ABS has revised its structural requirements for newbuild FPSO and FSOS and for single and double hull tanker conversions to FPSO/FSOS. Environmental loads, operational loading conditions, low cycle fatigue, hull girder ultimate strength and the structural and loads interface between the hull and topsides production facilities are included in the new ABS requirements.

These requirements apply FPSO-specific loading conditions and prescribed strength assessment procedures for both newbuilds and conversions. Realistic tank load patterns and appropriate load combination factors are used in the structure assessment of FPSOs. FPSO site operations include variations in tank loadings due to the many loading and offloading cycles.

The ABS requirements include:

• Consideration of the sea waves and swells in non co-linear directions for the onsite condition
• Onsite fatigue strength assessment by including high cycle fatigue due to waves and low cycle fatigue due to cargo loading and offloading
• An evaluation of the interface structure between the hull and topside and also between the hull and position mooring system using FEA
• An evaluation of hull girder ultimate strength

Together with the sea waves and swell at a site location, the wave and swell loadings subject the hull structure to high cycle fatigue loads. The loading and unloading of the cargo tanks result in low cycle loads. The high and low cycle loadings contribute to the fatigue damage on an FPSO. Therefore a prescribed fatigue assessment is included in the new requirements that address these loads.
For tanker conversion to an FPSO, the strength and fatigue assessments must consider the tanker operations prior to conversion. After conversion, in addition to the tank loadings, account must also be taken of the topside loads and mooring system loads. These conditions, prior to and after conversion, and required assessments are addressed.

Conversion requirements include:

- A determination of the environmental severity factors (ESF) based on the vessel’s past trading history, expected transit route and projected onsite location
- A reassessment of the scantling determination based on the onsite, transit, inspection and repair conditions
- An FEA based on the reassessed scantling

The ABS Eagle FPSO program has been developed to perform the environmental sea loads calculations, determine the environmental severity factors and perform fatigue and strength assessment for both newbuild FPSO/FSOs and conversions.

The FPSO program is comprised of three main components:

- Sea Environment Assessment System (SEAS)
  - Factors accounting for different wave climates during lifetime as a trading tanker (applicable to FPSO conversion), in transit and onsite
- Initial Scantling Evaluation (ISE)
  - Rule-based strength and fatigue evaluation
- Total Strength Assessment (TSA)
  - Three cargo hold FEA, FE-based strength and fatigue evaluation
  - Cargo block FEA, first principle based, as an alternative to a three-hold finite element analysis

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