the ancillary equipment. Readings taken at the last overhaul should be reviewed. Maintenance records should be reviewed to verify that the maintenance has been conducted in accordance with the maintenance plan and that there have been no re-occurring problems.

Rating criteria - Refer to Tab 14.

Table 14 : Diesel generator drive side - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Trips are operational. Generator able to hold the rated electrical load. - Liner calibrations taken at last overhaul are within 25% of the allowable tolerance. - Insulation and double wall piping without damage. No leakage observed.	- Liner calibrations taken at the last overhaul are between 25 - 75% of the allowable tolerances. - Trips are operational Insulation and double wall piping without damage. - No leakages observed. Generator able to hold the rated electrical load.	- Liner calibrations taken at the last overhaul are between 75 - 100% of the allowable tolerances. - Trips are operational. Insulation and double wall piping without significant damage. - Minor leakages observed. Generator able to hold at least 90% of the rated electrical load.	- Liner calibrations taken at the last overhaul are over 100% of the allowable tolerances. - Some trips not operational. Insulation and/or double wall piping with significant damage. Leakages observed. - Generator not able to hold at least 90% of the rated electrical load.

9.7 Air compressors and air receivers

9.7.1 The air compressors and air receivers need not be opened for inspection. The maintenance record should be reviewed.

The general rating criteria is to be applied taking into account the liner wear readings of the compressors.

Relief valves and/ or bursting discs should be visually inspected and dismantled, if deemed necessary.

9.8 Purifiers and separators

9.8.1 The purifiers and separators need not be opened for examination and are to be tested, as deemed necessary. Maintenance records should be reviewed, general rating criteria should be applied.

9.9 Automation

9.9.1 The automation equipment should be randomly tested and inspected. The testing should include the calibration, settings, alarms, auto change over/ start of the stand by equipment and the auto control of valves, pumps etc.

9.10 Pipes lines

9.10.1 Pipe lines should be inspected under pressure. Main superheat steam, saturated steam, feed water lines and ballast lines are to be randomly ultrasonically tested. Insulation should be examined for condition and intactness. The general rating criteria (see [5.2.1]) is to be applied except for those lines that are subject to ultrasonic gauging.

Rating criteria - Refers to Tab 15.

Table 15 : Pipe lines subject to UT gauging - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Wall thickness reduction less than 25% of the corrosion allowance.	- Wall thickness of reduction between 25 - 75% of the corrosion allowance.	- Wall thickness of reduction between 75 - 100% of the corrosion allowance.	- Wall thickness reduction over the corrosion allowance.

9.11 Fire pumps

9.11.1 A functional test should be conducted. If satisfactory, it is not necessary to dismantle the pump. The rating criteria that is to be applied is the same as the one for pumps and pipe lines respectively.

9.12 Fire/ Smoke/ Gas detection/ Fire fighting systems

9.12.1 Random testing should be conducted and a valid service certificate is to be available. The general rating criteria is to be applied.

9.13 Breathing/ Emergency escape breathing apparatus

9.13.1 The general rating criteria is to be applied.

9.14 Emergency generator engine and emergency fire pump

9.14.1 A functional test should be conducted, this includes testing of the remote starting. It is not necessary to open the emergency generator engine and the emergency fire pump for examination unless the results of the functional test are not acceptable. The survey scope and rating to be applied is the same as the one for the diesel engines and pumps as required.

9.15 Machinery spares

9.15.1 The machinery spares should be randomly inspected and audited against the inventory.

Rating criteria - Refer to Tab 16.

Note 1: It is possible that some spares are kept onshore with contractors/suppliers.

Table 16 : Spare parts - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Adequate spares properly stowed and protected and correctly documented in the inventory.	- Adequate spares, properly stowed and protected, listed in the inventory.	- Spares stowed and protected but showing signs of deterioration. Listed in the inventory.	- Spares showing signs of heavy deterioration that affect their fitness for use. Inventory is incomplete.

9.16 Electrical installations - General

9.16.1 An overall survey of the installation should be made at the start of the CAP survey with a detailed survey as indicated below. The scope of the survey may be extended or reduced according to the results of the overall survey.

9.17 Instrumentation (liquid level gauges, pressure and temperature gauges and remote, gas detection equipment)

9.17.1 Visual inspection.

The following instrumentation should be checked at random: operation of liquid gauges, operation of pressure and temperature gauges by comparison betwen different sensors and indicators, operation of the gas detection system using span gas.

Rating criteria - Refer to Tab 17.

Table 17 : Instrumentation - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Instruments regularly calibrated and reading correctly. - No action required.	- Instruments regularly calibrated and reading within the defined tolerances. - Minor maintenance and ajustement required.	- Instruments are reading close to limit of the defined tolerances. - Calibration performed when needed. - Presence of corrosion of cable glands and boxes. - Maintenance and recalibration required.	- Instruments are reading outside the defined tolerances or systems are not working properly. - Calibration not conducted. - Presence of corrosion on cable glands and boxes. - Major maintenance and re-calibration required.

9.18 Emergency shutdown system

9.18.1 The CAP surveyor should test at random before and after cargo operations the emergency stops which activate an emergency shutdown.

Rating criteria and operation checks - Refer to [9.31] and Tab 30.

9.19 Electrical equipment in hazardous areas

9.19.1 A general visual examination should be carried out. The file for this equipment should be randomly checked to ensure that it is up to date and contains copies of the certified maintenance. Equipment identified as repaired or replaced should be especially checked for proper certification and installation. Additionally, it should comply with relevant IEC series 60092 standards.

Doubtful fittings should be checked and defective parts should be repaired to the standards applicable to the certified item in question.

Rating criteria - Refer to Tab 18.

Table 18 : Electrical equipment in hazardous areas - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: Rating 1. - Performance tests achieve the rated values. - Safety certificates are available. - No action required.	- Insulation test results: Rating 2 or better. - Performance tests are within the defined tolerances. - Safety certificates are available. - Minor maintenance and cleaning required.	- Insulation tests results: Rating 3 or better. - Performance tests are close to minimum requirements. - Envelopes, cable glands with minor defects not affecting the explosion proof characteristics. - Maintenance and cleaning required.	- Insulation test results: Rating 4 or better. - Performance tests are below the minimum defined levels or system is not working properly. - Installation no longer complies with the rule requirements. - Envelopes, cable glands damaged. - Explosion proof characteristics cannot be confirmed.

9.20 Electrical installation spares

9.20.1 The electrical installation spares should be randomly inspected and audited against the inventory. On older ships the availability of the spares will have to be discussed with the Owners and taken into account.

Note 1: It is possible that some spares are kept onshore with contractors/ suppliers.

Rating criteria - Refer to Tab 16.

9.21 Cabling

9.21.1 For cables of:

- Power, main and emergency lighting,
- Controls,
- Instrumentation,
- Communications.

The CAP Surveyor should check the condition of the cables of power, lighting and emergency circuits and pay special attention to hot and humid compartments, feeders to forced draught fans, cables in the holds, particularly at the upper grating levels, and cables in the galleys. The CAP Surveyor should likewise examine the circuits exposed to salt air, particularly those on the outside of the superstructure.

If there are cable runs inside conduits, the CAP Surveyor should check, as far as possible, that these conduits are free from moisture. Additionally, the cable ends and the intermediate junction boxes should be checked. If the neutrals are earthed, then the earthing clamps should be checked.

The CAP Surveyor should require a preliminary set of insulation readings for the circuits as soon as possible, to locate leakage to earth.

A comparison of results should be done in case there are records of the insulation test on board, keeping in mind that the state of the insulation of a circuit is not sufficient in itself. The important factor is how the insulation condition has varied with time.

Rating criteria - Refer to Tab 19.

Table 19 : Cabling - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results with rating 1. - Cables in original situation, sheathes and connections clean. - Labels well readable and not damaged - No action required.	- Insulation test results with rating 2 or better. - Cables moved or changed, without apparent damage. - Labels without apparent damage. - Minor maintenance required.	- Insulation test results with rating 3 or better. - Sheathes with surfaces scratched or armour slightly damaged, clamps missing. - Labels missing or unreadable. - Maintenance required but no overdue recommendations.	- Insulation test results with rating 4 or better. - Sheathes scratched, conductors are bare, clamps are missing, corrosion on connectors. - No labels. - Out Class standards.

9.22 Earthing

9.22.1 The earthing circuits should be checked in the same way as general cabling. Particular attention should be paid to the electric continuity of earthing and the corrosion of earthing connections of the electrical components.

Rating criteria - Refer to Tab 20.

Table 20 : Earthing - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Cables in original situation. - Sheathes and connections clean. - No action required.	- Cables moved or changed, without apparent damage. - Equipment changed and connections modified correctly.	- Sheathes with surfaces scratched or armour slightly damaged, clamps missing. - Connections corroded. Links in poor condition.	- Sheathes scratched, conductors are bare. Links and clamps are missing. - Connections are corroded. Electric continuity poor.

9.23 Power generation

9.23.1 External examination of the generators, including shaft driven generators and emergency generators should be carried out. Running tests should be carried out when testing both the mechanical trips and functioning of electrical circuit breakers, alarms and instrumentation. Refer to the machinery for the diesel engines, turbines and power take off units.

The most important being:

- Parallel operation and load sharing, etc.,
- Over-speed trips,
- Lubrication oil low pressure trips,
- Reverse power trip of circuit breaker,
- Generators, main and emergency.

The generator should be verified in operating condition. If deemed necessary, the CAP Surveyor should require that (where fitted):

- Protection plates and brush carriers are removed, field coil and armature windings vacuum cleaned,
- The brushes are renewed, if worn. The brushes may have to be adjusted to have good contact on the slip rings,
- Thyristors checked as necessary.

The CAP Surveyor should:

- Examine the slip rings which are machined, as necessary,
- Require, if necessary, the re-varnishing of armature windings and field coils,
- Examine the air filters for cleaning and leaks for totally enclosed type generators,
- Check the bearings.

The CAP Surveyor should also verify the air gaps (top/bottom/port/starboard) readings taken by the workshop.

Rating criteria - Refer to Tab 21.

Table 21 : Generator electrical side - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Performance tests reach the rated values. - Capable of operating at rated electrical load without abnormal temperatures & vibration. - No maintenance required.	- Performance tests reach the rated values. - Capable of operating at rated electrical load without abnormal temperatures and vibration. - Minor maintenance required.	- Performance tests are below the rated values. - Capable of at least 90% rated electrical load. - Temperatures and vibration close to limits. - Maintenance required.	- Performance tests are below the rated values. - Vibrations and temperature out of tolerances. - Generator not able to hold at least 90% of the rated electrical load or system is not working properly. - Overdue maintenance and Class recommendations.

9.24 Batteries

9.24.1 The following aspects should be be checked:

- Visual aspect, age of elements,
- Voltage and autonomy with regard to service (starting batteries, emergency power source, radio communications …),
- Verification that servicing of batteries for emergency, transitional or supplying other essential services has been done (connections, bars, tightness of trays and electrolyte levels),
- Verification that when charging source is disconnected that batteries hold their charge as required by the installation,
- Battery room installation and ventilation,
- Check that only the same type of batteries are present in the battery locker.

Rating criteria - Refer to Tab 22.

Table 22 : Batteries - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: Rating 1. - Performance tests reach the rated values. - No corrosion and battery location in clean condition. - No action required.	- Insulation test results: - Rating 2 or better. - Performance tests reach the rated values. - Slight corrosion, battery location requires cleaning. - Minor maintenance required, not affecting Class.	- Insulation test results: Rating 3 or better. - Performance tests are below the rated values but still acceptable. - Presence of corrosion on batteries and supports. - Battery location dirty. Maintenance required.	- Insulation test results: Rating 4 or better. - Performance tests are below the rated values or system is not working properly. Supports and trays very corroded. - Supports and trays very corroded.Battery location very dirty. - Overdue Class recommendations.

If Battery chargers/ inverters are fitted :

The CAP surveyor should verify the:

- Visual aspect checked, quality of connections, measurements of voltages and current,
- Cooling system in good operation (if applicable),
- Insulation test and insulation resistance measurements.

Rating criteria- Refer to Tab 23.

Table 23 : Battery chargers/ inverters - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: Rating 1. - Performance tests achieve rated values. - No action required.	- Insulation test: Rating 2 or better. - Performance tests achieve rated values. - Minor maintenance required. - No Class recommendations.	- Insulation test results: Rating 3 or better. - Performance tests are close to the minimum rated values. - Maintenance required but no overdue Class recommendations.	- Insulation test results: Rating 4 or better. - Performance tests are below the minimum rated values or system is not working properly.

9.25 Switchboards and electrical sub distribution panels

9.25.1 The CAP Surveyor should survey the following:

a) Main switchboard:
- Examination of maintenance logbook,
- Switchboards dust freeing, vacuum cleaning and electrical chemical cleaning, connections and assemblies which may slack to be tightened. The Surveyor checks that the locking devices are properly fitted (locking washers, varnish between threaded spindles, nuts, etc.),
- Cleaning and tightening of bus-bars, examination of circuit breakers and various types of switches and fuses,
- Reconditioning or replacement of contacts and arc screens. Checking of setting, adjustments and fuses,
- Examination in a repair shop and calibration of measuring instruments considered to be inaccurate by the ship's engineers,
- Servicing of breakers,
- An infrared analysis to identify bad connections or elements creating hot spots.

b) Emergency switchboard:
- Same as main switchboards,
- Testing of the automatic start of the emergency generators, if applicable.

c) Sub-distribution panels:
- Same as main switchboards.

Rating criteria - Refer to Tab 24.

Table 24 : Switchboards and electrical sub-distribution panels - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: Rating 1. - Performance tests reach the rated values - No infra-red hot spots. - No maintenance or cleaning required.	- Insulation test: Rating 2 or better. - Performance tests reach the rated values. - No infra-red hot spots. - Minor adjustment and cleaning required.	- Insulation test results: Rating 3 or better. - Performance tests are below the rated values. - Minor hot spots detected by infrared analysis. - Adjustment and cleaning required but not affecting class. - No overdue Class recommendations.	- Insulation test results: Rating 4 or better. - Performance tests are below the rated values or system is not working properly. - Important hot spots detected by infrared analysis. - Overdue Class recommendations.

9.26 Transformers

9.26.1 The CAP Surveyor should survey the following:

For transformers:
- Check visual aspect, quality of connections. Measures of voltages and currents, insulation resistance,
- Induced voltage test,
- Check cooling system (if applicable).

For liquid cooled transformers, if fitted:
- Analysis of liquid coolant.

Rating criteria - Refer to Tab 25.

Table 25 : Transformers - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: rating 1. - Performance tests achieve rated values, high voltage test. - Temperature rise well within tolerances. - No action required.	- Insulation test results: rating 2 or better. - Performance tests above minimum rated values. - High voltage and temperature rise tests within tolerances. - Minor maintenance is required, no Class recommendations.	- Insulation test results: rating 3 or better. - Performance tests are close to the minimum rated values. - High voltage test is at limit of tolerance. - Maintenance required but no overdue Class recommendations.	- Insulation test results: rating 4 or better. - Performance tests are below the minimum rated values or system is not working properly. - High voltage test and temperature rise test outside of tolerances.

9.27 Rotating machines

9.27.1 This paragraph applies to rotating machines over 50 kW namely, alternators and electrical motors. For general scope of work, refer to the power generation paragraph.

The motors of essential services should be verified in operating condition at the time of the vibration measurements.

If deemed necessary, the CAP Surveyor should extend his surveys to bearings, induced circuits, rotors, windings, etc.

The CAP Surveyor should check, at random, the insulation condition of the feed conductors penetrating into the terminal plate.

Rating criteria - Refer to Tab 26.

Table 26 : Rotating machines - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: rating 1. - Performance tests reach the rated values. - Analysis results close to the 'as new' condition according to vibration records. - No action required.	- Insulation test: rating 2 or better. - Performance tests reach the rated values, with no abnormal temperatures and vibration. - Analysis results within 25% to 74% of the allowable tolerance. - Minor cleaning required.	- Insulation test results: rating 3 or better. - Performance tests reach rated values with no abnormal temperatures and vibration. - Analysis results within 25% to 74% of the allowable tolerance. - Minor cleaning required with no overdue Class recommendations.	- Insulation test results: rating 4 or better. - Performance tests are below the rated values or system is not working properly. - Vibrations and temperature out of tolerance.. - Analysis results outside the tolerance. - Overdue Class recommendations.

9.28 Main lighting

9.28.1 Visual examination of the lighting appliances (cleanliness, fastening, cabling…).

Lighting appliances and their switches should be functionally tested on a random basis.

Rating criteria - Refer to Tab 27.

Table 27 : Main lighting - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: rating 1. - Fittings and protections are satisfactory. - No action required.	- Insulation test: rating 2 or better. - Fittings and protections are generally satisfactory. - Minor maintenance required not affecting Class.	- Insulation test results: rating 3 or better. - Fittings and protections meet minimum Class requirements. - Maintenance required, no overdue Class recommendations.	- Insulation test results: rating 4 or better. - Defective fittings and/or missing protections. - Maintenance and/or renewals urgently required. - Overdue Class recommendations.

9.29 Emergency lighting

9.29.1 The survey scope should be the same as for the main lighting.

Batteries of self-powered lighting should be checked, as well as the spare lamps.

Rating criteria - Refer to Tab 28.

Table 28 : Emergency lighting - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: rating 1. - Fittings, protections and functional tests satisfactory. - Battery condition of self powered lights satisfactory. - No action required.	- Insulation test results: rating 2 or better. - Fittings, protections and functional tests satisfactory. - Battery condition of self powered lights satisfactory. - Minor maintenance required.	- Insulation test results: rating 3 or better. - Fittings, protections and functional tests are at minimum Class requirements. - Battery condition of self powered lights is near minimum Class requirements. - Maintenance and/or renewals required, no overdue Class requirements.	- Insulation test results: rating 4 or better. - Defective fittings and/or missing protections. - Batteries of self powered lights are out of service. - Maintenance and/or renewals urgently required.

9.30 Control of propulsion and steering - Engine telegraph

9.30.1 The CAP Surveyor should test the means of communication and order transmissions between the bridge and the machinery control positions, as well as for the bridge and the alternative steering position, if fitted.

Rating criteria - Refer to Tab 29.

Table 29 : Control of propulsion and steering - Engine telegraph - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: rating 1. - Performance tests achieve the rated values. - No action required.	- Insulation test results: rating 2 or better. - Performance tests achieve the rated values. - Minor maintenance and adjustment required.	- Insulation test results: rating 3 or better. - Performance tests are close to minimum rated values. - Maintenance and adjustment are required. - No overdue Class recommendations.	- Insulation test results: rating 4 or better. - Performance tests are below the rated values or system is not working properly.

9.31 Automation control systems

9.31.1 The following items should be examined:

- Remote control devices to allow the starting, stop, speed adjustment or other operations from one or several control positions fitted for this purpose. e.g. remote control system or automatic control system for propulsion plant,
- Automatic regulating devices to maintain satisfactory operating conditions for machinery which avoid foreseeable interventions, the periodicity of which could be less than 24 h,
- Automatic monitoring systems to warn the engineer in charge, in case of failure (this optical and acoustic alarm is activated where permanent watch is assumed),
- Automatic safety devices intended to take immediate action to protect the monitored machine or to allow restart of the installation without waiting for engineers' intervention,
- Local, or remote indications to show the position of machinery parts (when this position cannot be directly monitored) to indicate the value of several parameters,
- Automatic start of stand-by pumps,
- Electric driven pumps,
- Driven pump,
- Sequential restart of plant after power failure.

The automation systems are made of panels containing electrical equipment; verifications recommended for switchboards should be applied in the same way.

Furthermore the CAP Surveyor should proceed to the following:

- Visual examination of internal parts (presence of dust, quality of connections, condition of components,
- Log book review, in order to identify the failures which have occurred, with the corresponding actions of correction (interventions, equipment replaced, software updating…),
- Verification of equipment identified as repaired,
- Functionalities review,
- Assessment of performances, running time.

Rating criteria - Refer to Tab 30.

Table 30 : Automation control systems - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Performance tests reach the rated values. - No action required.	- Performance tests reach the rated values. - Minor maintenance, calibration and cleaning required.	- Performance tests are on the rated values. - Presence of corrosion on electronic cards. - Maintenance, calibration and cleaning required.	- Performance tests are below the rated values or system is not working properly. - Defective and/or missing instrumentation, poor calibration.

9.32 Alarm system

9.32.1 Rating criteria and verification scope - Refer to [9.31] and Tab 30.

9.33 Fire alarm system, panels / detectors

9.33.1 Refer to the automation system for fire alarm panel.

A satisfactory function test of the fire detection system should be carried out.

Rating criteria - Refer to Tab 30.

9.34 Internal communication means

9.34.1 For the internal communication systems, a visual examination should be carried out (presence of dust, corrosion, quality of cabling and connections:

a) Public Address - General Alarm (PA-GA) system:
   - Louder speakers should be tested individually,
   - The sound level should be measured (reference will be made to IMO LSA code 7.2.1 requirements).

b) Self-generator telephone
   - Functional test,
   - Automatic relephone,

Rating criteria - Refer to Tab 31.

Table 31 : Internal communication means - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Performance tests reach the rated values - Loud speakers are properly working with sound clarity and levels at the" as new condition - No action required	- Performance tests reach the rated values - Loud speakers are generally working. Sound clarity and levels close to as new condition for the speakers - Minor maintenance required	- Performance tests are at minimum rated values - Loud speakers are working through clarity and levels at minimum acceptable levels - Presence of corrosion - Maintenance, repair and renewal required	- Performance tests are below the minimum rated values - Some loud speakers are not correctly working - Sound clarity and levels of some speakers below minimum requirements - Presence of corrosion - Major maintenance, repairs and/ or renewals required

10 Bridge, navigational and radio equipment & systems

10.1 Navigation equipment

10.1.1 Special attention should be paid in case of **SYS-NEQ** notation.
Rating criteria and verification scope refer to [9.31] and Tab 30 & Tab 31.

10.2 Radio equipment

10.2.1 Rating criteria refer to Tab 31.

10.3 Navigation lights

10.3.1 The following verifications should be carried out for the navigation lights assessment:

- Visual examination (presence of corrosion, quality of cabling and connections),
- Functional test and alarm checking,
- Insulation test.

Rating criteria - Refer to Tab 32.

Table 32 : Navigation lights - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Insulation test results: rating 1 - Lighting, alarms and indicator panels working correctly, cabling satisfactory - No action required	- Insulation test results: rating 2 or better - Lighting, alarms and indicator panels working correctly, with superficial damage to cabling - Minor maintenance, cleaning required	- Insulation test results: rating 3 or better - Lighting, alarms and indicator panels working correctly, damage to cabling and fittings, still within Class requirements - Maintenance is required	- Insulation test results: rating 4 or better - Some lighting, alarms and/ or indicator panels not working correctly - Cabling is damaged

Section 4 Specific Assessment for LNG Carriers

1 General

1.1 Scope

1.1.1 This Section defines the CAP methodology specific to LNG carriers and must be read in conjunction with Sec 1, Sec 2, and Sec 3.

1.1.2 The Owner's representative defines the areas to be assessed, taking into consideration the type of vessel and specific requirements. However, the hull is to be assessed as a minimum requirement for the Condition Assessment.

1.1.3 Complementary studies may be undertaken; this would include the fatigue analysis of the hull and which should be clearly defined in the contract. Where the SFA may highlight potential 'hot spot' areas then sufficient time should normally be allowed for the analysis to be completed before surveys commence as these areas would be subject to close up survey.

1.1.4 This Section has been developed specifically for Membrane and Moss type LNG carriers and is aimed at vessels of 15 years age and above, it must be read in conjunction with Sec 1, Sec 2 and Sec 3 which forms the basis of the CAP surveys.

1.2 Survey flexibility with Class

1.2.1 The LNG CAP may be spread over the period between the 2nd and 3rd annual surveys in line with the intermediate survey. When this is done the survey plan is to clearly indicate the method for verifying the ratings assigned to those items surveyed at the commencement of the LNG CAP Survey.

2 Hull

2.1 General

2.1.1 Experience has identified specific areas within the hull where cracking could occur and are well known to the industry. With the increasing age, fatigue becomes another factor in the condition of the vessel. The LNG - CAP should take these factors into account in the survey requirements for the hull. Similarly, the history of defects and repairs should also be considered.

This may be divided into three parts:

- Critical areas map
- Structural strength and fatigue analysis
- Surveys.

2.2 Critical areas map

2.2.1 The critical areas map is to be developed on the basis of:

- Typical defects for that design of vessel
- Results of the SFA, if requested by the Owner, providing the potential list of “hot spots’ which must be CVI
- The history of defects of the individual vessel in service.

2.3 Fatigue analysis

2.3.1 If a Structural Strength & Fatigue Analysis 2D/ 3D (SFA) is to be carried out, this shall normally be completed prior to commencing the surveys such that potential fatigue 'hot spots' are closely surveyed and UT gauged as necessary.

A repair procedure should be defined for those 'hot spots' found with cracks or defects affecting their efficiency.

Note 1: Some charterers may reject a CAP report for which the SFA has been carried out following the start of the CAP survey. Therefore, we strongly recommend the Owner to discuss the SFA scope expectation and provide all documents to the BV Office in charge of the analysis.

2.4 Survey

2.4.1 General

A survey plan should be developed before commencement of the surveys. The plan should define the scope of the survey, identify the areas for additional survey together with the means for access, lighting and safety requirements.

The CAP survey should take into account that this type of vessel could be in active service well into its thirties, i.e. the ship could be more than 30 years old. In addition, the condition of the coating could have deteriorated permitting the corrosion rate to increase.

2.4.2 Survey scope

Where the coating in the ballast tanks is fair or poor, the close-up survey should be extended. Steel work renewals should be suitably coated after repair to minimise corrosion from occurring.

Close up survey of the potential fatigue 'hot spots' and the critical areas identified in the critical area maps.

Hydrostatic testing of ballast tanks should be conducted, when these are required by the Society.

2.4.3 Suspect areas

Suspect areas should be investigated by the CAP Surveyor to ascertain their extent. Although corrective action remains a recommendation, it is strongly advised that any suspect areas which may affects the CAP rating of a section / module, or constitue a high-risk condition be cropped out and renewed prior to completion of the CAP survey.

2.4.4 Photographs

A library of photographs taken during the CAP survey is to be established. Photographs are to be taken in the tanks to show the general condition of that tank. Where repairs are conducted, before and after photographs should be taken. Defective fatigue hot spot areas and critical areas should be photographed as well, if no defects are found in these areas, sample photographs should be taken. Photographs should be identified in the report.

3 Containment system

3.1 General

3.1.1 In general the containment system will need to be examined in service in loaded condition, in heel condition and also with the vessel gas free with cargo tanks opened and in dry air.

3.1.2

The cargo tanks and adjacent spaces opening for the CAP survey is required unless:

- it is not due to be opened up for Class, and in accordance with the manufacturer's maintenance scheme program
- and the functional test demonstrates that the equipment is working correctly
- and the last CAP survey with internal inspection of the cargo tanks and adjacent spaces was conducted by Bureau Veritas M&O maximum 3 years ago.

This alternative assessment covers the module cargo containment system of the CAP survey and is based on criteria defined in [3.2]

Note 1: As per IACS, Procedural requirement N°37, an adjacent space is defined as any space bordering the confined space in any directions, including all points of contact, corners, diagonals, decks, tank tops and bulkheads.

Note 2: Some charterers and vetting departments may reject a vessel for which this alternative inspection scheme of cargo tanks has been done. We strongly recommend the Owner to discuss with the charterers and vetting departments they intend to send the CAP report and CAP certificate to verify their requirements.

3.2 Rating criteria

3.2.1 Rating criteria are given within various sections of this document. The criteria are to be used in conjunction with operational testing and taking into consideration the results of non-destructive tests. They are broadly defined in Sec 1, [1.6], specifically in Sec 1, Tab 3. For membrane type containment systems the rating criteria is given in Tab 1 and in Tab 2 for the alternative cargo tank assessment inspection scheme; for moss type systems the rating criteria is given in Tab 3.

3.3 Membrane type containment systems

3.3.1 Tank covers external examination

The CAP Surveyor should examine the upper surface of the tank cover for cracking and signs of temporary repair especially under the flange drip pans, suspect areas should be subject to hammer test or NDT. Visual inspection of the membrane inter-barrier space safety valves for condition and leakage should be carried out. Examination of the vapour and pump dome covers for leakage should be carried out. The condition of the safety rails around the tank cover should be examined. The external condition of the cargo tank safety valves should be checked. Foundation of the vent mast should be examined and connection to the riser should be examined for corrosion. The connection of the tank cover to the main deck should be checked for cracking and suspect areas should be subject to NDT.

3.3.2 Cofferdam internal examination

The cofferdams should be internally examined for structural condition, coatings and corrosion. Internal equipment, heating coils, purge pipes, bilge arrangements, etc,. should be inspected and where possible functionally tested.

3.3.3 Cargo tank internal examination

The records of existing dents at bottom should be reviewed and compared with earlier records.

When accessing the tanks, some pump masts are designed with the ladder going directly to the bottom; make sure that a harness is available. The tank should be provided with powerful lighting, necessary safety and escape equipment. Shelter and protection should also be set up by the crew before entering the tanks. Whilst descending, a visual check of the pump mast structure, the pump tower base plate and the pump tower base support, temperature sensors and their attachments and the cargo lines should be made.

A first general inspection of membrane surface should be carried out:

- identify any deformation or scratches
- spotting dropped objects and foreign materials
- identify potential dust, sand, deposits.

Special protection should be worn at the tank bottom, to prevent damage to the membrane.

A visual examination should be made of the cargo pumps, the securing of the electric cables, and the non return valves. When possible, the free rotation of the impeller of the cargo pumps. The area at bottom of the mast should be checked for dust and local corrosion. The expansion arrangements for the mast foot and the connection of the membrane to the mast support plate should be checked.

A visual examination of the bottom should be made, existing dents should be already marked with their date of recording nearby. If not, the dent should be recorded and its geometry agreed with the CCS manufacturer.

Examine areas at bottom and hoppers side which might be covered by dust coming from the storage tanks ashore (perlite, sand etc,.) Check after smooth cleaning if corrosion remains by magnifying glass, dye check or helium test according to the defect.

Check the colour of the membrane. Stainless corrugated plates might turn dull with time. The invar plate might turn orange brown (general surface corrosion). Check if the membrane is tightly fitted onto the faces of the tank without waves that might indicate insulation problems.

Table 1 : Membrane type

No.	Element	Component / characteristic	Inspection	Criterion
1	Primary barrier	Membrane	a) Visual checking: absence of deformations, deflection on panel, and/or setting plate, waves, impacts, cracks. b) Cleanliness: examination of the bottom notably around liquid dome, gas dome [falling objects], pump tower attachments & sliding pads, the lower slopes and the transverse bulkhead behind the pump tower. c) Thorough examination of tank bottom and left of specific objects such as: - screws left on the filling pipe guide, - plastic collar, ropes, nuts, gasket & graphic. Visual examination as in depth as possible of high areas (if no scaffolding).	Rating 1: no visual defect as new. Rating 2: slight indentations or waves, no effect on performance. Rating 3: heavy indentation but no signs of cracking or deterioration in performance. Rating 4: heavy deformation, deflection and damage, signs of cracking or membrane failure.
2	Primary membrane	a) Tightness test b) Tightness monitoring	a) Tightness test: global tests such as Primary Global Vacuum Test (PGVT) or Primary Barrier Global Test (PBGT) carried out in accordance with builders or designers instructions. b) Depending on the CCS design, tests may have to be done depending on tank's work or every 5 years. Measurement of gas content in inter-barrier spaces - Low differential pressure test (LDPT).	a) Results of the global test will determine the need for repairs Pass: Rating 1, Fail: Rating 4. b) Rating 1: no gas detected in Primary Barrier or readings as new or better than new. Rating 2: as present but less than 30% by volume with normal nitrogen operation and readings steady. Rating 3: gas present but kept successfully below 30% by volume by nitrogen sweeping. Rating 4: gas above 30% by volume even with nitrogen sweeping.

No.	Element	Component / characteristic	Inspection	Criterion
3	Secondary membranes	Tightness monitoring	The tightness tests should be conducted in accordance with the latest instructions from the engineering designer. These tightness tests might include the Thermal Assessment of Membrane Integrity (TAMI) which is conducted on the secondary barrier.	Secondary Barrier Tightness Test (SBTT) - TAMI where applicable, Global Test Ratings: - Rating 1: no gas detected. - Rating 3: gas detected but below 30% lower explosive limit (LEL). - Rating 4: gas above 30% lower explosive limit (LEL). LEL corresponds to the lowest level a gas can ignite in air in the presence of an ignition source.
4	Insulation	Aspect	Moisture presence / plywood condition / staples / anchoring system. Glue / failure PUF or balsa.	
5	Pump mast Pump Tower Base Plate (PTBP) Pump Tower Base Support (PTBS)	a) Visual inspection b) Welds NDT	a) Visual examination of ladders expansion arrangements, and locking devices. b) NDT (10%) of structure 100% of pump mast support.	Rating 1: as new connection in place no wear, deformation or cracking of expansion arrangements. Rating 2: tower used regularly for tank access, connections in place and effective but obviously used and worn. Rating 3: tower fittings and locking devices should be replaced, risk of them failing and broken parts ending up in the tank. Rating 4: locking devices poor or not fitted, heavy wear on expansion arrangements.
6	Connection of the pump mast on the support	Sliding pads	Visual examination measurement of gap	
7	Liquid dome cover	Welding of liquid dome on the ship's structure	NDT (100%)	
8	Gas dome	a) Welding of junction ring between gas pipe and membrane on tank top b) Welding of gas dome on the ship's structure	NDT (100%)	

3.3.4 Alternative cargo tank assessment

Following [3.1.2], the CAP survey program is aligned with the Class survey scheme in place for the cargo tanks. When the cargo tanks opening is not required by the vessel's Class Society during the CAP survey, the module “Cargo containment system” of the CAP survey is therefore based on:

- Review of the previous CAP reports, the module “Cargo containment system” specifically,
- Review of records, logs and trends related to cargo tanks barriers and insulation spaces temperatures, pressures, and other relevant parameters over the last 3 years,
- Assessment of nitrogen consumptions, gas detection system readings, and relief valves operations,
- Evaluation of cargo pumps, stripping & fuel gas pumps performance records,
- Consideration of vessel’s operational profiles, including exposure to severe weather conditions and potential sloshing,
- Examination of motion sensors and accelerometers records, if installed.

This survey program considers that the last CAP survey with internal inspection of the cargo tanks and adjacent spaces, was conducted by Bureau Veritas M&O, maximum 3 years ago.

Table 2 : Membrane type - Alternative cargo tank assessment

No.	Element	Component / characteristic	Inspection	Criterion
1	Primary barrier	Membrane	a) Review of records, logs and trends related to cargo tanks, barriers and insulation spaces temperatures, pressures and other relevant parameters over the last 3 years. b) Examination of motion sensors and accelerometers records, if installed.	a) Rating 1: no visual defect reported. Rating 2: slight indentations or waves reported, no effect on performance. Rating 3: heavy indentation reported without signs of cracking or deterioration in performance. Rating 4: absence of reports. b) Rating 1: no exceed. Rating 3: exceed noted but no effect on performance. Rating 4: exceed with impact on performance (identified with gas detectors log files) or absence of reports.
2	Primary membrane	a) Tightness test b) Tightness monitoring	For the tightness test: a) Review of global tests such as Primary Global Vacuum Test (PGVT) or Primary Barrier Global Test (PBGT) carried out in accordance with builders or designers instructions. For the tightness monitoring: a) Assessment of nitrogen consumptions, gas detection system readings, and relief valves operation. b) Evaluation of cargo pumps, stripping & fuel gas pumps performance records.	Tightness test rating: a) Results of the global test will determine the need for repairs, rating 1: pass, rating 4: absence of reports. Tightness test monitoring rating: a) Rating 1: no gas detected in primary barrier or readings as new or better than new. Rating 2: gas present but less than 30% by volume with normal nitrogen operation and readings steady. Rating 3: gas present but kept successfully below 30% by volume by nitrogen sweeping. Rating 4: gas above 30% by volume even with nitrogen sweeping. b) Rating 1: readings as new or better than new. Rating 2: readings operational without any deterioration of the performance. Rating 4: absence of reports.
3	Secondary membrane	Tightness monitoring	The tightness tests to be conducted in accordance with the latest instructions from the engineering designer. Review of the SBTT and TAMI, where applicable in accordance with builders or designers instructions.	Rating 1: no gas detected. Rating 3: gas detected but below 30% lower explosive limit (LEL). Rating 4: gas above 30% lower explosive limit (LEL). LEL corresponds to the lowest level a gas can ignite in air in the presence of an ignition source.
4	Pump mast Pump Tower Base Plate (PTBP) Pump Tower Base Support (PTBS)	Assessment	Review of the previous CAP reports (visual and NDT) and Manufacturer's inspection report.	Rating 1: as new condition. Rating 2: defects reported with no impact on operational. Rating 3: tower fittings and locking devices reported to be replaced, repairs postponed. Rating 4: absence of report or CAP report not issued by Bureau Veritas.
6	Connection of the pump mast on the support	Sliding pads	Review of the previous CAP reports.	

No.	Element	Component / characteristic	Inspection	Criterion
7	Liquid dome cover	Welding of liquid dome on the ship's structure	NDT (100%)	
8	Gas dome	a) Welding of junction ring between gas pipe and membrane on tank top b) Welding of gas dome on the ship's structure	NDT (100%)	

3.3.5 Membrane tightness

Membrane tightness should be investigated during the last loaded and heel voyages before docking and compared with existing earlier operational records and the records from when the vessel was new. Recordings of N_2 daily consumption, gas detection in inter-barrier spaces and possibly temperature sensors should be reviewed and studied to assess the general overall operating condition of the membranes. Note that inter- barrier gas readings should be taken both on the loaded and heel passages.

If nitrogen usage is excessive or if gas in the membrane spaces is high then consideration should be given to carrying out a global vacuum test at the docking period to determine the size of leakage. If necessary a helium test will give the location of the leaks and their seriousness in view of repairs. The ratings assigned are to be according to the rating criteria.

3.4 MOSS - Type containment system

3.4.1 Tank void space covers external examination

The CAP Surveyor should examine the upper surface of the void space cover for cracking and signs of temporary repair especially under the flange drip pans, suspect areas should be subject to hammer test or NDT. A visual inspection of the void space safety valves for condition and leakage should be carried out. The condition of the safety rails around the dome should be examined. The rubber bellows between the tank dome and the void space cover should to be examined for cracking and for leakage, if necessary sections of the shield are to be removed to make examination easier.

The external condition of the cargo tank safety valves should be checked. Foundation of the vent mast should be examined and connection to the riser should be examined for corrosion.

The connection of the void space cover to the main deck should be checked for cracking and suspect areas should be subject to NDT. Particular attention should be paid to external brackets between the void cover and the main deck, these frequently suffer cracking or detachment but may propagate cracks into the main deck. Void space doors should be checked for air leakage (soap solution) whilst void spaces are pressurised. A visual examination of the nitrogen supply and exhaust piping should be made.

3.4.2 Void spaces internal examination

Before entry into the void spaces it is essential to ensure that they are properly ventilated with dry air to ensure that build up of nitrogen is reduced to normal atmospheric levels. The necessary safety precautions should be taken for entry into enclosed spaces. Powerful lighting should be available.

The tank insulation can be of two different types, either the spiral wound type, recognized by an unbroken outer surface like duct tape or the panel system where it is easy to identify the mosaic of panels. With the wound system there will be a support structure of straps and springs holding up the system on the southern hemisphere, these should be examined to ensure that they are still providing the necessary support. The insulation should be examined for signs of cold spots (icing) that would indicate moisture in the void atmosphere. It should also be examined for sagging and other forms of damage or detachment from the sphere. Consideration should be given to removing sections of the insulation to examine and test the material and to check the attachment to the sphere.

In particular the wedge space between the skirt and southern hemisphere should be checked to ensure that the insulation is intact. The nitrogen supply and exhaust lines should be checked for security and sealing where they enter and leave the insulation.

The skirt should be visually examined for signs of cracking or buckling especially where it is attached to the sphere and at the foundation deck. On aluminium tanks, the transition joint from the aluminium part of the skirt to the steel part should be especially examined for signs of failure. The connection of the ballast tank bulkheads to the foundation deck should also be examined for signs of cracking and signs of weeping. Inside the skirt, depending upon the age of the vessel, there will be different "secondary barrier" arrangements, these can range from complete insulation and sheathing in stainless steel of the hull double bottom inside the skirt to just a small drip pan underneath the sphere. The secondary barrier should be examined for damage. The pressure relief devices at the lower part of the southern hemisphere should be examined and checked for freedom of

operation. The condition of the sump, void space eductors and piping should be checked and consideration should be given to blowing through the lines with air. The condition of the blanking devices between cargo and sea water driving medium should be checked.

The general condition of the void space paint work should be examined and assessed as this can give a good indication as to the efficiency of the dry air system.

3.4.3 Cargo tank internal examination

The cargo tank should be examined should be gas free and safe for entry. The necessary safety precautions should be taken for entry into enclosed spaces. Powerful lighting should be available.

The condition of the upper part of the tower should be checked especially expansion arrangements (sliding shoes). Locking and securing devices for clamps, nuts and bolts, cabling for cargo pumps and measuring systems should be examined. As much as possible the upper part of the sphere and the connection to the dome should be visually examined from the upper gallery for signs of corrosion or fatigue. The spray rails and securing devices should also be examined as far as possible from the upper gallery. The tower should be visually examined for signs of damage, buckling, cracking etc. The mid level gallery should be examined in preparation for the mounting of the tank inspection boom. The base of the tower should be especially examined depending upon type. Those where the expansion takes place at the base by way of diaphragm plates or other arrangements should be specially examined for cracking; those where the aluminium tower rests upon a steel foundation should be examined for failure of the contact points; those where the tower is connected directly to the shell of the sphere should be examined for cracking.

Location of the cargo and spray pumps should be checked for security. Piping should be checked for security of fittings, clamps and locking devices.

If considered necessary and if available the cargo tank inspection boom should be deployed and an examination made of the internal welds of the sphere.

NDT should be carried out on the tower and sphere as considered necessary.

Table 3 : MOSS types

No.	Element	Component / characteristic	Inspection	Criterion
1	Void space cover	Visual inspection	- Examination of steel void cover for surface cracks, signs of temporary repair, coating condition. - Condition of void space relief valves, of vent mast and foundations. - Condition of rubber seal between dome and void cover. - Condition of junction boxes and instrumentation cabinets in dome area. - Condition of safety rails and platforms in the dome area. - Examination of connection between void cover and deck for cracks especially in way of brackets. - Test of void space doors for tightness.	Rating 1: as new no deterioration, no leakage, no cracks, coatings good. Rating 2: coatings fair, minor cracks on main deck brackets, minor leakage of safety valves and doors not affecting operation. Rating 3: coatings require attention, cover cracks temporarily repaired, noticeable leakage from safety valves and doors. Rating 4: unacceptable, void space unable to be pressurised, large cracks in cover requiring immediate action, cracks in brackets could lead to main deck cracking. Coatings poor.
2	Void spaces	Visual inspection	Examination for cleanliness, coatings, corrosion, cracking, secondary barrier, cargo/ bilge eductors, sump and alarms.	Rating 1: as new condition coatings good, no corrosion, no cracks, eductors as new, secondary barrier without defects. Rating 2: coatings generally good, signs of crack repairs in hull structure, equipment functional. Rating 3: coatings showing signs of breakdown, corrosion present, signs of weeping from ballast tanks but no leakage. Rating 4: coatings poor, secondary barrier poor signs of leakage from ballast tanks, eductors poor blanks missing.

No.	Element	Component / characteristic	Inspection	Criterion
3	Tank insulation	Visual inspection, samples for tests if considered necessary.	- Examination of insulation for integrity and security of fastenings. Checks for sagging, cold spots and/ or surface abrasion. - Check support system, straps & springs on wound type insulation, check for panel gaps & cracking of seals on panel systems. Areas that indicate breakdown remove core sample core testing. Samples should ideally be taken in way of the equatorial ring, tank dome & bottom area. Samples to be analysed in a laboratory for density, water content, compressive strength, pH value, chemical analysis of leachable chloride ion & thermal impact (boil-off rate). - Wherever cargo tank insulation is removed, supporting structure & secondary barrier configuration shall be examined. If in doubt about the security of the panels, the key panel shall be removed for examination of the fixing system. - Examination of the space between the tank & the skirt for signs of loosening of the insulation. - Examination of the bursting disc & the drain away system.	Rating 1: as new condition no signs of damage or cold spots, insulation secure. Rating 2: insulation shows signs of wear and possible previous repair but is in good condition, insulation secure, surface free of frost. Rating 3: insulation shows surface indications of frost, signs of wear and requires minor repairs and shows small cold spots, samples may be called for. May also show signs of sagging. Rating 4: insulation shows signs of failure, heavy cold spots, severe sagging and indications of touching the tank surface insulation between the tank and skirt falling out.
4	Cargo tank	Visual internal inspection	Presence of cracks, corrosion of welds, pitting.	Rating 1: as new condition no signs of cracking corrosion or build up of dust. Rating 2: no signs of cracking, no signs of corrosion, slight build up of dust on surfaces. Rating 3: no signs of cracks, possible corrosion of welds or heavy build up of dust deposits. Rating 4: cracks may be detected, corrosion of welds and other internals, very heavy build up of deposits.
		Weld NDT	- Dome to upper hemisphere: NDT from inside (if possible - if not, from outside after removal of insulation) 360° or as near as possible - Pipe tower to lower hemisphere: NDT from inside, 360° or as near as possible Circumferential welds (zone 1 to zone 4L): NDT from inside, 360° - Circumferential welds (zone 4U to zone 7): NDT from inside, 360° - Circumferential welds (equator to upper/lower hemisphere): NDT from inside, port and starboard forward quadrants as allowed by gantry access. (Or 360°) - Meridional welds: NDT from inside Circumferential welds (equator to skirt) NDT from outside over a length about 10° around three positions 0°, 90° and 270° (0° = forward), according to removal of insulation.	
6	Pump tower	Visual inspection	- Visual examination of welds, piping, cables, ladders, hatches and double fastening devices. - Examination of expansion arrangements, shoes or diaphragm plates for wear or deformation and cracking. - Examination of spray rails from the upper gallery.	Rating 1: as new connections in place no wear, deformation or cracking of expansion arrangements. Rating 2: tower used regularly for tank access, connections in place and effective but obviously used and worn. Rating 3: tower fittings and locking devices should be replaced, risk of them failing and broken parts ending up in the tank. Rating 4: locking devices poor or not fitted, wear on sliding shoes and or deformation of diaphragm plates.

No.	Element	Component / characteristic	Inspection	Criterion
7	Cargo tank skirt	Structural transition joint	- Visual examination to ensure no de-lamination or corrosion. - NDT over a length about 10° around four positions 0°, 90°, 180° and 270° (0° = forward).	
		Skirt	- Aluminium part, visual and DP checks on welds of stiffeners top skirt, particularly at their upper end, and the continuing bracket just below the equator. - Lengths about 10° around three positions 0°, 90° and 270° (0° = forward) according to removal of insulation. - Steel part visual examination and thickness measurement.	

4 Hull fittings - Deck fire fighting systems

4.1 General

4.1.1 The items detailed within this section are in addition to those identified within Sec 2 and Sec 3.

In general, it is not required to request that the units/ systems are to be dismantled for the CAP survey unless:

- it is due to be opened up for overhaul for Class, or in accordance with the vessel's PMS, or
- the functional test demonstrates that the equipment is not working correctly.

Readings taken during the last dismantling should be examined in conjunction with the results of the operational tests. However, for some of the equipment, dismantling has been specifically requested or specific tests should be performed e.g. vibration measurement.

4.2 Rating criteria

4.2.1 The rating criteria are to be used in conjunction with operational testing and NDT results such as vibration measurements. See Sec 1, Tab 4.

4.3 Dry powder units

4.3.1 The vessels may have large central dry powder systems, smaller individual deck systems or a combination of the two. The systems work on exactly the same principle as large dry powder extinguishers with a pressure vessel containing the powder and driving nitrogen cylinders.

The central units will also have, at the dry powder stations, an activation cylinder. Nitrogen cylinders should be examined for corrosion and the weight checked. The powder cylinders should be examined for corrosion externally and if the powder is removed internally also. Safety valves should be checked and relief settings proven. High pressure flexible hoses should be examined and a pressure test carried out if in doubt. The powder should be examined for caking and a sample should be taken and a test made to ensure that the correct powder is used and the moisture content is satisfactory. The deck powder piping should be examined for corrosion as should the activation piping. The hose boxes should be examined for condition. The hoses should be flaked out and examined for cracking and other damage. The guns should be checked for freedom of operation.

The individual units should be examined and tested in the same way. A representative functional test of at least one unit should be carried out.

4.4 Deluge system

4.4.1 The deluge system will consist of one or more deluge pumps and the necessary pipework and spray nozzles for the bridge front, deck houses, domes and the cargo valves. The system may be zoned with a manifold and control valves, manual or remote controlled. The pumps should be examined and the performance checked if dismantling then clearances should be taken and adjusted as necessary. The piping system in the engine room and on deck should be checked for corrosion; a hydro test should be considered if there is doubt about the integrity. Clamping sliding feet joints and welds should be examined. The nozzles should be examined and a functional test carried out to ensure none are blocked with shell or other debris. The nozzles should be checked for proper positioning.

5 Steam turbine and gear box systems

5.1 General

5.1.1 The CAP survey for the machinery should be conducted when the plant is in operation, both before and after the maintenance stop and when the plant is shut down for access to the boilers, turbines and ancillary machinery. The surveys conducted prior to the maintenance stop are to determine which machinery is to be opened up for Survey- taking into account Class survey requirements and the Vessel's Planned Maintenance System. The surveys after the maintenance stop are operational tests of the machinery and to verify the settings of alarms and safety devices such as the boiler safety valves.

In general it is not required that machinery is dismantled for the CAP survey unless it is due to be opened up, for Class / Owners requirements, or the functional test demonstrates that the equipment is not working correctly.

Readings taken during the last dismantling should be examined in conjunction with the results of the operational tests. Similarly, the log books should be reviewed at the start of the CAP survey to determine the overall condition of the plant, reports of excessive vibration etc. However, for some specific equipment dismantling and/or additional testing has been specifically requested.

5.2 Machinery general rating criteria

5.2.1 The rating criteria are to be used in conjunction with operational testing and the results of non destructive tests such as vibration measurements. See Sec 3, Tab 4 for reference.

Specific rating criteria for various individual items of machinery, heat exchangers and fittings are also specified within this document.

5.3 Vibration measurements

5.3.1 Please refer to Sec 3, [7.3].

5.4 Turbines

5.4.1 It is not necessary to open a turbine for a CAP survey. Alternatively, if opening up has been foreseen, advantage should be taken to examine the rotor, stator, bearings and the coupling etc. and to assign the ratings accordingly.

Where the casing is not lifted, a file review is to be conducted that would include the readings recorded when last it was opened, review of the lub oil analyses as well as the operating conditions of the turbines.

Turbine bearings need not be opened for survey unless they are required to be opened for Class. However, where these are opened up the bearing clearances and the fore and aft thrust clearances should be measured. The rating is based on the bearing wear, the fore and aft movement and the condition of the collar, journals, pads and bearings.

In addition, sea trials should be conducted to observe the turbines under operational conditions. These trials should be done preferably at the time the vibration measurements are being conducted.

Trips, alarms and safety devices to be tested.

Rating criteria - Refer to Tab 4 and Tab 5.

Table 4 : Turbines - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- This is assigned where the casings are lifted and overhaul conducted and the items placed in an as new condition. - Remaining tolerances are between 75 - 100%. - A rating 1 cannot be assigned unless the casings have been opened.	- This is assigned where the casings are not lifted, but the item is well maintained and free from obvious defects with the insulation in satisfactory condition and no evidence of leakage. - Or, where the casing is lifted and there is evidence of wear but it is well within the prescribed tolerances. - The remaining tolerance is between 75-25%.	- This is assigned where the casing is not lifted but the item is showing signs that maintenance will soon be required and that the insulation will need repair. - Or, where the casing has been lifted and the wear found within the prescribed tolerances. - The remaining tolerance is between 25 - 0%.	- This is assigned where the casing is not lifted but the item is beyond tolerance and outside class limits. - Or, where the casing has been lifted and the wear found outside the prescribed tolerance.

Table 5 : Bearings - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Clearances are 25% of the defined tolerances. - No grooving or surface damage to the bearing, journals, collar or pads. - White metal free from damage or inclusions.	- Clearances are between 25 -75% of the defined tolerances. - Slight grooving of the surface of the journals and collar, no attention required. - White metal free from damage or inclusions.	- Clearances are between 75 - 100% of defined tolerances. - Slight grooving on the journals and/or collar requiring polishing. - White metal scratched and grooved particularly on the trailing edge of the ahead pads.	- Clearances are outside tolerances. - Grooving of the journals and bearing requires machining. - White metal in poor condition requiring re-metalling.

5.5 Vacuum pumps and air ejectors

5.5.1 The Vacuum pumps and air ejectors need not be opened provided they are capable of drawing the required vacuum taking into account the sea temperature. Review of the ER log should be made to see the extent of the vacuum achieved and the rating defined accordingly.

5.6 Deck spray and drenching system

5.6.1 The pumps and associated pipe lines are to be functionally tested. It is not necessary to dismantle them unless the results of the functional test are not acceptable. The survey scope and rating to be applied is the same as that for pumps and pipe lines respectively.

6 Boilers

6.1 Safety

6.1.1 It is to be reminded that boilers may be considered as confined spaces and that entry should only be made under controlled conditions. In addition, if other boilers are 'on line' boiler entry should never be made until the CAP Surveyor has satisfied himself of the arrangements for isolation.

6.2 General

6.2.1 Water tube boilers are high pressure, high temperature boilers (superheat pressure and temperature normally around 62 bars, 515°C with a steam drum pressure around 78 bars) producing large quantities of superheated steam for main turbines, auxiliary machinery such as turbo alternators, cargo pumps, feed pumps etc. Whereas the tank boiler most frequently seen is a low pressure boiler producing saturated steam around 6 bars.

In general, the boilers are to be reported on separately. Similarly, where there is more than one water drum or header, these are to be reported on separately using the formats below.

The survey should be supported by non destructive testing as necessary. In addition, a boroscopic internal survey of a selection of the various types of tube is to be conducted based on the examination of the tube ends made during the survey of the headers and drums.

In principle, as this is a heated, high temperature pressure vessel, the lowest grade that can be accepted for the drums and headers is grade 3, i.e., minor deficiencies not requiring repair.

Weld repairs can only be done under controlled conditions by approved welders using approved procedures and materials.

The CAP survey for water tube boilers may be broadly divided into two parts:

- Document review,
- Survey.

6.3 Document review

6.3.1 The following documents should be reviewed:

- Engine room log book
- Water treatment log book
- Evaporator log book
- Maintenance records for:
  - Boilers and ancillary machinery
  - Evaporators.

6.4 Survey

6.4.1 Boiler room

General examination of the boiler room in connection with the points listed with particular attention to boundaries of fuel tanks.

General criteria to be applied: see Sec 1, Tab 4.

6.4.2 Boiler external

This comprises a general examination of the boiler casings for damage and gas leakages. Verification of the tightness of the foundation bolts, the arrangements for expansion and the anti-rolling struts and supports are in order. The furnace sight glasses and smoke detectors should be inspected.

General criteria to be applied: see Sec 1, Tab 4.

6.4.3 Steam drum

The steam drum should be examined externally and internally. If necessary, internal fittings should be removed to facilitate the survey of the inside of the drum plating. Particular attention should be paid to the feed pipe end spray arrangement as these can become severely eroded.

Particular attention should be paid to the areas between tubes for evidence of pitting and cracking, if considered necessary for NDT examination to be conducted. Cracking is assessed with a CAP rating 4, slight pitting is evaluated with a CAP rating 3. The drum longitudinal and circumferential welds should be examined for cracking.

The inside of the boiler, including fittings, should be coated with a thin layer of black scale and/or slight dusting of black or dark brown powder material (i.e. FE_{O3} or Magnetite) This is a reliable indication that the water treatment of the boiler water is correctly being applied. The presence of a magnetite layer also indicates that no active corrosion of the area in view is occurring.

If corrosion or salts scale is present internally and/ or there are corrosion deposits externally these are to be removed to enable an accurate survey of the drum to be conducted. Scale build up inside the drum will indicate a problem with the boiler water treatment and could be detrimental to the operation of the boiler; this will also require increased scope in the examination of the tubes.

Access doors, studs and strong back should be examined for corrosion, wastage and distortion. The drum ends, in way of the flanged end for the door, should be examined for wastage and cracking. Similarly the joint faces should be inspected for wastage and erosion/grooving due to steam leakage.

Openings to the various boiler mountings should be examined and verified clear of obstruction or scale build up.

Rating criteria - Refer to Tab 6.

The boiler cannot be assigned a rating higher than the one assigned to this item.

Table 6 : Steam drum - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- No maintenance or repair required. - No pitting or corrosion.	- Minor deficiencies to internal fittings not requiring repair. - No pitting or corrosion.	- Minor deficiencies to internal fittings not requiring repair. - Slight pitting or corrosion within Class requirements.	- In principle, rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.4 Tubes and tube ends, including down comer tubes and ends

Tube ends should be inspected internally for corrosion and pitting. This examination is used to select those tubes to be submitted for boroscopic examination for assessment of the internal condition of the tube. Particular attention should be paid on the side closest to the furnace.

Scale build up will lead to the overheating of the tube and its eventual failure if de- scaling is not performed. It will indicate poor boiler feed water treatment.

Poor feed water treatment can lead to pitting due to the presence of oxygen. Where screen tubes have been subject to excessive heat due to poor combustion circumferential cracking can occur. This can be exacerbated through rapid thermal cycling.

Negligible scale is to be present and only slight surface pitting should be evaluated with a rating 3.

Where repairs are conducted the grading should be brought back to rating 2 or better.

Where tubes are renewed the rating of the tubes is based on the overall condition of the remaining tubes of that bank.

Rating criteria - Refer to Tab 7.

Table 7 : Tubes - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- No scale or pitting observed.	- Slight hard scale and/or surface pitting on less than 10% of the internal surface.	- Scale build up or pitting deeper than 5% of the tube thickness over less than 25% of the internal surface.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of class requirements.

6.4.5 Water drum(s)

The water drum(s) should be examined internally and externally, generally in the same manner as the steam drum. Particular attention should be paid to the area between the tubes for cracking, internally and externally. The drum longitudinal and circumferential welds should be examined for cracking. Depending on the size it may not be possible to access the drum therefore mirrors and other visual aids may also be used to assist this inspection.

If considered necessary, NDT examination should be conducted. Cracking is assessed with a CAP rating 4 and slight pitting is evaluated with a CAP rating 3.

Access doors, studs and strong back should be examined for wastage, corrosion and distortion. The drum ends, in way of the flanged end for the door, should be examined for wastage and cracking. Similarly the joint faces should be inspected for wastage and erosion/grooving due to steam leakage.

Sludge build up inside the drum(s) will indicate a problem with the boiler water treatment and/or the blow down regime and could be detrimental to the operation of the boiler.

The boiler cannot be assigned a rating higher than the one assigned to this item.

Rating criteria - Refer to Tab 8.

Table 8 : Water drum(s) - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- No maintenance or repair required. - No pitting or corrosion present.	- No maintenance or repair required. - Slight pitting or corrosion present, not requiring action.	- Slight pitting and corrosion within Class requirements.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.6 Headers

Headers should be inspected internally and externally.

The external examination is to examine the surface for corrosion and cracking between the tubes. Due to the headers' size the internal examination will usually be undertaken from external therefore a sufficient number of hand-hole doors should be removed to allow for adequate internal examination of the header, tube ends and the areas between the tubes, mirrors and other visual aids may also be used to assist this inspection. As with the drums the tube ends should be sighted and tube selected for boroscopic inspection.

Negligible scale is to be present and only slight surface pitting should be evaluated with a rating 3.

Door faces and their corresponding faces in the headers should be examined for distortion and damage due to steam leakage. Internal division plates where fitted should be examined.

The boiler cannot be assigned a rating higher than the one assigned to this item.

Rating criteria - Refers to Tab 8.

6.4.7 Furnace

The furnaces will usually be of mono-wall construction. Poor flame control can lead to flame impingement and tube damage and, when in conjunction with poor boiler water control, can cause tubes to distort and even rupture. The tubes should be externally examined for distortion, bulging, burning and corrosion.

Floor, wall, roof and screen tubes should be examined.

The 'hot' gas passages through the screen tubes to the uptakes should be examined and should be free from carbon deposits and slag build up. No 'bridging' of the spaces between the screen tubes should be evident.

The refractory material in the way of the drums and headers should be examined. If this is in poor condition, damage to the drums could occur.

When repairs are conducted this should bring the grading up to a rating 2 or better.

Rating criteria - Refer to Tab 9.

Table 9 : Furnace - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Superficial defects, no maintenance or repair required.	- Minor defects, slight maintenance to the brickwork.	- Defects that do not require immediate attention.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.8 Superheater tubes

The superheater tube ends should be sighted at the time the header is inspected. As with other tube banks a selection of tubes should be made for boroscopic internal inspection. This is particularly important for these tubes as boiler water 'carry over' could have a detrimental effect on them.

Slight distortion of the superheater tube nest is not uncommon with the boiler in the cold condition however the external appearance of the tubes should be examined for bowing and/or distortion and for indications of local overheating. The superheater support plates and tubes should be examined for distortion, cracking and/ or burning; damage to these could lead to distortion or bowing of the superheater tubes. No 'bridging' of the spaces between the tubes should be evident.

Rating criteria - Refer to Tab 10.

Table 10 : Superheater tubes - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- No bowing or surface defects to the tubes and internally free from pitting and deposit is. - Support plates free from damage.	- Slight bowing of tubes with no surface defects or internal deposits or pitting. - Support plates slightly burnt.	- Bowing of tubes within manufacturer's limits. - Slight surface defects and indications of internal pitting and deposits. - Support plates burnt but within manufacturer's limits.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.9 Economiser

Economiser tube banks consist of a series of finned tubes. The fins are fitted for better heat transfer but these tend to cause soot to build up that can lead to high corrosion and a loss of efficiency. The outside of the tubes should be examined for localised pitting. Internally the tube ends are inspected as with other tube bundles. A selection is to be made for boroscopic internal inspection. The elbow connections should be thickness checked at random, approximately 10%.

Rating criteria - Refer to Tab 11.

6.4.10 Steam air heater

The combustion air is preheated using steam tubes. As with other tube bundles the tubes should be inspected internally and externally. Internally, the tube ends are inspected via the headers with boroscopic examination of a selection of tubes. Externally, they are inspected along their length for bowing and corrosion.

Rating criteria - Refer to Tab 11

Table 11 : Economiser - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Tubes and fins free from carbon deposits. - No pitting or corrosion internally or externally.	- Tubes and fins with slight carbon deposits. - Slight pitting and corrosion externally. - No pitting or corrosion internally.	- Tubes and fins with carbon deposits. - Pitting and corrosion present internally and externally but within manufacturer's limits.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.11 Soot blowers

These are steam lances that are extended into the tube banks of the boiler. Using steam they blast off loose carbon deposits on the tubes and avoid scale build up externally.

These are automatically operated using a programme control system which should be inspected for correct sequential operation. The soot blowers should be checked for ease of operation, condition of the nozzle and for distortion.

If the soot blowers are not working, the CAP Surveyor will find carbon build up on the tubes. This carbon build up can be dangerous and lead to up-take fires that, in turn, can lead to a melt down of the boiler tube stacks when the fire temperature is extremely high; uncontrollable hydrogen fires can result due to this. It is of the utmost importance that soot blowers are working correctly.

Rating criteria - Refer to Tab 12.

Table 12 : Soot blowers - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Soot Blowers and nozzle free from defects and able to be easily operated. - Automatic sequential operation is working.	- Some Soot Blowers showing minor nozzle erosion. Operation a little stiff for some blowers. - Automatic sequential operation is working.	- Significant nozzle erosion to most blowers. Stiff to operate but still extend. - Automatic sequential operation is working.	- Heavy nozzle erosion. Difficult to operate, some soot blowers do not completely extend. - Automatic sequential operation is problematical.

6.4.12 Safety valves

The safety valves are very important to the safety of the boiler and operating personnel, as such their condition is of prime importance. The valves should be dismantled for inspection. Where pilot valves are fitted, these should be dismantled and inspected.

Where the valves are overhauled by the manufacturer or recognized workshop the scope of the survey may be reduced. Valves should be dismantled for inspection. The valve and the seat should be inspected for signs of wear and wire drawing. High pressure steam leakage can cause very high erosion of the valve and seat. The profile of the valve and seat are critical to the operation of the valve, not just to its opening but also the closing. Consequently, the valve and seat should be checked against the manufacturer's tolerances.

In addition, the spindles, springs and castings should be checked. The drain arrangement should be checked to ensure that it is not blocked as this could allow water to build up in the waste pipe and affect the valve setting. On completion, when steam is raised, the valves are to be floated in the presence of the Class Surveyor and checked against the required setting pressures.

The hand easing gear should be checked and verified that it is free to operate the valve in the event of an emergency.

On completion of the floating of the safety valves, the settings are locked.

Rating criteria - Refer to Tab 13.

Table 13 : Safety valves - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Valves and seats within 25% of manufacturer's original tolerance, no machining required, valves and seats require only lapping.	- Valves and seats required machining now between 25% and 75% of the manufacturer's original tolerance.	- Valves and seats required machining, now between 75% and 100% of the manufacturer's original tolerances.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.13 Gauge glasses

Gauge glasses should be opened for inspection. Gauge glass shut off valves, cocks and drain valves should be checked to ensure that they are tight and that the spindles have not been twisted. The glass and castings should be checked for damage.

The boiler nozzles should be checked to ensure that there is no reduction in diameter of the bore due to scale or other obstructions.

On assembly the operation of the gauge glass cocks should be checked. In addition, the level in the gauge glass should be compared to that of the remote indicators to ensure that they are indicating the same level of water in the boiler.

The gauge glass lighting should be checked on assembly to ensure that it is working.

Any deterioration affecting its functionality should be reflected in the assessment and rating assigned.

Rating criteria - Refer to Tab 14.

Table 14 : Gauge glasses - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- No leakages or defects present, cocks and valves are easy to operate, without leaking.	- No leakages or defects present, cocks and valves are stiff to operate, without leaking.	- Not Applicable.	- Defects or leakages are identified, cocks and valves are stiff to operate with leaking.

6.4.14 Boiler water level control

There are several different types of control in service. The boiler water level control should be examined in operation and inspected for defects and abnormal wear. If necessary the sensors and valves should be opened for examination.

General criteria to be applied - Refer to Sec 1, Tab 4.

6.4.15 Main & auxiliary stop valves and other stop valves

Valves should be opened up for inspection. A selection should be removed from the drum to verify the condition of the holding down studs.

The scum and blow down valves should be checked to ensure that there is no blockage in the valves or in the overboard piping.

Rating criteria - Refer to Tab 15.

Table 15 : Main & auxiliary stop valves and other stop valves - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Valves are tight, free from gland leakage and easy to operate.	- Valves have slight leakage but free from gland leakage, stiff to operate.	- Valves have slight leakage and stiff to operate.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.16 Oil fuel system

It is necessary to dismantle the burner units for the CAP survey, particular attention should be paid to the registers, electrodes, nozzles and the vanes.

The piping and associated valves should be examined under pressure and the various valves manually and automatically tested. The quick closing valves and re- circulating valves should be tested as well.

The burners are usually steam assisted to improve the atomisation of the fuel and the efficiency of combustion. The steam valves and associated pipes should be inspected as well. The operation of the burners is automatic, this is to be checked, in particular, the operation of the registers and the igniters. The purging and lighting sequences should be tested.

The steam has two functions, to assist in atomisation and to cool the burner nozzle when not in use. The steam is turned on manually when the boiler is flashed up. A non return valve and drain are fitted in the steam line to prevent oil from passing back into the system. The drain is led to a drain tank with a float alarm. During the survey this tank should be checked for signs of leakage.

Various alarms, switches and shut downs are incorporated into the systems. These should be tested. In addition for 'roof fired' boilers the burner front forms a 'save all' with drains leading to the drain tank.

Rating criteria - Refer to Tab 16.

Table 16 : Oil fuel system - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Valves and pipe lines are tight, free from leakage. Valves are easy to operate. Alarms, switches and shut downs adjusted and functioning correctly. - Shields and insulation in order.	- Valves and pipe lines are tight, free from leakage. Valves are stiff to operate. Alarms, switches and shut downs functioning. - Shields and insulation in order.	- No rating 3 can be assigned as leaks, defects or mal functioning would incur a rating 4.	- In principle, a rating 4 cannot be assigned as deficiencies are outside of Class requirements.

6.4.17 Gas fuel system

A functional test of the gas burning system and the relevant change over to and from oil burning are to be performed along with a test of alarms and shut downs. This may be carried out on passage before the docking survey of the vessel.

The CAP Surveyor should visually inspect the fuel gas line running from the LNG room on deck to the engine room bulkhead for condition, special attention should be given to the seating of the pipe on the pipe supports and pipe clamps for signs of wear, corrosion and possible leakage. The nitrogen purge lines should be similarly examined. The deck main gas valve should be opened for examination to ensure the seats are in acceptable condition; similarly, the nitrogen purge valve should be examined.

The double trunk in the engine room should be examined for signs of corrosion, cracking and failure of access door seals. Similarly the gas hood and gas burner double pipes at the boilers should be examined along with expansion arrangements. Access doors should be removed for examination of the gas pipe for wear and corrosion.

The double trunk vent fans should be examined and run on test to ensure satisfactory operation, special care should be taken regarding the venting of these fans if they are located in the engine room.

Boiler gas isolation and control valves and flame arrestors should be examined and consideration should be given to opening for internal examination the individual boiler gas stop valves. Similarly the nitrogen purge valves should be examined.

The calibration of instrumentation should be made randomly to gauge the overall condition of the control systems. Alarms and shut downs must be functionally tested including the trunk vent fan failure and gas detection trips.

The burner registers should be removed from the furnace and the gas burners examined for signs of erosion, corrosion and general wear.

Rating criteria - Refer to Tab 17.

Table 17 : Gas fuel system - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- As new condition, no corrosion or damage.	- Good condition, slight corrosion, fittings acceptable and working, and functional.	- Acceptable condition fittings working, limited signs of wear and break down, some standby items not functional.	- Heavy corrosion, signs of cracking, items missing, gas detected in double trunk, failure of safety and control systems.

6.4.18 Boiler automation, combustion control, alarms and safety systems

Rating criteria and verification scope - Refer to Sec 3, [9.31] and Sec 3, Tab 30.

6.5 De-aerator

6.5.1 The de-aerator should be opened for internal examination of the shell and nozzles.

Rating criteria - Refer to Tab 18.

Table 18 : De-aerator - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Shell external and internal free from corrosion and pitting. - Spray nozzles intact and showing no evidence of erosion.	- Shell external and internal showing slight corrosion and pitting with less than 75% of the corrosion allowance. - Spray nozzles intact but with erosion not affecting the operation.	- Shell external and internal showing corrosion over 75% of the corrosion allowance but less than 100%. - Spray nozzles intact with erosion affecting seriously the operation.	- Shell external and internal showing corrosion over 100% of the corrosion allowance. - Spray nozzles missing or eroded seriously affecting the operation.

7 Cargo handling system

7.1 General

7.1.1 In general it is not required to dismantle the cargo handling system for the CAP survey unless:

- It is due to be opened up for overhaul for Class or in accordance with the vessel's planned maintenance system, or
- The functional test demonstrates that the equipment is not working correctly.

Readings taken during the last dismantling should be examined in conjunction with the results of the operational tests. Similarly, the log books should be reviewed at the start of the CAP survey to determine the overall condition of the plant, reports of excessive vibration etc. For some of the equipment dismantling has been specifically requested or specific tests are to be performed such as vibration measurement.

7.1.2 Rating criteria

General criteria to be applied, see Sec 3, [5.2.1] for reference, except where specific rating criteria is given for individual items. The criteria should be used in conjunction with operational testing and the results of non-destructive tests such as vibration measurements.

7.1.3 LNG room / Motor room

Depending on the machinery configuration, the installation may consist solely of an LNG compressor room when the plant is steam-driven. Alternatively, an electric motor room may also be provided, with the drive shaft passing through the separating bulkhead. In some older installations, the machinery may be located directly on the open deck. Where rooms are fitted, the structural condition should be examined for corrosion, damage, and safety of walkways, railings, ladders and stairs. Particularly the roof should be checked where often ventilation machinery is fitted and where water can collect causing wastage where people may walk. The airlocks serving the motor rooms should be tested to verify their proper operation, ensuring that all associated alarms, safety interlocks, and shutdown systems function as intended. The ventilation system should be examined for signs of corrosion or damage to the trunks. In addition, any interlocks fitted to prevent the operation of electrical equipment unless adequate ventilation is established should be demonstrated to be operational. Electrical equipment installed within gas-hazardous areas should be examined to verify its integrity, including lighting fixtures.

7.1.4 Cargo compressor

Cargo compressors may be of different types.

These machines should be visually examined for condition and obvious defects and a running test should be made to ensure that associated equipment such as suction mist separators and stand by lube oil pumps are functional. Records of lube oil testing should be reviewed. Control gear should be examined and tested as far as possible, especially the isolation valves, non-return valves, nitrogen sealing and surge control on radial compressors. When fitted, the electric motors should be examined and megger tested, results of regular vibration monitoring would be useful. Bulkhead seals should be examined for proper functioning. Alarms and shut downs should be tested and found working. For gas burning the compressors should be functionally tested and the operation of the controls, alarms and shut downs confirmed.

7.1.5 Cargo heat exchanger, if fitted

The cargo heat exchanger should be assessed with particular attention to its condition, operational performance and ability to maintain the required cargo temperature and pressure conditions. The CAP Surveyor should verify the exchanger body, shell and tube assemblies or plate elements, the supporting structure, connected pipings, valves, expansion arrangements and instrumentation and associated control systems. Particular attention should be paid to signs of external corrosion, leakage, insulation, deterioration or deformation affecting the integrity and efficiency of the equipment. The satisfactory operation of the associated monitoring control, alarm and automatic shutdown systems should be verified, where practicable and under safe operating conditions.

7.1.6 Gas Combusition Unit (GCU) , if fitted

The CAP Surveyor should verify the availability and condition of the combustion unit including alarms/ indications and the interface with the gas handling system. Evidence of the latest functional test should be reviewed and any open recommendations should be recorded in the report.

7.1.7 Vaporisers, cargo and fuel gas heaters

The units should be visually examined for general condition and obvious defects. Flanges, joints, and welded connections should be checked for corrosion and signs of leakage. The condition of the insulation should be assessed. Relief valves should be examined as well as the drain away arrangements, especially for cargo liquid. The unit should be functionally tested if possible. The temperature controls should be examined and functionally tested, alarms and shut downs should be tested and resulting actions confirmed. Electrical bonding arrangements should be confirmed.

7.1.8 Steam and drains piping in the cargo area

The piping should be visually externally examined for the presence of corrosion and wastage in particular the drains piping should be tight. Joints, valves, welds and insulation should be assessed.

The gas detector fitted in the drain return line to the machinery spaces should be assessed for condition and proven functional.The alarm and subsequent shut downs should be tested and found operational.

The grading assigned to the cargo vaporizing system can not exceed that of the drain gas detection arrangements.

7.1.9 Cargo pumps/ spray pumps/ emergency cargo pumps

The function of cargo pumps should be checked during a discharge whereby the running may be monitored. The starting arrangements should be checked soft or otherwise, the running current checked, vibration assessed, alarms and shut downs tested. During tank entry the pumps and associated equipment should be visually examined. If the pumps are open for survey or for repair/bearing renewal then the internals should be examined and assessed. Bear in mind that most cargo pumps will have very low running hours compared with other ship machinery. Megger test readings should be taken in both the cold condition and warm gas free state.

7.1.10 Emergency Shut Down (ESD) / Emergency Release System (ERS)

The CAP Surveyor should verify that functional tests (test/ simulation/ documented trial) demonstrate correct operation and proper interface with the ESD sequence. The demonstrations or test results should attest that the systems are operating in safe condition.To be considered for CAP assessment, certificates or test results should be dated within six months prior to the CAP survey start date. Certificates or test results older than six months should not be considered as valid evidence.

7.1.11 Cargo Switchboards/ distribution boards

The switchboards may be in separate switchboard rooms or they may be distribution boards in the engine control room. They should be examined taking into consideration the guidelines in the main electrical part of the CAP.

The paneling should be visually examined to verify its condition and security. The tightness and security of busbar connections should be checked. The condition of starters, starter panels, and isolating circuit breakers should also be assessed, together with the condition of the instrumentation. The alarms and shutdown functions, particularly the emergency isolation arrangements, should be functionally tested. An insulation resistance (Megger) test should be carried out at the switchboard, and thermal imaging records of the panels and cabling should be reviewed to identify any signs of overheating or deterioration.

7.1.12 Junction boxes on deck

The junction boxes should be checked for proper location according to the hazardous area rating. Boxes should be checked for fastening and security, cable entries the condition of the explosion protection arrangements e.g. Ex.e, Ex.d, Ex.p etc. should be examined and assessed. The condition of identification plates should be assessed. Cable glands should be checked for tightness and the condition of the cables at the glands assessed.

7.1.13 Electrical cables on deck

There will be many types of cables on deck from power supply for compressors and cargo pumps to intrinsic control and instrumentation cabling. These should be assessed for general conditions.

The cable trays should be examined for condition and for security, corrosion of the main tray itself, water drainage arrangements, condition of clamps, loose old cables, condition and security of new cable runs.

7.1.14 Cargo monitoring and control systems

The visual condition of transmitters, cables, sounders, light signals and cabling should be assessed. Control systems and circuits should be functionally tested wherever possible, the records of regular testing, maintenance and repair may be taken into consideration. Particular attention should be paid to local isolated control loops. A functional test of the emergency shut downs should be carried out. Random calibration test of transmitter pressure / temperature should be carried out and a functional test of the alarms. The general condition of the control spaces should be examined.

A review of the log files of the cargo monitoring and control systems should also be reviewed and assessed by the CAP Surveyor in the case an alternative survey scheme is carried out.

7.1.15 Safety systems

A visual examination should be made of the safety valves, liquid and vapour. Special attention should be paid to the escape and drain arrangements. The liquid drain chamber level alarm should be functionally tested. Where valves are operated by pilots, the pilots and the connection piping should be especially checked. A random test of bursting discs in a workshop can be considered. Relief valves should be bench tested for lift pressure in a specialised workshop. The vent masts should be examined.

The foundations should be examined for corrosion and structural integrity. Ladders should be inspected to ensure they are securely fitted and that safety hoops are correctly. The condition of the flame screen should be visually examined and assessed. Fire-extinguishing arrangements should also be inspected and, where practicable, functionally tested to verify their proper operation.

7.1.16 Cargo piping and accessories

The cargo liquid and vapour pipes should be examined visually for general condition. The condition of joints, welds, supports, sliding feet, clamps, electrical bonding, and insulation is to be assessed. Bellows and expansion arrangements should be examined for corrosion cracking and wear. The condition and correct position of liquid line drip trays should be examined. The condition of cargo pipe accessories, flexible hoses, blanks, reducers etc is should examined, pressure test to be considered and storage conditions assessed.

Consideration should be given to the removal of selected insulation to check for pitting, especially on the stainless steel pipes.

7.1.17 Cargo valves and actuation systems

The cargo valves both manual and remotely operated should be examined and functionally tested, the general condition of the valve body and actuator should be assessed. The valve indicators both local and remote should be tested for proper operation. Indication of valve leakage such as additional frosting of a pipe beyond the valve should be investigated and workshop repair followed by tightness test considered.

In the case of power operated valves the connection for hydraulic oil and or compressed air should be checked for leakage. The condition of the main valve hydraulic or air pipes on deck should be checked for leakage.

The condition of the valve power system supply should be checked, hydraulic aggregate unit, or cargo compressed air system, auxiliary systems such as stand by pumps, dryers etc shouldl be examined and tested. The alarms and shut down systems should be tested for correct operation. The condition of the hydraulic oil should be tested and records of such tests reviewed. For compressed air systems, the air dew point should be tested at the furthest point of the distribution system

An ESD test should be carried out and the timing of the closing of the valves checked.

7.1.18 Cargo tank spray system

During entry, the spray rails should be examined as far as possible for damage, missing clamps or perhaps missing nozzles. A review of the cool down records should be made, if these are available.

7.1.19 Membrane evacuation system

A visual examination of the pumps for general condition should be made. The piping system should be checked for corrosion and potential leaks. Special attention shall be paid to the pump exhaust and flame arrestors. An examination and functional test of the control systems, alarms and shut downs should be made.

7.1.20 Cofferdam heating system

The heating system may consist of steam heating coils on older vessels or warm glycol circulation on more modern ships.

A general examination of the heating coils in the heated spaces should be made for signs of leakage, corrosion, damaged or missing supports and clamps. A hydraulic test of the pipes should be considered if in doubt as to the integrity. Isolation valves should be examined and steam traps checked. Gas detection on the steam drain lines should be checked and functionally tested. Alarms and shutdowns should be proven operational.

Glycol circulating pumps should be examined and functionally tested. Alarms and shut downs should be tested and proven operational, motors should be megger tested. Glycol heaters should be examined and megger tested, if electric. If these are steam then the drains gas alarm shall be proven operational along with associated shut downs.

A functional test of the system should be made.

7.1.21 Nitrogen system

The nitrogen system can be considered in different parts, production and storage, systems on deck for membrane/ wedge spaces, gland sealing and fire extinguishing, and in the gas burning system for purging and inerting.

The production units should be visually examined externally for general condition, compressors, stacks, piping, monitoring equipment and storage tanks. A functional and capacity test should be carried out to show proper operation, special attention should be paid to the oxygen content of the gas produced. The storage tanks should be internally examined and the relief valves tested. Alarms and shut downs should be tested and proven operational.

The deck supply piping should be visually examined externally for corrosion and a sample of nitrogen taken from the farthest point in the system to confirm the oxygen content, the electrical bonding should also be checked.

The barrier space/ wedge space pressure control system and valves for the tanks should be visually examined for general condition and leakage and should be functionally tested to prove correct operation. Alarms should be functionally tested and shut downs proven operational. The sealing supply system should be examined and functionally tested. The alarms and shut downs should be proven operational.

The purge piping and valves for the gas burning system should be examined for general condition. A functional test should be carried out to show correct operation. The alarms and gas burning shut downs due to low nitrogen pressure should be tested and found operational.

7.1.22 Inert gas system

The inert gas system, if fitted, should be visually examined for general condition of the generation plant, the cooling plant, the drying plant, and the pipework and fittings, both in the machinery spaces and on deck. The system should be functionally tested to ensure correct leak free operation and the ability to provide dry inert gas of low oxygen content and dry air to the deck. The safety systems and control systems should be tested and proven functional, the alarms and shut downs should be tested and proven operational.

The condition of the furnace, fuel system, controls and water supply should be checked, the condition of the cooler, refrigerant compressor condenser and normal refrigerant trips and alarms should be examined and functionally tested. The condition of the desiccant dryer should be assessed along with its ability to regenerate on the heating cycle. The final dew point should be measured at the end of the working cycle before change over to ensure that it is still satisfactory. The oxygen content monitor and alarm setting should be examined, spanned and tested for proper operation and response to the alarm. The recirculation to the funnel at high oxygen content should be tested and proven operational. The inert piping and valves but especially those in the machinery spaces should be checked for condition corrosion and leakage. The non-return valves on deck should be tested for operation. Valves in the inert gas and dry air lines to void spaces should be checked for freedom of movement and proper operation.

7.1.23 Gas detection system

There may be a central gas detection system, individual gas detector heads or both.

The system should be visually inspected for general condition and the availability of spare parts. The individual gas detector heads should be spanned and calibrated. The central detector should be spanned and calibrated and the alarms and shut downs proven operational. The results of the alarms on the cargo system should be checked to see if they are correct and that the right sequence operates. For the central system, the lines should be proven clear and leak free and the no flow alarms should be proven operational. Records of calibration and maintenance should be reviewed.

7.1.24 Custody transfer system

A visual examination of the system including the gauging system should be made. A functional test of the alarms such as high and low levels should be made. Operational testing should be carried out by the makers representatives.

Section 5 Specific Assessment for OSVs

1 General

1.1 Scope

1.1.1 This Section defines the CAP Methodology specific to Offshore Support Vessels (OSVs) and must be read in conjunction with Sec 1, Sec 2, and Sec 3.

1.1.2 The Owner's representative defines the areas to be assessed, taking into consideration the type of vessel and specific requirements. However, the hull is to be assessed as a minimum requirement for the Condition Assessment.

1.1.3 Complementary studies may be undertaken to support targeting and acceptance criteria; this would include the fatigue analysis of the hull which should be clearly defined in the contract. Where the fatigue analysis may highlight potential 'hot spot' areas, then sufficient time should normally be allowed for the analysis to be completed before boarding so the survey plan can include close-up examinations and thickness measurements at those locations.

Note 1: Some charterers may reject a CAP report for which the SFA has been carried out following the start of the CAP survey. Therefore, we strongly recommend the Owner to discuss the SFA scope expectation and provide all documents to the BV Office in charge of the analysis.

1.1.4 Requirements from this Sec 5 should be applied independently from Class and statutory regimes. Where an energy majors, a wind-farm operator or any owner requires additional criteria, there are to be stated in the contract and should govern if they are more demanding than the requirement in this Section.

1.2 Application

1.2.1 This Section is intended primarily for OSVs of 15 years and above, or for any OSV where the Owner requests a CAP.

Offshore support vessels are defined as any ship intended for offshore operation as defined in NR467, Pt A, Ch 1, Sec 2, [4.12] or NR467, Pt A, Ch 1, Sec 2 [4.15.4].

These multi-mission vessels are ranging from a diverse type of vessels which are well listed in the Tab 1.

At the outset of each CAP job, the survey plan is to explicitly state the applicable categories and the main fitted features, such as towing/ anchor arrangements, fire-fighting systems, DP, lifting and ROV/ LARS equipment, offloading gear or dry-bulk installations, since these will determine the specific items covered later in this Section.

1.2.2 Unlike tankers, many OSVs do not carry petroleum cargo in large integral cargo tanks, they primarily transport service fluids such as mud, brine freshwater or sometimes methanol on PSVs. They are also fitted with deck cargo on extensive open work decks. As a result, the internal arrangement often includes numerous ballast tanks and freshwater tanks, while PSVs may also be fitted with dry-bulk systems with their associated equipment and devices.

Table 1 : Type of OSVs applicable for CAP

OSV Category	Type
OSVs	- Anchor Handling Tug (AHT)/ Supply (AHTS), - Platform Supply Vessel (PSVs) including HNLS/ WELLSTIM supply variants, - Maintenance Support Vessel (MSV), - Multi-purpose Supply Vessel (MPSV)/ Construction support vessels, - Installation, Maintenance Repair Vessel (IMR), - Fast Support Intervention Vessel (FSIV), - Emergency Rapid Respond Vessel (ERRV), - Standby/ rescue vessels, - Special service vessel, - Fire Fighting Vessels (FiFi I/II/III).
Passenger Transfer Vessel	- Crew Transfer Vessels.
Specialised	- Diving Support Vessels (DSVs), - Cable / Pipe-layer support vessels, - ROV support vessels.

2 Hull

2.1 General

2.1.1 This section applies to the OSV categories listed as per Tab 1.

Based on these vessel-life experiences, it has been identified specific areas within the hull where cracking could occur and some are well known to the industry. With the increasing age, fatigue becomes another factor in the condition of the vessel.

The CAP OSV should take these factors into account in the survey requirements for the hull. Similarly, the history of defects and repairs should also be considered by the CAP Surveyor.

This may be divided into three parts:

- Critical areas map
- Structural strength and fatigue analysis, if applicable and requested by the Owner
- Surveys.

2.2 Critical areas map

2.2.1 The critical areas map is to be developed on the basis of:

- Typical defects for that design of vessel
- The history of defects of the individual vessel in service.

The survey plan should include a critical areas map that identifies AUCs for close-up examination and measurements. As a baseline for OSVs, the map should normally includes the work-deck plating and stiffening (heavy-use lanes, flush fittings, heat-affected zones around foundations); the foundations and pedestals for cranes, A-frames, davits, ROV/ LARS and winches (ring stiffeners, collars/ doublers , under-deck stools, alignment and hold-down bolt); and the stern working area, including the stern-roller if fitted, its bearings and supports, together with the manner in which loads are transmitted into the transom structure.

The map should also cover side-shell regions in the aft towing zone (dent, grooving, local reinforcement near fairleads), lashing /ISO sockets lines (padeye toes, socket deformation and backing structure), superstructure and deckhouse interfaces including helidecks support if fitted, where vibration and DP-related thrust can promote cracking, openings such as moon pools and side doors (insert transitions, scallops and cofferdam boundaries); thruster tunnel and sea chest (erosion at tunnel toes and bracket connections, anodes and sealing); cement/ mud compartments where fitted (attachment and load distribution); and deck-tank arrangements (portable tank chock, stools, manifolds, lines and other adjacent deck plating).

2.3 Fatigue analysis

2.3.1 If a 2D SFA is to be carried out, this is to be completed prior the start of the surveys such that potential fatigue 'hot spots' are closely surveyed and UT gauged as necessary. Sufficient time is to be allowed to complete the structural & fatigue analysis before boarding to inspect the list of “hot spots”, if applicable.

Note 1: To ensure the long-term structural integrity of the vessel, Bureau Veritas recommends that a SFA is carried out for vessels of 90 meters long and above, but this is a recommendation and not a requirement for the CAP-OSV.

2.4 Survey

2.4.1 General

This Section should be read together with Sec 1, Sec 2, Sec 3, which provides further details on the hull survey, Ultrasonic Thickness Measurements (UTM), the hull ratings and some items ratings from the “Propulsion and auxiliary systems” module.

The hull assessment combines general visual examination throughout the scope with close-up examinations at the AUCs identified above and wherever condition or history suggests.

Additionally, UTM are planned to capture the OSV structural patterns: on the main deck, in heavy use lanes, complemented by readings beneath each major foundation and at insert/ doubler boundaries; on the side shell in the aft towing region and in thruster tunnels; and on the transom and stern roller supports. Bulwarks and stays are checked with readings supplemented by target points at scallops and stays wherever wastage or deformation is suspected.

In the case particularities are found at foundation weld toes, knuckles around moonpools or transitions between original structure and insert, the CAP Surveyor may ask to carry out NTD.

On the equipment part: the survey should include functional demonstrations when safely practicable or certificate/ test results alongside: a no-load emergency release of the towing winch, a short run-up of fire-fighting pumps and monitors, fire-alarm test, representative lifting motions of cranes or davits, results from certificates of bench/ simulation checks of DP modes and alarms, FMEA document, and a bench test of ESD. In the case, these tests have already been done within a short window of time prior to the CAP survey, they might be approved. Therefore, the approved tests should be checked and will be included in the CAP report.

A survey plan is to be prepared before commencement of on-board work. The plan should:

- define the scope and any additional survey areas
- specify means of access, lighting, and safety arrangements
- list documentation to be reviewed as per [2.4.2].

Service life consideration is another key factor to take into consideration for OSV. The CAP OSV survey should take into account that this type of vessel could be in active service well into its twenties, i.e. the ship could be more than 20 years old. In addition, expect coating breakdown in high-traffic/ work deck zones and plan UTM accordingly to capture potential accelerated corrosion.

2.4.2 Additional documentation

Documentation review is an important part of the survey preparatory planning. Where applicable, the following documents should be submitted and reviewed by the CAP Surveyor prior to the start of the CAP Survey and referenced in the specific annexes of the CAP report.The documentation package typically includes the general arrangement and the structural drawings relevant to the AUCs such as midship, and all documents related to the ship history review. For OSV features, it should also include the:

- Towing/ anchor-handling records/ certificates such as brake rending certificates and emergency-release procedures/ logs
- DP Trials and results/ certificates, Failure Mode Effects Analysis (FMEA) report including annual/ periodic verification summary, alarm/ event log
- FiFi testing certificates and capacity/ foam record
- Fire safety documentation such as the fixed systems in cargo/work-deck areas; gas/ vapour detection specification
- Lifting/ offloading gear records/certificates (exams, load tests, maintenance),
- Electrical: hazardous-areas classification plan
- Lifting/ ROV/ LARS examinations and load-test certificates
- Offloading/ bow-loading interface and emergency-release test evidence/ certificates
- On PSVs, the dry-bulk compressor, filter and relief-valve maintenance test with loading/ discharge connection/ Certificates.

Note 1: The OSV package documentation is supplementary and specific to this type of vessel. They do not replace the main CAP documentation; they are intended to be applied in addition to the standard information required to perform the hull structure assessment preparation and the completion of the SHR.

2.4.3 Suspect areas

Suspect areas should be investigated by the CAP Surveyor to ascertain their extent. Although corrective action remains a recommendation, it is strongly advised that any suspect areas which may affects the CAP rating of a section / module, or constitue a high-risk condition be cropped out and renewed prior to completion of the CAP survey

2.4.4 Photographs

A library of photographs taken during the CAP survey is to be established. Photographs should be taken in the compartments and equipment part of the scopes. Where repairs are conducted, before and after photographs should be taken. Defective fatigue “hot spot” areas and critical areas are to be photographed as well, if no defects are found in these areas, sample photographs are to be taken. Photographs should be identified in the report.

2.4.5 Structural architecture

OSVs differ from tankers by their large open work decks, heavy localized deck loads and modular mission equipment. As a result, foundations and interfaces largely govern structural conditions.

On deck, the CAP surveyor should pay close attention to coating breakdown where cargo and gear are repeatedly landed, and to the heat-affected zones around welded foundations. At pedestals, the integrity of ring stiffener, collar and doublers, together with correct alignment and hold-down arrangements, is essential.

Around moonpools and side openings inserts, stress concentration and hard-spot behaviour at knuckles and transition demand careful close-up examination and local measurement.

In the stern working area, the stern-roller, if fitted with its bearings and supports, should be examined; free rotation should be verified and the load path into the transom assessed.

Bulwarks and feeing ports warrant particular attention for deformation, cracked bracket toes and scallops wastage that may compromise freeing capacity.

Superstructure and Deck house interfaces, including helideck supports where fitted should be checked for interfaces cracking and loose fastenings due to vibrations and DP-related thrust.

Additionally, thruster tunnels frequently show erosion at toes and around bracket connection and sea chests require similar scrutiny of sealings and anodes. In the aft towing zones, dents and grooving near fairleads are common; the acceptability of side-shell strakes is judged against thickness requirements as per Sec 2, [3.4]

Lashing/ ISO sockets lines should be verified for padeye-toe tearing or sockets deformation and for the integrity of the backing structure. Where fitted, cement/ mud compartments and deck-tank arrangements such as chocks, stools, manifolds should be examined for proper load distribution and local wastage.

The following OSV-specific structural items highlighted as per Tab 2 supplement the Sec 2 baseline and should be considered into the hull and equipment and systems assessment, as applicable to the vessel.

Table 2 : OSV Structural AUC & Inspection Focus

Structural OSV IUC	Inspection Focus	Applicability
- Forecastle - Bulkwards - Freeing port - Guide members	Deformation, bracket-toe cracking, freeing capacity; scallops/ drain wastage.	All
- Work deck plating & stiffening	Heavy-use lanes, set-in bluckling, HAZ around foundations	All
- Foundations & pedestals - Cranes - A-frames - LARS - Winches	Collars, doublers, ring stiffeners, under-deck stools, alignement/ hold down.	If fitted
- Moonpools and side openings	Knuckles/ transitions, cofferdam boundaries, scallops.	If fitted (AHTS/ Tug / Workboats)
- Stern working area - Stern roller	Bearings, supports, load path into transom.	If fitted
- Superstructure - Deckhouse interface/ Helideck if applicable	Interface cracking, vibration/ DP thrust effects, loose fasteners.	If fitted
- Side Shell in aft towing zone	Dent/ grooving near faileads/ gittings. Reinforced strakes.	Where towing gear fitted
- Lashing/ ISO sockets Lines	Padeyed-toe tearing/ integrity of backing structure.	If fitted
- Cement/ Mud compartment & Supports	Attachments to superstructure, load distribution, local reinforcement.	PSV, FiFi, if fitted
- Deck tank arrangements	Chocks/ stools, manifolds/ lines, adjacent deck condition.	If fitted
- Bow/ fffloading or Bow loading structure	Coupler/ fairleads/ chain stoppers / foundations / interface condition.	If fitted

For structural AUCs subject to UTM, the procedure follows Sec 2, [3.4]. For OSVs the transverse belt coverage in the way of different cargo/ service spaces should be based on three transverse sections within the amidships 0,5L. When the vessel history, coatings condition, heavy localised deck loads, or dynamic operations indicate increased risk, the CAP Surveyor should complement the baseline coverage with target spot UTM measurements in the relevant areas.

Note 1: Unless otherwise stated, the technical criteria for AUCs and rating rules defined in Sec 2, [6] apply to all structural items listed above.

The key structural AUCs and typical criticalities requiring close-up visual examination during the condition assessment survey part are defined in Tab 3:

Table 3 : Structural AUCs subject to CVIs

Structural AUCs	Age of ship
	age > 15
Specific AUCs	AUCs identified as requiring a CVI from either the history review or the structural and fatigue analysis, if any.
Web frame(s) in ballast tanks	All web frames in all ballast tanks.
Transverse bulkhead(s) & swash bulkheads in ballast tanks	All transverse bulkheads and swash bulkheads in all cargo/ service spaces and all ballast tank (including D.B tanks).
Longitudinals bulkheads	All longitudinals bulkheads in all cargo/service spaces and all ballast tanks (including D.B tanks).
Side structure	One web for each longitudinally framed side.
Superstructure and exposed deck	Stiffeners on deckhouse located on the forecastle deck. Local reinforcement, bulwarks, guide members and lashing points.

2.4.6 Close-up examination with vessel age

As a general rule, all AUCs identified by the ship's history or by any structural & fatigue analysis study should receive CVI. In ballast tanks, web frames should be examined throughout; for any remaining cargo-type tanks on board, patterns that begin as representative expand to each tank on older ships. On the side structure, at least one intercoastal web per side is expected with coverage extended to each longitudinal and transversely-framed side. Exposed weather deck and superstructure interfaces, including guide members, bulwarks and lashing points, should receive increased close-up inspection where vibration records, or DP thrust effects are present.

2.4.7 Additional structural architecture and requirements for OSV granted with HNLS and/ or WELLSTIM additional service features (BV Class Notation/ Equivalent) - NR 467, Chap 3, Sec 2, 2.2

Where the OSV is assigned additional service features such as HNLS and/ or WELLSTIM under the BV rules or Class equivalent, the CAP Surveyor should give closer attention to structural boundaries and openings that govern containment segregation and flooding integrity. In particular, the following require target CVI and, where justified by condition or vessel history, UTM and/ or NDT:

- Double bottoms,
- Collision bulkhead,
- After peak including stern tubes,
- Machinery spaces boundaries,
- Height position and continuity of transverse watertight bulkheads other than the collision and after-peak bulkheads,
- Openings in watertight bulkheads and internal decks,
- Openings in shell plating below the bulkhead deck.

The key additional structural AUCs and typical criticalities requiring close-up visual examination during the condition assessment survey part for vessels granted with additional notations are defined in Tab 4.

The extent of examination should reflect the assigned service features and the SHR, and any findings should be evaluated using the acceptance criteria of Sec 2, [5.3.1].

Table 4 : Additional Structural AUCs subject to CVIs for OSV granted with HNLS/ WELLSTIM

Structural AUCs	Additional notation
	HNLS/ WELLSTIM
Double bottoms	Double bottom structure in way of girders, longitudinals, brackets and connections.
Collision bulkhead	All transverse bulkheads and adjacent boundaries: stiffeners, brackets and weld toes.
Aft peak	Aft peak structure including stern tubes foundations, brackets and bulkhead connection.
Machinery spaces	Watertight boundaries of machinery spaces: bulkheads, stiffeners, local reinforcements.
Superstructure and exposed deck	Stiffeners on deckhouse located on the forecastle deck. Local reinforcement, bulwarks, guide members and lashing points.
Watertight bulkheads and internal deck	All watertight bulkhead.
Shell plating	Shell openings and inserts.

3 Equipment and systems

3.1 Hull, equipment and systems assessment scope (for OSV only)

3.1.1 The scope of inspection covers the assessment of the equipment, fittings, piping, machinery and systems which are part of the following groups of items:

- Anchoring and mooring installation and equipment,
- Steering & rudders,
- Towing arrangement,
- Lifting appliances,
- Deck fittings,
- Hull machinery,
- Hull electrical equipment and cabling,
- Hull fittings,
- Closing appliances,
- Hull piping and valves,
- Sea connections and valves,
- Hull miscellaneous,

- Fire/ smoke/ gas detection and firefighting systems,
- Life saving equipment and fittings,
- Environmental management,
- Hull and PMS,

The assessment is carried out through the following:

- A visual inspection to assess the visual condition,
- A function test, if applicable,
- Additional criteria specific to the Item (test and maintenance records, load test, foam test, UTM).

3.1.2 Criteria and rating rules

Unless otherwise stated, the methodology for technical criteria and rating rule of Sec 3, [5.2.1] applies to all items in this Section. Functional checks and tests for IUC should be conducted and witnessed by the CAP Surveyor. In the case, live testing is not practicable, test results or certificates are acceptable with supporting evidence.

3.1.3 Towing Winch, brake rendering & Emergency Release

The CAP Surveyor should examine the winch, drum and end flanges for distortion or cracking and check the reduction gear and brake housings for leakage or heat discolouration. A no-load haul-in and haul-out should be witnessed from local and remote panels to confirm smooth motion, correct direction and reliable indications. The brake rendering setting is verified against the latest certificate and a commanded emergency-release test should be carried out to prove that the brake opens promptly without shocks, or abnormal vibration. The guards should be in place, the alarms should report correctly and foundations, fasteners and weld toes should be inspected for movement or tearings.

Functional operational tests to witness on the towing equipment, if fitted:

- Brake functional test at no-load (hold and release),
- Static holding/ locking check (certificate evidence),
- Emergency quick release actuation,
- Winch emergency stop and alarm test,

Rating criteria - Refer to Tab 5.

Table 5 : Towing winch/ Brake rendering/ Emergency release - Rating critiera

Rating 1	Rating 2	Rating 3	Rating 4
- Brake holds at set. - Release clean, and motions are smooth. - Certificates of tests are up-to-date. - Guards and alarms are effective.	- Brake holds at set. - Release clean, and motions are smooth. - Minor seepage or wear noted. - Certificates of tests are up-to-date.	- Minor seepage or wear visible. - Bearing play or minor distortion visible. - Certificate tests are up to date.	- Structural cracking or torn foundation. - Bearing play and major distorsion. - Brake release poor condition and slight malfunction. - Certificates of tests are overdue.

3.1.4 Towing Pins/ Jaws/ Towing hook

The CAP Surveyors should witness the operation of the equipment by a extend-retract lock at no-load from both local and remote control and confirm the position indication. Hydraulic manifolds, hose and glands should be examined for leakage, or damage. Bushes and hook safety latch should be verified for wear and correct seating. Finally, the foundations, bolts and weld toes should be checked for movement, elongation or cracking.

Rating criteria - Refer to Tab 6.

Table 6 : Towing pins/ Jaws/ Towing hook - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Lock and release positive from all controls. - Indication corrects. - Hydraulic systems in good condition. - Bushes sound, foundation intact.	- Lock and release positive. - Light seepage. - Indication corrects. - Minor wear and paint cracking.	- Minor control faults. - Light seepage, loose/ bent fasteners. - Minor local distortion at base. - Minor hydraulic leak.	- Minor control faults. - Lock or release does not properly function. - Majors cracks and wear. - Presence of hydraulic leak.

3.1.5 Anchor handling winch

Anchor handling winch are essential equipment on anchor handling vessels and are often subjected to significant static and dynamic loads during operation. The CAP Surveyors should witness the structural condition of the winch and its foundations, the condition of wire rope and associated handling equipment, and the satisfactory operation of all control monitoring and safe systems. Particular attention should be paid to the remote control system, spooling device, speed and tension control systems, alarms, emergency stop and emergency release arrangements. Additionally, maintenance, examination, testing and calibration records should be reviewed by the CAP Surveyor including records related to wire ropes and load, tension and speed monitoring systems. The CAP Surveyor should get a closer look at the periodical testing results of the equipment.

In the case any repairs, modifications or alterations of a major component of the equipment is done within the CAP survey, specific witness of the equipment should be expected by the CAP Surveyor. Therefore, new tests should be conducted and reviewed to complete the assessment of the item.

Rating criteria - Refer to Tab 7.

Table 7 : Anchor handling winch

Rating 1	Rating 2	Rating 3	Rating 4
- Good operating condition of the equipment and remote systems and fully operational. - No visual significant deterioration. - No leakage observed. - Maintenance, safety systems and test records up-to date.	- Good operating condition of the equipment and remote systems. - Slightly visual deterioration. - Minor wear and paint cracking. - Maintenance, safety systems and test records up-to-date.	- Minor control faults noted during the operability of the equipment. - Local deterioration noted and slight leakage observed. - Minor local distortion at base. - Maintenance, safety systems and test records up-to-date. - Open recommendations.	- Major control faults. - Lock or release does not properly function. - Deterioration noted and leakage observed. - Major cracks and wear. - Maintenance, safety systems and/ or test records overdue. - Open recommendations.

3.1.6 Stern roller

The CAP Surveyor should inspect the free rotation of the roller and then assess axial and radial play. Lubrication points should be checked such as the bearing temperature following a short run. The cheeks, brackets and transverse supports should be examined for deformation, imprinting and tears at the weld toes and all guards and protections are confirmed in place. Where indentation, unusual noise or local heating is observed the CAP Surveyor should request to take spot UTM on the supports.

Rating criteria - Refer to Tab 8.

Table 8 : Stern roller - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Smooth rotation of the equipment. - Axial and radial play is within manufacturer's limits. - Cheeks and supports are in good condition. - Guards fitted, no leakage observed.	- Smooth rotation of the equipment. - Axial and radial play is within manufacturer's limits. - Superficial corrosion and minor paint crack at supports. - Guard fitted, no leakage observed.	- Rough rotation of the equipment. - Axial and radial play are below the manufacturer's limits. - Local thinning or imprinting is detected at supports. - Presence of leakage.	- Unsafe functionment and rotation of the equipment. - Axial and radial play are below the manufacturer's limits. - Cracked or bracked supports. - Guards damaged or not fitted. - Presence of leakage.

3.1.7 Bulwarks/ freeing port/ guide members

The CAP Surveyor should inspect the full length of the work deck bulwarks, check the alignments, dents and buckling from green water or gear impacts and the examination of the weld toes. The verification of freeing ports such as the size, obstruction, and that the drain patch to scuppers are clear. The CAP Surveyor should note if any coating breakdown or pitting is present at scallops. Deck interface areas should be closely inspected for any signs of imprinting or cracking caused by stays or guide members. It should also be verified that, in the operational configuration, the freeing capacity is not compromised.

Rating criteria - Refer to Tab 9.

Table 9 : Bulwarks/ Freeing port/ Guide members - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Freeing ports clear. - Coating generally sound. - Guide members sound.	- Light waviness/ dents. - Minor pitting/ paint failure. - Small debris in drains but capacity maintains.	- Noticeable deformation. - Toe cracks or loosened stays. - Port slightly obstructed.	- Crack/ deformation on bulwark or stays noticeable. - Freeing compromised. - Thinning/ tear requiring repair.

3.1.8 Capstans/ Fairleads/ Bitts

The CAP Surveyor should witness a no-load test of the capstans with a start/ stop and a brake/ holding test and therefore inspect the general examination of the components to verify their satisfactory condition.

Verify that fairleads and sheaves rotate freely with acceptable side-play and that guards are correctly fitted.

Inspect bitts / bollards for toe-cracking at welds, condition of the backing plate and any base movement or deck imprinting.

Rating criteria - Refer to Tab 10.

Table 10 : Capstans/ Fairleads/ Bitts- Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Equipment functions correctly under no-load, brake holds and release are clean. - Guards present. - Fairleads/ sheaves free. - Bitts and/ or bollards secure. - No leakage observed.	- Equipment functions correctly under no-load, brake holds and release are clean. - Guards present. - Bitts secure. - Minor leakage observed and/ or wear might be noted.	- Trips recurs and slight rotation noise under operation are noted. - Local thinning at supports, loose fasteners. - Minor leakage and/ or wear might be noted.	- Unsatisfactory functionment and slight rotation noise of the equipment. - Cracked support or bracket. - Fracture base or welds at bitts/ bollards. - Presence of leakage.

3.1.9 Lifting appliances, if fitted

The CAP Surveyor should witness and check the structural condition, mechanical integrity, operational performance and safety arrangements of the lifting appliances and loose gear associated.

The assessment scope for LA should cover as far as applicable the following list: hose/ deck crane, store crane, derrick and derrick crane systems complemented by their associated loose gears and foundations.

Safe Working Load (SWL) marking should be well documented with documentary evident and visually in good operating condition.

The CAP Surveyor should verify first the evidence of testing by reviewing the latest thorough examination and load test certificates, manufacturers reports and maintenance logs confirming that the serial number matches the installed crane and that any recommendation has been closed. If any repairs, modifications or alteration of a major component of the LA have been conducted prior or during the CAP survey, a new test should be conducted and witnessed by the CAP Surveyor.

To be considered for CAP assessment, LA certificates or test results should be dated valid during the CAP survey.

The inspection should concentrate on the primary structural members, including crane jibs, housing, pedestal and foundations and foundations connections for any sign of corrosion and damage. Mechanical components such as winches, hydraulic cylinders, bearings, sheaves and pins should be closely inspected for any signs of wear and corrosion.

Loose gear should be visually inspected for any sign of wear, corrosion or deterioration. Additionally, evidence of proof test and records should be reviewed by the CAP Surveyor.

Records of maintenances, and examinations should also be closely reviewed.

Rating criteria - Refer to Tab 11.

Table 11 : Lifting Appliances - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Good operating condition of the equipment and fully operational. - SWL mark visible. - No visual significant deterioration on the primary structural members and mechanical components. - Certificate and maintenance records up-to-date. - No leakage observed.	- Good operating condition of the equipment and fully operational. - SWL mark visible. - Slight deterioration on the primary structural members and mechanical components. - Certificate and maintenance records up-to-date. - No leakage observed. - Certificate up-to-date.	- Local deterioration noted and slight leakage observed. - SWL mark slightly deteriorated - Slight sign of wear and corrosion noted on the primary structural members and/ or loose gear. - Certificate test/ load test up-to-date.	- Local deterioration noted and slight leakage observed. - SWL marks deteriorated and are not visible or unmark. - Major sign of wear and corrosion noted on the primary structural members and/ or loose gear. - Certificate/ load test overdue. - Major leakages visible.

3.1.10 Deck & Mast cabling (incl. supports, conduits and cable pipes)

The CAP Surveyor should check all cable runs on deck, up masts and to the equipment. Inspect the trays, saddles, cleats, conduits, cable pipes and penetrations for corrosion, loose fixings or chafe. Additionally, verify the bending radius, drip loops and tightness. Confirm the earthing/ bonding jumpers and segregation of power/ instruments/ circuits. The insulation resistance should be verified at the maker allowed test voltage through an IR test.

Rating criteria - Refer to Tab 12.

Table 12 : Deck & Mast cabling - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Support secure, glands tight, trays intact, no chafe. - Test results (IR) within acceptance criteria.	- Support secure, some touch up needed on trays, few loose cleats, some label missing. - Test results (IR) within acceptance criteria.	- Chafe / Flattened sections, wet junction box, slight segregation corroded tray spans. - Test results (IR) within acceptance criteria.	- Exposed conductors, and damaged support. - Chafe, flattened section, corroded tray spans. - Test results (IR) not within the acceptance criteria.

3.1.11 A-Frame/ ROV LARS, if fitted

The CAP Surveyor should firstly examine the latest certificate and function tests of the equipment. Then a closer look should be carried out at the foundations, weld toes and hold down bolts. Look for movement marks, elongated holes, imprinting on the deck and any cracking at bracker/ doublers.

To be considered for CAP assessment, A frame / ROV LARS certificates or test results should be dated valid during the CAP survey.

Rating criteria - Refer to Tab 13.

Table 13 : A Frame / ROV LARS - Rating criteria

Rating 1	Rating 4
- Certificate up-to date.	- Certificate overdue.

3.1.12 Offloading/ Bow loading coupler & manifolds / Hydraulic Power Unit (HPU), if fitted

The CAP Surveyor should verify the latest hose pressure-test certificates and connection certificate. A closer focus should be carried out on foundations, weld toes and bolts of couplers and manifolds for cracking or movement, confirm that guards / pinch point covers are in place. Check for blisters, crushing on hoses and verify end fittings/ gaskets. For the HPU, a general examination of the equipment should be carried out to verify the satisfactory condition. Verify the oil level, filter, operating pressure and temperature, control and monitoring systems.

Rating criteria - Refer to Tab 14.

Table 14 : Offloading/ Bow loading coupler & manifolds/ HPU - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- HPU responsiveness and good condition, - Spooling clean. - Hoses good condition. - Manifold/ coupler tight. - No defect visible on foundations.	- HPU responsiveness and good condition. - Slight spooling, minor gasket weep, imperfections.	- Minor alarms. - Hoses slight deteriorations or slightly damaged. - Local thinning at supports.	- Major leaks or control default. - Cracks visible at foundations, gasket weep and hoses damaged.

3.1.13 Lashing/ Sockets & guide members

The CAP Surveyor should witness and check the padeyes and lashing points for tearing at the welds toes, deformation and correct Safe Working Load (SWL) marking. ISO sockets and deck insert should be inspected for worn edges and proper weld attachment. Verify that guide members/ rollers are straight, attached and free to turn where fitted. A closer look should be carried out for imprinting or local buckling of the surrounding deck, and corrosion at scallops and drain path.

Rating criteria - Refer to Tab 15.

Table 15 : Lashing/ Sockets & guide members - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
• Padeyes and sockets in good condition. • Backing intact, guide member straight. • SWL mark visible.	- Padeyes and sockets in good condition. - Light wear or minor paint loss.	- Minor degradation of the padeyes and sockets. - Major wear and paint loss.	- Poor condition of the padeyes and sockets. - Majors wear and paint loss. - Deformation visible that prevents safe lashing/ guide function.

3.1.14 Firefighting systems

The CAP Surveyor should witness the pressurisation of the fire main using the duty pumps and verify the integrity of the ring main systems. The inspection should include :

- The ring main and hydrants/ valves: check for leak, tightness, hose stations, and the ease of the operation,
- The foam system: verify the correct concentrate type/ age, review the sample test record and confirm the deck coverage through a controlled test discharge to a test line or recovery tanks,
- Additional components: verify the proper condition and function of the reliefs, gauges, and low points drains.

Additional requirements are available as per Sec 3, [9.11.1] and Sec 3, [9.12.1]

Rating criteria - Refer to Tab 16.

Table 16 : Firefighting systems - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Main hold pressure, Hydrants/ monitors operate in good condition. - Foam type/ ratio correct. - No leakage observed.	- Main hold pressure, hydrants/ monitors operate in good condition. - Foam test approved. - Slight leakage observed.	- Inability to achieve the right pressure/ coverage at end-of-line. - Foam test overdue. - Slight leakage observed.	- Major leaks or pumps trip prevents service and good operations. - Foam test overdue. - Presence of leakage.

3.1.15 Fixed firefighting systems

The CAP Surveyor should verify the type of fixed fire extinguishing system fitted (e.g., CO_2, water mist, foam or equivalent) and confirm that the system is available, correctly configured and maintained. The CAP Surveyor should review the latest inspection / test certificates and verify that any recommendations are closed. A visual check should be performed on the release cabinet, pipework supports and nozzles in accessible areas.

Rating criteria - Refer to Tab 17.

Table 17 : Fixed firefighting systems - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Certificate of current system available. - Release arrangements in good condition. - Visual condition satisfactory. No leakage observed.	- Certificate of current system available. - Minor observation. - Slight leakage observed.	- Certificate due soon. - Open recommendations. - Local deterioration noted and slight leakage observed.	- Certificate overdue and system not fitted for operation. - Major non conformity noted.

3.1.16 External fire monitors (FiFi monitors), if fitted

The CAP Surveyor should witness, where permitted a short functional demonstration of each monitor and confirm indication. When live discharge is restricted, recent test records are acceptable, supported by evidence. The CAP Surveyor should check the condition of monitor foundations, associated piping supports, valves and actuators, and should note any leakage. Additionally, the monitors and control should be clearly labelled.

Rating criteria - Refer to Tab 18.

Table 18 : External Fire Monitors - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Demonstration/ test evidence current. - Monitors operate correctly - Supports/ Valves sounds, no leaks	- Demonstration/ test evidence current. - Minor damage but no impact on operation.	- Mainteance due soon and test evidence overdue. - Damage visible. - Slight leakage observed.	- Monitor inoperative or unsafe. - Maintenance overdue and not fit for service. No evidence of test. - Presence of leakage.

3.2 Propulsion & Auxiliary machinery fittings & system IUC

3.2.1 Dynamic positioning systems

A visual check of the steering gear interface, sensor rack and DP console for condition, cleanliness, cabling integrity and clear labelling should also be part of the inspection scheme for DP.

DP architecture, redundancy and test scope depend on the vessel's DP notation. The CAP survey should verify the condition and evidence appropriate to the fitted notation. The following documentation should be requested such as the latest DP FMEA (Failure Modes & Effects Analysis) test programme. The CAP Surveyor should check that the DP documents match the installed configuration (thruster, power, sources, sensors..) and that recommendations /defects are closed or managed. During the survey, a closer look of the equipment condition should be carried out such as the controller, joystick / independent joystick, alarm and event logging.

Rating criteria - Refer to Tab 19.

Table 19 : Dynamic positioning systems- Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- FMEA up to date and proving trials current and consistent with the vessel. - Controller/ joysticks and alarm in good operation condition.	- FMEA up to date and proving trials current and consistent with the vessel. - Alarm in good operation condition. - Slight deterioration of the cleanliness of the equipment.	- FMEA overdue. - Slight deterioration of the cleanliness of the equipment. - Some recommendations are still pending.	- No FMEA document available.

3.2.2 Emergency Shut Down (ESD) / Emergency Release System (ERS)

The CAP Surveyor should witness and confirm that the ESD/ ERS functions are demonstrated by tests, simulations or documented functional trials as permitted by operations. The demonstrations or test results should attest that the systems are operating in safe condition.

To be considered for CAP assessment, A frame / ROV LARS certificates or test results should be dated valid during CAP survey.

Rating criteria - Refer to Tab 20.

Table 20 : ESD / ERS - Rating criteria

Rating 1	Rating 4
- Certificate/ tests results up to date and attest the proper operation of the equipment.	- Certificate/ tests results overdue.

3.2.3 Thrusters (tunnel/ azimuth) & control

The CAP Surveyor should witness the good operating condition of the thruster through testing or review of tests in normal condition mode. The CAP Surveyor should check seal-oil levels/ pressure, cooling flow and control/ alarm indications and should inspect foundations, stools, fasteners and weld toes in the thruster room. The verification of the lube oil for any sign of leakage, hose condition, ventilation and cleanliness should be carried out.

The following documents should be checked: latest overhaul/ inspection reports if applicable, vibration testing results and bearing condition, lube oil analysis results.

Rating criteria - Refer to Tab 21.

Table 21 : Thruster (tunnel /azimuth) & control - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Good operating condition of the equipment, no abnormal vibration/ seal tight. - No leakage observed.	- Good operating condition of the equipment. - Slight coating loss.	- Good operating condition of the equipment. - Minor coating loss. - Minor leakage visible.	- Minor deterioration of the equipment. - Major coating loss and cracked/ torn support. - Major leaks and non clealiness visible.

3.2.4 Retractable thrusters

The CAP Surveyor should witness the good operating condition of the retractable thruster through testing or review of tests in normal condition mode. The review of the tests should include the retraction / extension records and checks or recommendations if applicable.

The CAP Surveyor should verify the guides, cylinders, pins lockings and seals for leaks/ play and cleanliness. Verification of the foundation and well coaming for cracking or imprinting should be carried out during the survey.

Rating criteria - Refer to Tab 22.

Table 22 : Retractable thrusters - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Good operating condition of the equipment, no abnormal vibration/ seal tight. - No leakage observed.	- Good operating condition of the equipment. - Slight coating loss.	- Good operating condition of the equipment. - Major coating loss. - Minor leakage visible.	- Minor deterioration of the equipment. - Major coating loss and cracked/ torn support. - Major leaks and non clealiness visible .

3.2.5 Dry bulk compressors (PSV)

The CAP Surveyor should check and inspect the good condition of the compressor in operation condition or review the latest working test which has been done following a reparation or repair. No noise or vibration should be witnessed. The manifolds, hoses, coupling should show no dust, oil mists and chafe/ flat spots. The skids, hold-down bolts, brackets and welds toes should show no cracks or movement marks.

Rating criteria - Refer to Tab 23.

Table 23 : Dry bulk compressors - Rating criteria

Rating 1	Rating 2	Rating 3	Rating 4
- Good operating condition of the equipment. - Stable pressure. - No leakage observed /chafe foundation. - Test results up-to-date.	- Good operating condition of the equipment. - Slight coating loss at supports. - Test results up-to-date.	- Slight deterioration of the equipment. - Slight coating loss at supports. - Minor leakage. - Test results overdue.	- Deterioration of the equipment. - Major coating loss visible at supports. - Cracked/ torn support noticeable. - Test results are overdue.

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