Abstract

Based on the experience gained during several FPSO projects over the previous years, this paper discusses the overall Classification services for a FPSO Project and, if carefully planned with the various actors (Project owner, EPCI and contractors) and balanced with the requirements to certification and verification, how they can provide added technical value and support project management.

Classification services for the construction of a seagoing tanker are standardized for overall process / project management and technical requirements. For the Classification of a FPSO, such services can be planned to maximize the benefit of having a third party partner along the entire execution of the project. The Classification requirements are to be balanced with the overall codes and standards applicable for the project to avoid any “grey” areas, and to address the maximum safety parameters. The services may incorporate review of drawings and inspection at the construction sites for all requirements coming from International Rules, National Authorities and Industry standards. Class can also adapt the services to fit with Asset Integrity Management plans or other planned programs for the operating units.

This paper defines the typical scope of Classification and discusses the different contractual setups of these services, such as enabling Class to communicate findings and surveyor comments directly to the Project Owner and/or EPCI. Class can play an important role as “messenger” improving communication between the different major contractors on the project. It is the aim that readers experienced with Classification of FPSO projects could use this paper as a check list for future projects and that offshore engineers inexperienced with Classification will get a more detailed view over these services and how they can benefit from them.

Finally contractual setup and organization in the Classification society should be followed up by application of an internet platform for centralizing drawing reviews and certificate register, including all written communication for supporting of the Project Management. The project manager is to have access to the numerous project correspondences from all involved offices at any time.

Codes and standards - project requirements

During the initial project preparations by the Project Owner, one of the important design tasks is to clearly identify the codes and standards to be applied in the project. For the floating unit the list is to include the following precisions:

- International Rules
- Flag state requirements
- Coastal state requirements
- Industry standards
- Classification notations

This list will support the project specification and be a reference document during the complete project. It should be provided with detailed reference of each code to assure that all contractors will refer to same editions. The list will help to clarify the deliverables in terms of certificates from the nominated Classification society and/or third-party certification agency.

By having this document available early in the project, it serves as a master reference for bids prepared by designers and shipyards. It is also recommended to have the Project Owner’s documents and specifications dealing with the interpretations of the industry standards and any Company particular requirements, as there seems to be a difference in the interpretations when comparing different FPSO projects. This is leaving room for uncertainties.

For the precision of the Classification notation, this is to be discussed with each considered Society as the exact scope of Classification for a FPSO may vary slightly between them. It appears that the bare minimum is the hull including marine systems and mooring. The principle is that the Owner together with the Classification Society will chose the most suitable marks and notation for the given service of the unit. The Owner may request additional notations and hereby extend the scope of Classification.

Project requirements for Classification

In the following it is assumed that the project is to be classed, either due to requirement from flag or coastal state, or due to project owner’s corporate requirements. This decision is then incorporated into the project specification and needs to
be further indicated and detailed in documents to involved contractors.

**FPSO Main Classification content**
- Hull (strength, subdivision, stability)
- Mooring (chains, anchors)
- Utilities (marine systems, cargo transfer)
- Process (optional)
- Process (optional)
- Risers (optional)

After the general package based on minimum marks and notations have been decided based on discussions with the Classification society, the main question is if the topsides process plant should be included in the Classification scope. The decision varies from one project to another, but it is a fact that Classification itself is not directly concerned with the performance of the process facilities but by the overall safety and integrity of the unit. The Classification societies have detailed rules for the hull and marine systems but for the process facilities, reference is often made to the industry standards and recommended practices, such as API. The expansion of the market of these societies into industry certification has led to the availability of more advanced Classification packages for topsides process plants, incorporating RAM modeling, safety case verification schemes, etc., and which opens for a more flexible Classification program regarding the topsides process plant. It is therefore suggested that decision of classing topsides should be based on an evaluation of the possible Class services together with the project requirements for design, construction and inspection during operation.

In the days where the FPSO’s were mainly converted tankers, the scope of Classification was more easily defined. The hull and marine systems would remain in Class for the new service and the added topsides modules could eventually be left outside scope of Class if so requested. But for new constructions today, the integration of ship marine systems with the process plant will often mix the systems and marine systems might also be positioned in the topsides area. If the process plant is not entirely classed, the detailed description of the Classification scope must be marked by Class on the relevant PID diagrams which can serve as the main document for all involved contractors regarding Classification. This marking is based on the principle that for the marine systems and equipment, boundary of Classification will include necessary features to assure the proper operation of the marine systems as required by the Classification rules.

The boundaries for Classification may need precision for piping, cables and systems. But also for the structure; Riser connections, riser protections, boat landing platform and other attachments to the hull may also leave room for interpretation of Class requirements. Some of these structures are designed and constructed outside the main shipyard, and Classification requirements need to be incorporated in specifications and purchase orders for these parts.

It is therefore recommended to request the Classification society to issue a document with the following content:

- Marks and notations.
- List of reference documents.
- Indication of Classification boundaries on relevant PIDs with general description of the scope of Classification.
- Preliminary structure drawings indicating the exact boundary of Classification for hull attached equipment.
- Preliminary equipment list with reference to Classification Rules.

The document will need to be revised during the project to reflect the latest edition of the PIDs and other relevant drawings.

Although significant time is spent on writing and keeping updated the document detailing the Classification scope, the time spent does not limit completely the hours needed to clarify the Class requirements for equipment certification. The presence of a high number of equipment onboard FPSOs, often supplied by vendors without previous experience in marine certification, will require a constant “hot-line” to Class for verifying if the equipment is falling under scope of Classification, and if so, explanation of the requirements to be given. The Class scope document is hence to indicate the contact numbers and organization chart and hereby give raise to further discussion about suitable project organization to be put in place.

**Project requirements for Certification**

It is an advantage to the project if the overall project specification includes a detailed description of the requirements to certification. It is not only a question about which standard to apply, but also to indicate who is responsible for this certification, when it is supposed to take place and from which third-party organizations this certification will be accepted.

Certification requirements often overlap the Classification scope and it should be assured that such situation will not create room for misinterpretations. It is recommended to inform the Classification society about the certification requirements as for some equipment, a certain acceptance of equivalence may be agreed upon agreement from the Project Owner. This is an important parameter which often is unknown by the topsides engineering. It may also be advisable to have the Class to map the possible conflicts for design codes and material requirements, if any.

**Project requirements for Verification**

Verification tasks cover a wide range of services, from verification of design drawings for compliance with project specification throughout review of safety critical elements, re-calculation of design performance and inspection at yards and manufacturer’s plants.

One important task is the interface management. As an example, Class can easily take a more active role in the discussions between the topsides designer and the shipyard to assure that the load assumptions considered by the shipyard are known by the topsides designer, follow-up on revisions on drawings and even support meetings between the various contractors.
When the choice of the third-party verification is made, it is recommended to take into account the interface issues which may arise. As an example, if a major topside equipment outside scope of Class such as a lifting appliance, riser pull-in or other, is verified/certified by another society than the one classing the FPSO, provisions for exchange of information between the certifying authorities should be made.

When a Classification society has been chosen and the scope of Class is well defined, it is advisable to extend the scope of Classification services to include verification for compliance with project specifications. During design review, it is efficient to have Class to verify well defined project requirements to design and performance standards—and the fact that Class will mobilize surveyors at many vendor production facilities, the surveyor duty could be enriched with verification tasks. All such jobs will result in the issuance of “Attestations” / “Statement of compliance” in addition to the normal Classification documentation.

Most of the large Classification Societies have expanded the activities in certification and verification over the last couple of years. When discussing with these societies, a high number of additional services will be offered and if the project specifications have been provided with detailed requirements to verification tasks, they can be included in an overall “package” expanding from Classification to overall Asset Integrity Management.

**Classification – Definition and application**

When Classification is not a mandatory requirement from National Authorities, the Project Owner may reconsider the decision about classing the floating unit. Generally, FPSO’s are classified during the design and construction phase, but some Project Owners do not maintain the Classification during operations at site. This may be initiated by the presence of other statutory requirements to the management system such as the Safety Case requirement in the UK continental shelf. But often a decision of discontinuation of Class is based on fear of operational constraints due to required survey intervals.

Experience has shown that Classification societies have unrivalled knowledge in terms of ocean-going structures and safety at sea. It is therefore recommended to keep the units classed, also during operation. Survey scheme should be optimized according to operation constraints and level of performed engineering analysis.

Another advantage of Classification is the fact that the Society, differently of other contractors, may remain on the project from early FEED stage to operation stage and hereby collecting valuable information on the floating unit for ready use by Project. This can later be expressed by entering the unit in Emergency Responsive Service or other additional Classification services.

But what does Classification mean? The word itself means a category into which something is put. In the marine industry, Classification Societies are well known and are large non-governmental organizations. In the oil and gas industry with different tradition, standards and culture, Classification may not always be correctly understood and often subject for discussion. But while Classification may be an unknown parameter for process engineers and even give raise to some uncertainties, shipyards and marine designers feel comfortable with involvement of the Classification Society.

The most important differences between Certification and Classification can be summarized into two aspects: First, the Classification standard is written by the Classification Society itself and based on IACS agreements, when applicable. Secondly, where as Certification is a kind of one time review, Classification is a continuous process based on a survey program during construction and operation of the unit.

Classification Rules have been developed over many years by each Society based on extensive research and return of experience from existing units. The Rules address design, construction and maintenance/survey requirements for structural strength, watertight integrity of the hull, safety and reliability of the propulsion plant, if any, and steering gear, and the marine systems fitted onboard to assure the safe operation of the unit (main and auxiliary machinery, control engineering systems, electrical installations, service or cargo installations, fire protection, detection and extinction and intact stability). The main target of Classification is to assure the floating unit for a given service and intended navigation or operation area as a piece of property. It should be kept in mind that Classification Rules are not primary intended to ensure the safety of life at sea, which remains a State responsibility.

Classification services for the construction of seagoing ships are highly standardized for overall process/project management and technical requirements (based on application of Class Rules). This principle is followed also in the operation phase where the seagoing unit is subject to periodic surveys according to a predefined program. But for offshore structures, Classification Societies have well understood the need of adapting their Rules to the operational requirements. Particular survey schemes may be considered for each unit and the Classification inspection program is often determined on a case-by-case evaluation. RBI methodology may also be considered and taken into account for the “close-up” survey requirements.

Classification can bring significant added value to the FPSO project if the classification requirements are included in the overall definition of certification and verification requirements. The Class Rules can cover “gray areas” in the certification and verification package, it adds a safety view and a construction standard independent of production requirements. It gives confidence and a reference to a shipyard. During in-service, the standard inspection scheme can be used as a reliable inspection program, eventually limited to the initial years until a full RBI for the complete construction has been finalized and after which Classification requirements for inspections can be adopted to.

**Statutory requirements – marine certification**

Once a floating unit is registered, the UNCLOS (United Nations Convention) requires the Flag state to implement measures to ensuring safety at sea. The international conventions have been heavily developed over the past years and Flag have often delegated their technical inspections to Classification Societies. An agreement exists between the Classification Societies to assure that Statutory surveys are performed by the Classification Society classing the unit as the
Classification Rules are a vital part of the statutory legislation.

Statutory requirements for FPSOs are often a subject to endless discussions, in particular if the Operator has left these requirements without further directions. The coastal or flag state will often require partly or full application of the conventions SOLAS, ILLC (Load Line), MODU and MARPOL published by IMO. Application of these conventions to FPSO’s gives room for interpretation by designers and shipyards, as the conventions were written for seagoing ships. Here the Classification Society can play a major role based on their experience from similar projects.

Flag states might keep some of the required statutory surveys to be performed by themselves. There seems to be a common rule that Flag states often keep the “people”-type issues for themselves delegating most of the other parts. But often this is related to the required manpower to be mobilized by the Flag state. If a statutory requirement to be checked during construction is requesting a constant presence at the constructing shipyard, this is typically delegated to the Classification society.

The Classification Societies are used to communicate with Flag administrations concerning application of the Statutory Rules. It can therefore be convenient for an Operator to ask the Classification society to be the coordinator for communication with Flag.

In the case it is decided to de-flag the unit upon arrival and installation at site, Classification services may include a verification of life saving appliances for compliance with certain parts of SOLAS or other statutory requirements if requested by the Project Owner. The many years of experience in such issues can be a valuable contribution to the offshore project.

Contracting strategy

For Classification of a seagoing tanker, the Classification process and contracting strategy is easily decided. The contract for the design and construction of the floating unit is signed between the operator / owner and the shipyard. The associated contract specification will detail the requirements for Classification and the shipyard will contract directly the selected Classification society.

The Class contract between shipyard and the Classification society will typically cover the design and inspection activities at the shipyard assuming that all equipment falling under Classification and Statutory requirements will be delivered by the vendors together with separate Classification certificate, i.e. costs for equipment inspection Class certification are born by the vendor. The shipyard will add the requirements for Classification in the purchase order to the vendor, who can contact the Classification society for obtaining Class certificate either on a one-time basis, or enter into a type-approval regime.

When the tanker is ready for delivery, the Classification Society issues the final Class and Statutory certificates to the shipyard, which handles over this package to the Owner of the vessel. Contact between the Owner and the Classification Society during design and construction is limited as there is no formal contract between these two parties. All correspondence is to pass through the shipyard, usually by regular meetings between the three parties. But even here will the subjects to be discussed be limited to the scope of the shipyard as in case of any delay with the Classification of vendor packages, this will fall under contract between the vendor and the Classification society and hence protected by confidentiality requirements.

Classification of a FPSO is contractually more complicated due to the presence of several involved parties and the fact that the Classification process includes towing, mooring, installation and hook-up before the final certificate can be issued. This means that a certain number of “intermediate” certificates are to be issued to the various contractors.

The Classification society will typically communicate with the Hull, topsides and mooring designer and constructing yards. As previously mentioned, the society is therefore able to compare and act as integrating facilitator transferring and comparing data from one contractor to the other. It could therefore be of an advantage to the EPCI / Owner to request the Classification Society to take a more active role and to inform the regularly the EPCI / Owner about the overall progress in the phase of design, construction, commissioning and installation. This will require that the Classification society can pass information from one contractor to another and hence will need contractual backup allowing for such “break” on the confidentiality included in the Classification contracts.

The Classification services should be expressed in three categories:

- Classification (for verification of Rule requirements),
- Statutory (for issuance of Statutory certificates on behalf of Flag or Coastal State Authorities),
- Additional services in terms of interface management, project management, reporting and eventually certification / verification of Company specifications for hull, topsides, mooring, etc.

As these services result in reporting and exchange of information at different levels in the project organization, it might not be possible to include all services under one single contract.

For a given FPSO project, Classification contracts and related services can be dealt into three groups. The first one is the group of contracts with vendors for marine certification of their equipment packages, as required by the Classification rules. It requires often design review, either on a basis of a type approval of the product and/or one-time approval. It may include certification of the fabrication quality system. It also includes the required inspection and presence during tests at the site of construction. After successful process, the certificate is delivered to the vendor, who can ship his goods together with the Class certificate.

The second level of Classification contracts is dealing with the main contractors such as the constructing shipyard for the hull, the topsides yard and the mooring main contractor. Each package consists of design review and fabrication surveys, which includes construction, mechanical completion, pre- and commissioning activities.

An optional third level of Classification contracts is the “umbrella” contract grouping together all the project contracts and dealing with the delivery of the final certificate provided...
that all other parts of the Classification will be finalized. Such contract may be signed between the Classification Society and Project Owner, EPCI or one of the main contractors. The idea with such a contract is to cover the parts of Classification services which are not easily grouped into the other Classification contracts as limited to each contractor’s own scope. The counterpart signing the “umbrella” contract will hereafter be the main client and contact point for all Classification services. This level of contract gives the opportunity to add additional services in terms of project management. As example, if this contract is signed with the EPCI or the Project Owner, it could request the Classification Society to report on a monthly or weekly basis concerning progress on all other project contracts. Of course such reporting would require that each project specification would request the contractor to accept that Class would communicate directly with the EPCI / Project owner to avoid breach of confidentiality requirements.

“Umbrella” contracts can be negotiated and signed before or after the main contractors have signed their Classification contracts. The advantage with signing an “umbrella” contract as the first contract is that it opens for a general negotiation and fixation of Class fees for all services provided to the project. It can also be signed as the last contract to include the parts which have not yet been addressed by the other contracts.

An advantage of introducing the third level of contracts, “umbrella” contract, is to arrange the agreement at the corresponding level in the project organization for the required communication deliveries and associated costs. Example of “umbrella” contract is given hereafter:

- Co-ordination of Class, Flag, Coastal state and Certification activities
- Reporting on Class interface with main contractors
- Monitoring and reporting of work progress against master schedule
- Monthly progress reports
- Preparation of in-service survey program

It is advisable to evaluate the contractual setup with the Classification Society as early as possible. It can even be beneficial to describe the intended number of contracts and their overall content in a preliminary document to be issued by Class and annexed to the overall project specifications.

**Classification Project organization**

Large projects with many involved parties make communication and effective coordination of activities a challenge. For the Project Owner or EPCI, it should be possible to quickly have an overview of the progress in Classification services – and including possible certification and verification jobs. And the wider range of services performed by the Classification societies does also call for more emphasis on project management.

It is important that the Classification Society aim to establish a project organization for the FPSO project matching the EPCI / Contractor organization. This means a Project Coordinator is to be nominated for each contract on a given project. The person should have access to all relevant Classification data, including the equipment certification, and he is to be the focal point of contact for the contractor. He should preferably be located in an office near the contractor’s main office, or in the office most involved in executing the project. There should also be an overall Project Manager responsible for the entire project and for regular reporting if required by the Project Owner / EPCI. This Project Manager should be positioned high enough in the Classification society organization to be capable of allocating the necessary resources for execution of the project.

The existence of such project coordinators and project manager could perfectly be defined when planning the overall Classification services package.

For people working in the offshore industry, it might be quite surprising that this paper argues for nomination of project manager and coordinators, as it is the normal way to work in the industry. But for marine services for seagoing ships, the Classification society is used to work in an environment where the involved parties have a clear understanding of the role of the society, and rarely gives rise to any particular discussion. The project manager on marine projects is typically the person in charge of either the plan approval or the inspection at the constructing shipyard.

It is therefore recommended to the Project Owner / EPCI to express expectations to the required project management in the Classification Society.

**Project Management tool**

VeriSTAR Project Management is an open web based system where controlled access allows the Bureau Veritas project team work world wide. The system is designed to improve design review process, inspection management and information control for different types of facilities. Information is stored and secured in a unique database and accessed in real time through the internet or intranet.

Each Project is handled by a Project Manager and user’s profiles may be defined according to the role of the different people acting in the project.

The Project Management tool consists of the following three main environments:

- New Building units
- In-Service units
- Asset Integrity Management

![Figure 1: web based Project Management tool](Image)
New Building

The VeriSTAR New Building environment is designed to handle all types of marine and offshore projects, for class or non-class units and product certification projects.

It is intended to assist, through a single tool, surveyors, owners, EPCIs, shipyards and equipment suppliers in the management of design review, product certification and survey at site of a new building or conversion project.

The system provides the personalized scope of class intervention, in accordance with the classification contract and can also accommodate Company-specific contractual requirements.

All documentation can be managed online and the yard and manufacturer can submit electronic drawings, receive comments and reply to them online.

All parties, according to their access rights, can track the project’s progress on a real-time basis and identify the eventual bottlenecks.

Each project may cover the following activities:

- Design review (LPO)
- Product certification (BVN)
- Survey at yard (SAY)

The system generates the project system tree for the unit, providing the list of interventions for each activity and associated systems, sub-systems, components and items.

Project checklists are generated, including lists of interventions to be performed by experts to achieve the certification of the unit or equipment, such as required drawings for design review, equipment inspections and interventions at shipyard.

In-Service Status

Once the unit is built and installed, the database generated during the design and construction phases will remain available during the operation life of the facility. It allows easily access the design documents and certificates issued for the unit and its equipment.

For those units classed by Bureau Veritas, owners or operators can also access online the Classification and Statutory status of the facility, including:

- Unit’s general information (name, location, flag, etc.)
- Classification notations
- Survey schedule and scope
- Certificates with expiration dates
- Class reports.

Asset Integrity Management

For classed or non-classed facilities, a specific system allows the AIM team (managers, auditors and administrative staff) to work world wide, providing support at each step of the Integrity Management Cycle process.

The main features of the system are:

- Storage and management of the asset documentation
- Access information on the available engineering calculation models (structure, hydrodynamic, stability, mooring, etc.)
- Inspection management tool
- Anomalies and maintenance history and statistics
- Automatic reporting and possibility to exporting to corporate business systems such as SAP
- Access to Emergency Response Service data

The documentation database includes different types of data and accepts the most common windows files format (*.jpeg, *.doc, *.pdf, *.xls). It includes unit’s relevant drawings, engineering analysis and inspection reports.

Information about the available calculation models included in the AIM Program is also provided. It is helpful in particular during the periodical re-assessment of the asset condition, where relevant modifications might lead to updating of these models and consequently to re-analysis.

The main objective of the Inspection management tool is to support people acting in the AIM program along the Integrity Management Cycle process.

The tool is based on a pre-defined Unit’s System Tree, which is customized and described based on the asset configuration and for the systems and equipment included within the AIM Program. Every information and IRM activities is stored and linked to the respective system or item described in the asset System Tree.

Planned Inspections based on the asset’s inspection plan can be checked for each system or equipment, as the support documentation. An alert-system based on colors provides users with information on the short-coming or delayed tasks. It helps the Asset Integrity Manager prepare the inspection campaign.

Figure 2: AIM system environment

Maintenance and Repair actions in the systems items and equipment are recorded, as the support documentation. Therefore, previous repairs, modifications or replacements can be checked at any time.

Finally, comments and/or actions resulting from inspection results can be recorded and associated to any component system. It can be an anomaly, a defect or any information considered relevant in the asset integrity management and for future re-assessment of the asset.
Conclusions
The nominated Classification Society should early in the project process issue a document given an exact description of Classification boundaries with reference to marks and notations requested for the project. This document is also to indicate the established organization chart for the project including nomination of key people and their contact details.

It is advisable to inform the Classification Society about the details in certification packages requested for the project. This is to clarify possible overlapping of requirements and to map the possible conflicts for design codes and material requirements, if any.

Classification can also provide a range of verification services simultaneously with the design review, inspection at works and commissioning activities. The fact that surveyors are mobilized at certain locations and already spending time doing Classification work can optimize the time and resources to spend on such verification jobs.

The extensive experience with statutory requirements can assist the offshore project with valuable verification of marine safety standards – even if the unit will not be flagged during operations.

The package of Classification services can be split into several contracts between Class and main contractors and all grouped in an “umbrella” contract between the Classification society and the party nominated by the Project Owner as being in charge of the overall Class contract.

The Classification society must assure the availability of a powerful database and easy access to in-house communication for all project correspondence.

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Nomenclature
AIM Asset Integrity Management
API American Petroleum Institute
CVI Close Visual Inspection
EPCI Engineering, Procurement, Construction and Installation
ERS Emergency Response Service
FEED Front-end engineering and design
FPSO Floating Production, Storage and Offloading System
IACS International Association of Classification Societies
ILLC International Load Line Convention
IMO International Maritime Organization
IRM Inspection, Repair and Maintenance
MARPOL International Convention for the Prevention of Pollution from Ships
MODU Code for the Construction and Equipment of Mobile Offshore Drilling Units
PID Piping and Instrumentation Diagram
RAM Reliability and maintainability
SAP Systems Applications and Products in Data Processing
SOLAS Safety of Life at Sea

1 Rules for the Classification of Offshore Units 2006, Part D – Bureau Veritas NR 445
iii M.F. Renard, P. Biasotto & B. Lanquetin: OTC 18142 “Specific Tools and Services for Integrity of F(P)SOs / Case Studies for GIRASSOL FPSO and a Concrete Unit”; OTC 2006.