

DNV Classification Capability & Track Record

For three decades DNV has been engaged in classification and certification of mobile offshore drilling and production rigs built and operated world wide. With nearly half the fleet of drilling units built during the last decade to DNV class, the society is widely recognised by the drilling industry as the provider of cost effective and highly beneficial classification services, supported by state of the art technology.

DNV has also been involved in verification of fixed and floating production units for more than 30 years. Currently 35 FPU's classified/certified/verified by DNV are in operation and additional 9 FPU's under design or construction.

Today 146 offshore installations, about 30 percent of the world's total tonnage, are classified with DNV.

The projects are spread around the world and DNV utilises its own global network of resource and service centres to accommodate our customers need. Wherever the business is, our local people have a common understanding of the classification systematic and an understanding of the specific region, its conditions and governing regulations. DNV Offshore Classification has offices in i.a Rio/Brazil, Houston/US, Oslo/Norway, Singapore, China, South-Korea covering all aspects from design, construction to in service phase. In addition DNV has numerous of offices in around the world covering construction to in service phase. Worth mentioning is our site offices in Tema/Ghana, Luanda/Angola and Lagos/Nigeria.

DNV CLASSIFICATION

DNV Classification Systematic

Classification is a system for safeguarding life, property and the environment due to operational consequences. Classification implies a process of verifying vessel standards against a set of requirements - the DNV Rules. Issue of a Classification Certificate confirms assignment of class. Classification has gained world-wide recognition as an adequate level of safety and quality and to provide a sound safety standard.

DNV's objective for Offshore Classification Services is also to create confidence and predictability for complicated and challenging offshore projects. Through a proactive approach and use of our extensive experience DNV Offshore Classification is:

- reducing financial and schedule risk by creating confidence and predictability relating to safe construction and operation
- guiding our customers through the tangle of international and national rules and regulations

The overall goal is to reduce our customer's project risk through services creating consistency and confidence for complex offshore projects.

DNV Classification Scope and Rules

Classification scope targets primarily the integrity of the asset through focus on safety critical elements. DNV Classification confirms that the unit with the class notations identified complies with requirements DNV Rules for Classification of Floating Production and Storage Units (Offshore Service Specification DNV OSS-102) including

applicable Classification Notes, Recommended Practices and Offshore Standards issued by DNV. Typically class notations for an FPSO can be:

Main Class and Service notation:

✘OI Ship-Shaped Oil Production and Storage Installation POSMOOR PROD CRANE HELDK COMF-V

The symbol ✘ will be given to units and installations built under the supervision of DNV.

The notation **OI** will be given to non-selfpropelled offshore installations intended for long term service at one offshore location with main structure, utility and safety systems found to be in compliance with the basic (common) requirements of the applicable DNV offshore standards referred to in the rules.

For **OI** main class there may be cases where the client wishes to limit the scope of classification to selected areas and items only. Such special class arrangements may be acceptable provided it can be demonstrated that areas and items not covered by classification have, or will be, designed, constructed and maintained to an appropriate recognised standard. The involvement by DNV will be specified in the class agreement and reflected in the class notations for the installation.

The following discipline areas are covered within main class, ✘ OI (mandatory):

- Safety Principles and Arrangement
 - design principles, including generic accidental loads
 - arrangement; including segregation of areas and location of plants and equipment
 - escape and evacuation
- Materials
- Hull design and construction
- Mooring
 - Additional notation POSMOOR (Position Mooring) is mandatory for FPSO with no propulsion
- Stability, watertight and weathertight integrity
 - intact and damaged stability
 - watertight integrity
 - freeboard
 - weathertight closing appliances
- Utility systems and equipment related to marine and safety functions
 - general piping design, fabrication and testing
 - pumps, valves and pipe connections
 - ballast, bilge and drainage systems
 - air, overflow and sounding pipes
 - hydraulic, steam and pneumatic systems
 - heating, ventilation and air conditioning systems
 - pressure vessels and incinerators
 - turret machinery, as applicable
- Electrical systems and equipment related to marine and safety functions
 - system design
 - switchgear and controlgear assemblies
 - rotating machinery
 - static converters
 - cables
 - miscellaneous equipment
 - installation and testing

- A.C. supply systems
as far as relevant for supplying marine (e.g. ballasting, bilge, mooring), firefighting and emergency services.
- Instrumentation and telecommunication systems related to marine and safety functions:
 - design principles and system design
 - computer based systems
 - component design and installation
 - environmental conditions
 - user interface
- Fire protection:
 - passive fire protection
 - active fire protection
 - fire fighting systems
 - fire and gas detection systems

Additional Service Notations:

*** Oil Production and Storage:**

Additional requirement for:

- Safety Principles and Arrangement
 - Arrangement
 - area classification
 - shutdown
 - escape, evacuation and communication
- Marine and Machinery and Utility Systems and equipment:
 - piping arrangements
 - ventilation in hazardous areas
 - use of gas and crude oil for auxiliary boilers and turbines
 - liquid cargo transfer and stripping
 - liquid cargo storing, segregation and treatment
 - venting, inerting, gas freeing and vapour emission control
 - oil discharge control
 - crude oil washing system
 - ventilation in hazardous areas
- Fire Protection
 - passive fire protection
 - fire water systems
 - active fire protection of specific areas
 - fire detection and alarm systems
 - gas detection.

Example of Service and Special Facility Notations (voluntary):

*** POSMOOR (Passive position mooring system)**

POSMOOR -notation will be assigned to units fitted with single or spread point mooring systems. The notation aim to cover the reliability of the mooring system and equipment, for the purpose of ensuring safe position mooring, and covers the following aspects:

- environmental conditions and loads
- mooring system analysis
- mooring equipment
- tests during hook-up

* PROD (Offshore Hydrocarbon Production Plant):

The notation covers the following systems and arrangements, including relevant equipment and structures:

- production and export riser systems
- well control system
- riser compensating and tensioning system
- hydrocarbon processing system
- relief and flare system
- production plant safety systems
- production plant utility systems
- water injection system
- gas injection system
- storage system
- crude offloading system

* HELDK (Helideck Strength, marking & equipment)

Units or installations fitted with erected landing platforms for helicopters or landing areas arranged directly on decks or top of deckhouses may be given the class notations:

HELDK Structural strength

HELDK-S Strength and unit or installation safety

or

HELDK-SH Strength, unit or installation safety and helicopter safety

* CRANE

CRANE -notation may be given to units or installations with permanently installed cranes. In addition to certification of the crane, the following is covered:

- supporting structure for the crane, (strengthening of deck structure, pedestal etc.)
- devices for locking crane in parked position (unit at sea)

* COMF

COMF-V -notation quantifies the comfort rating of noise and vibration for the vessel.

COMF-C -notation quantifies the comfort rating of the indoor climate.

Class notations for an FPSO are defined in DNV Rules for Classification of Floating Production and Storage Units (Offshore Service Specification DNV OSS-102).

DNV Classification Main Elements

Classification implies an activity, in which an offshore unit or installation is surveyed during construction on the basis of design approval, tested before being taken into service, and surveyed regularly during its whole operational life. The aim is to verify that the required safety standard is built-in, observed and maintained.

Hence, DNV Classification comprises the following main elements:

- Design approval
- Certification of materials
- Certification of components and equipment
- Surveys, tests and trials during fabrication and commissioning (including pre-commissioning, sea-trials, commissioning and offshore hook-up).

DESIGN APPROVAL

Design approval is based on a combination of document reviews and spot check calculations, independent analyses and technical workshops. Design approval includes initial review, issue of comments and review of next revision to confirm incorporation of DNV comments.

The builder or manufacturer shall make available to DNV the following documentation according to documentation lists (Docreq - see below) supplied by DNV upon receipt of class request, before production commences:

- a) Documentation required for approval.
- b) Corresponding technical descriptions, calculations and data, including material specifications.

The builder, with which DNV normally has the classification contract, is responsible for co-ordinating that drawings and other documents are submitted, and for distributing any approval comments that may have been given. In case of different contractual arrangement, alternative arrangement must be organized in order to ensure efficient co-ordination of submission of drawings and documents.

The design requirements

Document Requirement List (DocReq)

The system for document requirement (DocReq) is implemented in the recognised electronic database for newbuilding design approval.

DocReq is organised with a standard documentation requirement list in line with the DNV Offshore Standard requirements.

Design Approval Preview (DAP) – Workshop

At an early stage of the design, DNV encourage to arrange a Design Approval Preview workshop. The objective is to perform a multi-discipline evaluation (DAP) of the design to identify possible showstoppers and discipline related requirements.

The scope is to evaluate the design on a high level by a workgroup covering the main disciplines. The DAP will typically comprise:

- Compliance with the applicable rules and regulations with respect to general arrangement, structural arrangement, systems, safety etc.
- Identify areas to be given high attention

Input data will typically be:

- General arrangement
- Main structural drawings
- Main drawings for systems
- Design brief

Deliverables will typically be a letter with comments to the design

CERTIFICATION OF MATERIALS AND COMPONENTS

The scope of classification includes certification of materials, components and systems intended for the unit or installation. The rules define the extent of the certification that is needed for classification.

The objective of the certification is to ensure that materials, components and systems used in units or installations to be classed by DNV conform to the rules and referenced standards within the framework of the rules.

The certification is a conformity assessment normally including both design and production assessment. The production assessment includes inspection and testing during production and/or of the final product.

The general principles and requirements for certification of materials and component are given in DNV Offshore Standards (DNV-OS).

Certification of materials and components is usually covered by separate agreements between each vendor and the local DNV office.

SURVEYS, TESTS AND TRIALS DURING FABRICATION AND COMMISSIONING

One of the tasks for DNV in the process of classification of an offshore unit is to contribute to, and later verify; that the quality of the unit meets the minimum requirements laid down in the Rules.

It is not possible to control quality into a product; it has to be built into it, under guidance by the manufacturer's internal quality system. It is also beyond any doubt that in addition to enhancing the quality, a good quality system will reduce the total production cost as mistakes will be avoided rather than corrected, which is the case in the event of the traditional final inspection approach.

In concurrence with the above philosophy DNV requires in the Rules that the builder has a relevant quality system which is to be evaluated by the Society.

This requirement applies to the main yard as well as to subcontractors fabricating primary structural elements containing special areas. The quality system shall include administrative and technical procedures for and control of:

- Planning
- Design
- Procurement
- Fabrication
- Testing
- Commissioning

The evaluation of the quality system, which is performed at the shipyard and subcontractors by DNV is a combination of:

- Quality programme review
- Audit to verify the implementation of and adherence to the procedures.

As an alternative to the case by case evaluation, a general approval of the builder's quality system may be granted. If this general approval at least covers the quality system expected for the fabrication in question, the case by case evaluation may be omitted.

Technical Requirement for Fabrication

Standard scope of work is given in applicable sections of 'DNV Offshore Service Specification' (Rules for Classification). The DNV Offshore Service Specification (OSS) refers to the relevant technical Offshore Standards (OS)

Requirements for:

- welding procedures and qualification of welders
- fabrication and tolerances
- testing
- corrosion protection systems

are given in DNV-OS-C401.

The standard contains requirements for fabrication and testing of offshore structures.

The objectives of this standard are to:

- provide an internationally acceptable standard to ensure the quality of all welding operations used in offshore fabrication, through identifying appropriate welding procedures, welder qualifications and test methods (NDT)
- serve as a technical reference document in contractual matters between purchaser and contractor
- serve as guideline for designer, purchaser and contractor
- specify minimum requirements for welding operations subject to DNV certification and classification

DNV Role in the OA system

Effective planning and execution of the new building survey is of utmost importance in order to achieving the specified quality with the optimum use of resources. The planning of the survey activity will depend on the type of inspection job.

Systematic utilisation of information and knowledge of the yard and the unit, and an early definition of scope of work including required resources are important prerequisites for a successful completion of a newbuilding project.

It is a condition for classification that the main yard and its sub contractors comply with the minimum requirements to quality assurance.

DNV's scope of work is normally adapted to the actual performance and efficiency of the yard's QA/QC systems.

To prevent problems which might result in costly repairs and delivery delays it is important that the surveyor has a close contact with the builder.

Problem areas such as the following can be discussed at a "pre-inspection meeting:

- Technical problems,
- Test procedures,
- Non conformances and fabrication deviations,

- Production plans/schedules,
- Inspection plans/schedules,
- QA/QC procedures,
- Etc.

The DNV surveyor's main approaches towards quality monitoring will be a combination of:

- I Quality System evaluation (audit the performance of the builder's QA/QC – system).
- II Product surveys (inspections, test - survey of the product itself)

The two categories complement each other and both are considered necessary to ensure sufficient evidence of compliance with project requirements.

Even with an apparently well-documented and implemented Quality System, the product surveys shall not to a too great extent be replaced by system audits. It is the obligation of the individual surveyor to find the correct balance between the two verification categories, based on his confidence in the Quality System.

Besides I and II above, the surveyor will also have to be a qualified engineer as he/she is expected and obliged to take care of the elements listed in the right column of Table 1.

Inspections and Tests - General Principles

Inspections and tests attended by the surveyor will as traditionally serve as the ultimate verification of conformance for the product to be classified.

In the initiation phase of the project the product inspection and tests should be planned by the yard in close cooperation with DNV, owners and possible vendors, Operators and Regulatory Bodies. Hold points and witnessing points for DNV should be identified.

The yard shall issue daily applications in writing to DNV for each scheduled inspection or test. The notification time (normally not less than 24 hours) should be agreed enabling the surveyor to plan his other activities for the day in question.

Any product non-conformity should be notified in writing to the yard so that rectification work can be planned and executed. It should also be agreed whether a scheduled re-inspection by DNV should be carried out after rectification.

If a scheduled re-inspection by DNV is not requested, the surveyor should obtain a positive feed back when the nonconformity has been deleted. Product non-conformities not settled on the spot or within a day or two should be included on a punch list in NPS (Nauticus Production System - DNV internal document handling system). It is feasible to split the punch lists into disciplines (hull/hull outfitting, machinery/piping, electrical). Refer 2.7.1.

The objective of the punch list is to keep a documented status of all pending matters between DNV and the yard. The punch list is updated continuously and distributed at frequent intervals e.g. at each quality meeting. The items on the punch list not deleted at the time of delivery of the product constitute DNV formal Condition of Class to the owners.



In addition to the scheduled product inspection/tests the surveyor will monitor the performance of important fabrication processes. This might be done through participation in the yard’s audits together with the yards audit group and as unscheduled ‘drop in’ visits. It is feasible to combine the product inspections by monitoring fabrication processes in progress nearby the scheduled inspection site on the way to or from the inspection site.

Distribution and extent of scheduled/unscheduled inspections and audits are to be optimised with respect to effect on quality.

The surveyor will not be tied up too much by the yard’s inspection schedule. Very often contribution to quality is much higher in an unscheduled spot inspection than in a well planned and scheduled inspection which in any case will be attended by a number of other inspectors.

The surveyors will keep record of all scheduled and unscheduled inspections.

Table I. MOU new building — Example of surveyor’s main functions		
<i>Quality system auditor</i>	<i>Product inspector</i>	<i>Engineer</i>
Continuous monitoring of - system - process based on - system audits - process audits - product, non-conformities follow-up	Structure - subassembly insp. - final block insp. - block erection insp - NDT-verification - pressure testing Machinery/system - piping - installation insp - pressure testing - operation testing etc. Governmental commission insp	- evaluation of fabrication, deviations / non conformities - evaluation and approval of minor design modifications - approval of design details - interpretation of rules and regulations - - initiate/communicate proposal of rule/IS changes to OCT/MTP - review/evaluate data books and reports - contact link from/to DNV specialists - information source - promote DNV services - trouble shooter - arbitrator - oracle

DNV PROJECT EXECUTION

The DNV project team will include a construction survey manager at the main fabrication site and an approval manager responsible for co-ordination of all approval activities at the approval centre.

DNV encourages proactive attitudes and direct dialogue to achieve effective communication of project status, resolution of queries and comments, and prompt closeout of reviews with minimal administrative efforts and controls. This will enable effective use of resources contributing towards common project objectives. Normally a DNV surveyor will be present at the main construction yard from 1 month before steel cutting.

The Overall Project Manager will prepare a Project Quality Plan that will be distributed to all parties. This document will define the DNV project personnel:

- Inter-company relations applicable to this project.
- Responsibilities
- Routines
- Procedures

The Project Job Descriptions is as follows:

Project Responsible (PR):

The Project Responsible (PR) main tasks are to provide the resources necessary to fulfil the contract and support the agreed project plan. The PR represents the project within DNV Management. The PR has regular meetings with the PM to evaluate and discuss the project's development.

PR is responsible for:

- Approval of proposals and contracts.
- Appointment of PM.
- Allocation of resources to the project, including resources outside PS domain of control.
- Making decisions having contractual implications for DNV.
- Making decisions with budgetary consequences for DNV.
- Approving major plans and budgets, including the Project Quality Plan.
- Review the project on pre-decided project milestones and decide whether the milestone can be passed or not. PS shall decide how the review shall be conducted, e.g. by dialogue, review by a team or by other means.
- Approve final deliverables, e.g. final report and project checklist.

Project Manager (PM):

The Project will be managed by a Project Manager (PM) who has the primary contact with the customer. The PM has the operational responsibility for running the project to meet the defined goals, milestones, budget and deliverables with the right quality. The PM participates actively in the project. The PM reports to the PR.

PM is responsible for:

- Handling contractual matters related to work orders, change orders etc.
- Preparation, implementation and updating of project management and control systems.
- Preparation and updating of plans for execution and control of the project including definition of tasks, deliverables, budgets and schedules for each part of the project and the members of the project team.
- Identification of project milestones.
- Establish the project organisation and organise the project work.
- Monitor the performance of personnel and other resources allocated to the project and take corrective actions as needed.
- Evaluate effects of project changes, including impact on deliverables, schedule and budget, and reach contractual agreement with client on these impacts.
- Implementing QA measures including adequate execution of internal verification of all project results.



- Cost control and timely invoicing of every chargeable item, accuracy of project accounts and follow-up of accounts receivable.
- Report project status to PS at defined milestones.
- Co-ordinate the integration between the topside verification and the classification part

Project Manager Approval (PMA):

The Project Manager Approval (PMA) is the manager of the design.

PMA is responsible to:

- communicate with PM, PMC and Project Team Members (PTM)
- administrate and co-ordinate technically, administratively and commercially
- perform quality control of document handling
- propose need for resources for approval work
- report matters of importance (e.g. having budget/economy/quality consequences, deviations from the Rules and Instructions, etc.).

Project Manager Construction (PMC):

The Project Manager Construction (PMC) is the lead site surveyor at the main building site and the formal contact person towards;

- the yard and EPC Contractor
- the yard's sub-contractors,
- the owner's/operator's site representatives, and own line management.

OTHER SERVICES

DNV may carry out additional review, such as self state requirements, flag state requirements if requested by client.

Statutory services

Depending on which flag chosen for the newbuilding, DNV will have different degrees of authorisation to approve drawings, including stability when appropriate, survey and issue the appropriate certificates on behalf of the Flag Administration.

Typically DNV offer to issue the following Statutory Certificates for FPSO including topside safety systems on behalf of the Flag Administration:

LL	Load Line Certificate
SOLAS	CCC Cargo Ship Safety Construction Certificate
	CEC Cargo Ship Safety Equipment Certificate
	CRC Cargo Ship Safety Radio Certificate
MARPOL 73/78	(International convention for the prevention of pollution from ships Annex I (IOPP Certificate) Annex 2,4 and 5 (statement of compliance)
TMC	Tonnage Measurement Certificate
COLREG 1972	as amended

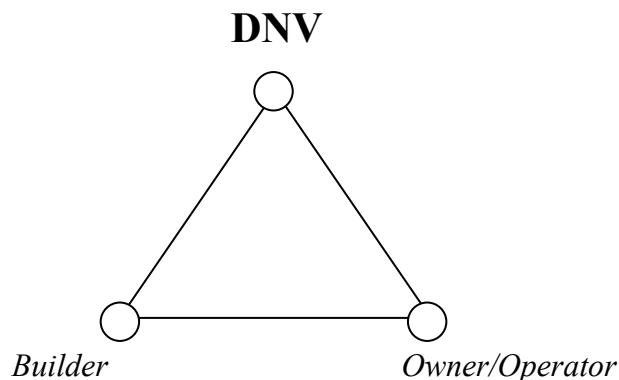
HOW CAN OPERATORS CONTRIBUTE TO A SUCCESSFUL VERIFICATION THROUGH CLASSIFICATION?

Typically DNV will recommend:

- a) Early involvement is a key to project success. The scope of the classification is agreed between the owner/operator and DNV prior to making the classification contract normally between the classification society and the yard. Hereby the owner/operator can assure that the class scope satisfies his need and also specify any analyses or verification tasks beyond the classification scope.

- b) Short time between CA and Steel order and consequently limited time to influence primary hull design
 - Main Scantling Approval (up front)
 - Motions study to confirm motions to be used for designers and purchase orders. Provide a standard set of results for rapid verification which can efficiently be updated and communicated throughout the project execution.

- b) Triangular Meetings – three way communication:



- c) Clear reporting procedures, including updated list of outstanding/deficiencies.
- d) Clear deviation controls, with actions to ensure deficiencies are addressed (i.e. brought up in Triangular Meeting).
- e) Have clear milestone payments, and withhold payments until punchlist items are cleared.
- f) Setup structural verification system to provide input into inspection planning (Inspection In-Service Program, RBI)
- g) Clear definitions of interfaces and responsibilities of parties involved