

Offshore Applications

Offshore production applications carry additional considerations for compressor selection, packaging and analytical studies. A conservative approach to the selection will offer the benefit of longer time between maintenance, for less maintenance work and replacement parts in this remote environment. This would include reduced speeds, lower discharge temperatures and conservative rod load usage.

Offshore structures do not carry the immense mass of earth and concrete to absorb the many forces and couples associated with reciprocating compressors. Therefore, selecting a compressor for offshore installation must keep this in mind. When possible, a four throw compressor will carry lower forces and couples than a two throw compressor. A six throw compressor will carry even lower forces and couples.

The forces and couples associated with reciprocating compressors can come from a number of sources. The offset distance along the crank centerline between opposing throws creates a couple. Different reciprocating weights on opposing throws, or between pairs of opposing throws creates forces and couples. Ariel balances the reciprocating weight on opposing throws to a very tight margin to limit the unbalance forces. The reaction to the conversion from rotating to reciprocating motion at the crosshead guide creates vertical forces at the crosshead guides. Torsional vibration forces can resolve into lateral vibration forces on some configurations.

A heavier skid structure will be necessary for greater rigidity with offshore packages. This includes a "full pedestal width" construction, tying the structure under the crosshead guide support to the frame supporting structure.

Along with the torsional and acoustical analyses, a full mechanical analysis of the skid and surrounding supporting structure is necessary.

Gathering, vapor recovery, gas lift, gas re-injection and fuel gas booster for gas turbine generator are most common FPSO applications.

Dry sump is recommended for vessel pitch, roll and yaw. Most often, 316SST tubing and fittings as well as duplex oil filter are specified by end user customers for offshore environments.

Third party certification is often required for FPSO, or offshore applications. These would include:

- FPSO Floating, Production, Storage, Offloading Vessels
- FSO Floating, Storage, Offloading vessels, without the processing facilities
- FSRU Floating, Storage, re-gasification and offloading vessels
- FLNG Floating Liquid Natural Gas Production vessels
- FDPSO Floating, Drilling, Production, Storage and Offloading vessels

The third party certification requirements for FPSO applications are specified by FPSO Classification Organizations as listed here.

- ABS (American Bureau of Shipping) in USA
- DNV (Det Norsk Veritas) in Norway
- Lloyd's Register of Shipping in United Kingdom
- Bureau Veritas in France

FPSO documentation as required by all the third party certification is termed Design Review by the classification organization.

1. For each compressor, an affidavit is required from the manufacturer stating that design and fabrication have fully complied with an applicable API standard, except as noted. All exceptions shall be listed and if no exceptions are taken to the specifications, then the affidavit should indicate as such.

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- 2. Compressor performance runs information shall be provided indicating maximum allowable suction and discharge pressures and corresponding temperatures (both maximum and minimum), as well as maximum rated discharge pressure.
- 3. For compressors handling hydrocarbons, casing (cylinder) drawings and casing (cylinder) strength calculations may be required. The casing strength calculation shall include cylinder thickness calculation and inlet/outlet nozzle reinforcement calculation. If casing drawings cannot be submitted due to confidentiality, a sketch of casing drawing including diameter and thickness and inlet/outlet diameter and thickness information is acceptable.
- · Ariel requirements to FPSO documentation are compilation and documentation of
- · Compressor configuration with serial numbers and general model ratings
- Compressor frame and cylinders outline drawings
- Compressor frame and cylinders data sheets
- Cylinder casing design data
- Compressor performance data sheets
- Comments and exceptions to API-618 and 11-P Specifications
- ASME Code Calculations for Special Flanges

Offshore environments can be corrosive due to salt water spray. Cylinder and valve cap bolts can be provided in 17-4PH stainless steel if salt water corrosion is a concern. The NACE Cylinder Bolting option will apply 17-4PH bolting and studs for the cylinder heads and valve caps.