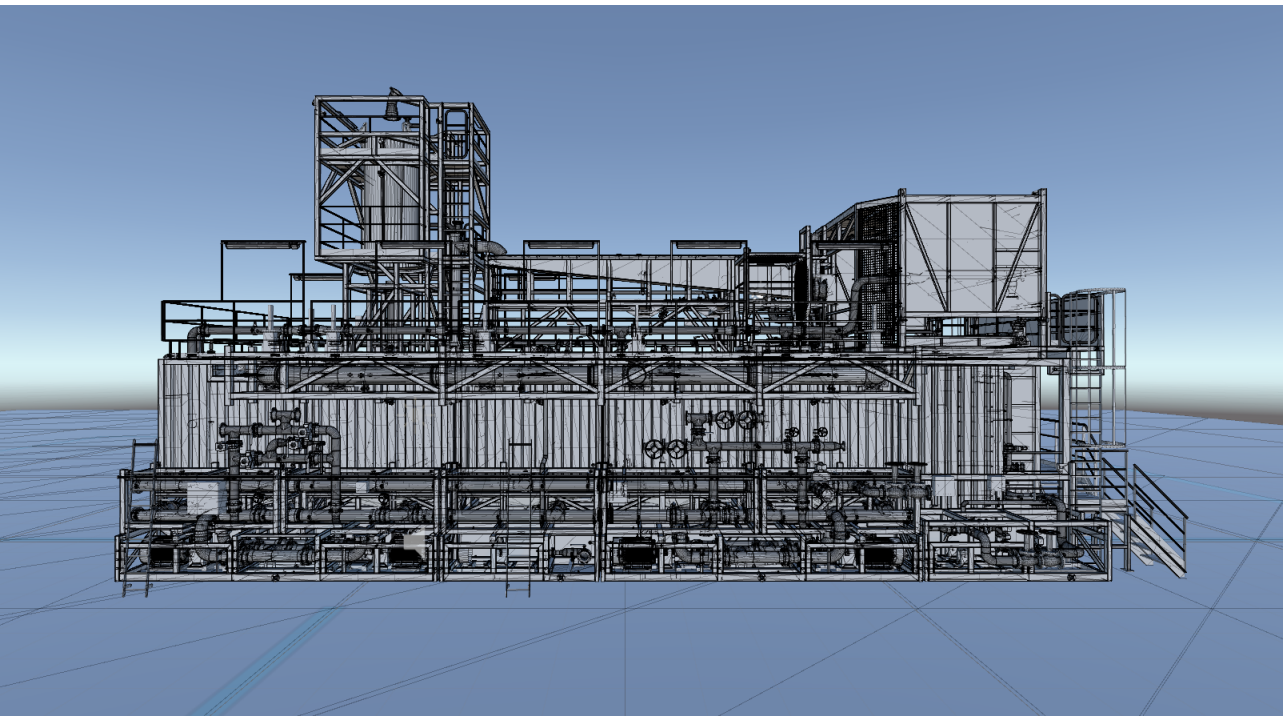
OFFSHORE MODULES AND PROCESS SKIDS

ENGINEERING AND TECHNICAL ASSISTANCE



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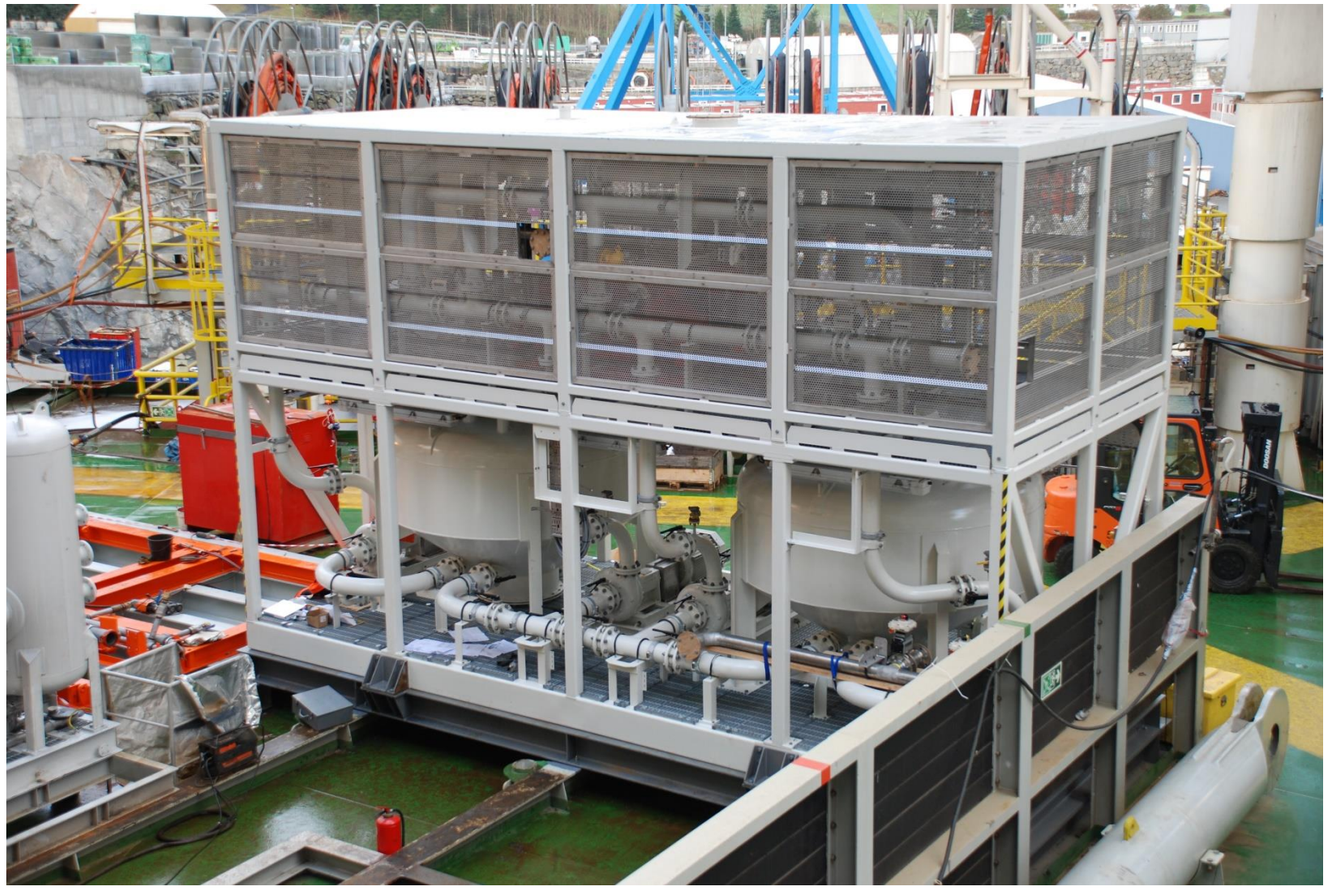


Photo top left
Cuttings reinjection unit being lifted during transportation to the rig.

Photo bottom left
Overall view of West Elara jack-up drilling rig with cuttings reinjection unit on deck.

Photo right
Cuttings reinjection unit installed onboard West Elara jack-up drilling rig.

OFFSHORE MODULES
CUTTINGS REINJECTION UNITS

Engineering and technical assistance

The cutting reinjection units have been designed so as to comply with Norsok D-001 Drilling Facilities and DNV OSS-101 Rules for Classification of Offshore Drilling and Support Units, and intended to operate in an offshore environment within a Zone 1 classified area. Since the packages are not meant to be lifted offshore, they have been designed so as to comply with the requirements laid out in DNV's Rules for Planning and Execution of Marine Operations for onshore lifting operations.

Other types of packages within our competence:

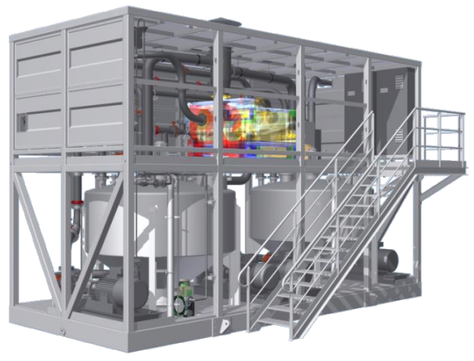
- Chemical injection systems.
- Methanol injection systems.
- Riser gas handling systems.
- Gas scrubbing and inter-cooling systems.
- Sand handling and treatment syst.
- Oil, gas and water separation syst.
- Fuel transfer systems.

Locations with strict environmental regulations require unique and integrated waste management solutions, with traditional solutions resulting in significant expenses in waste transportation and final treatment and disposal of cuttings. The use of cuttings reinjection packages allows for significant savings with respect to traditional approaches, while at the same time ensuring compliance with “zero discharge” requirements.

Cuttings reinjection has, over the last few years, become recognized as an environmentally responsible and cost-effective disposal method for offshore drill cuttings. Our cuttings reinjection packages, designed to exact specifications and basic design provided by the customer, are in use in hazardous areas within state of the art drilling rigs, for continuous injection of seawater and slurries, drill cuttings, drilling muds and sand into subsea strata, over a wide range of flows and pressures.

All our modules and mechanical packages are designed so as to comply with strict rules and regulations and are engineered to operate in harsh and hazardous environments. Where certification is required by a Classification Society, we liaise and take responsibility to communicate and support the design review process, providing documtation and acting upon comments as they are available.

The reinjection unit above is installed onboard a Drill (N) Class jack-up drilling rig and it is shown undergoing verification prior to the commissioning stage.



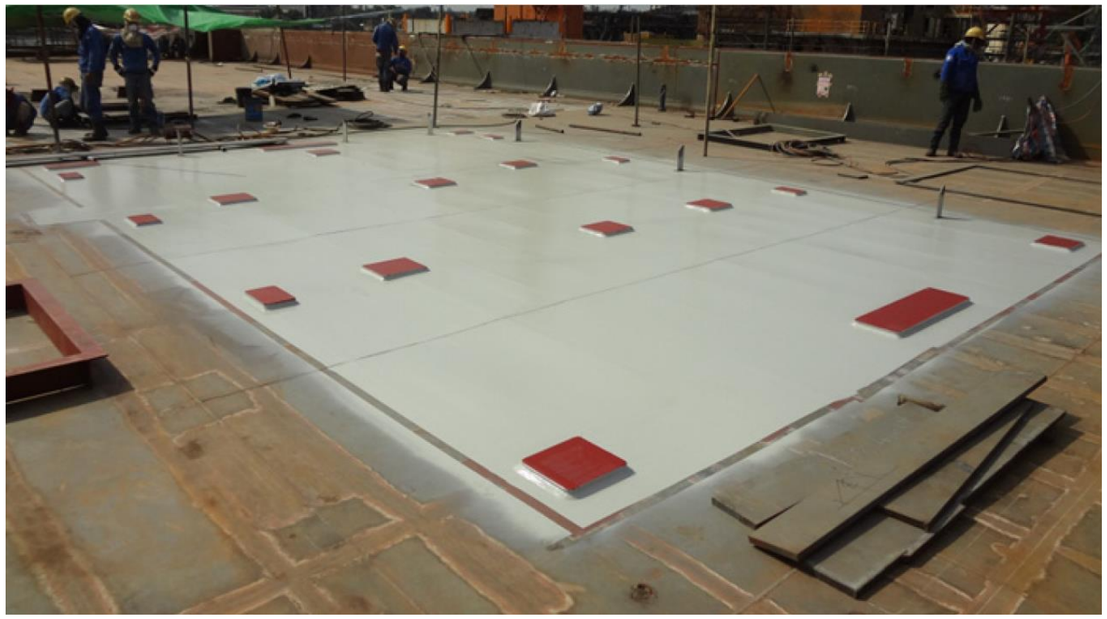


Photo top
Design assessment of foundation pads underneath cuttings reinjection unit.

Photo bottom
Cuttings reinjection unit (pump segment) being lifted onboard West Linus jack-up drilling rig.

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The cuttings reinjection units have been designed so as to comply with Norsok D-001 Drilling Facilities and DNV OSS-101 Rules for Classification of Offshore Drilling and Support Units, and intended to operate in an offshore environment within a Zone 1 classified area.

Since the packages are not meant to be lifted offshore, they have been designed so as to comply with the requirements laid out in DNV’s Rules for Planning and Execution of Marine Operations for onshore lifting operations.

OFFSHORE MODULES
CUTTINGS REINJECTION UNITS

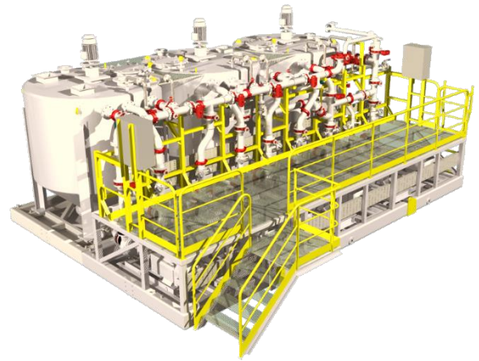
Engineering and technical assistance

We design and engineer our modules within a full 3D environment, allowing us to efficiently plan and execute construction, and share reliable information with the client during the design review process.

This procedure facilitates fine tuning to ensure each module is properly fitted out, with space and weight constraints in mind, allowing the client to confirm its fitness for purpose at an early stage of design.

Each and every discipline is included in the 3D model, and potential interferences identified prior to production drawings being issued for formal approval.

All participants in the design and manufacturing process are provided with the same reference model which can be used as supporting material during clarification discussions. Whenever changes are made to the model, a controlled revision which is associated to the new drawing revisions is handed over and propagated to the different recipients.



OFFSHORE MODULES

MODULAR DRILLING MUD SYSTEM

Engineering and technical assistance

The modular drilling mud system complies with DNV's Offshore Standard OS-E101 Drilling Plant, and the individual modules have been designed so as to comply with DNV's Standard for Certification No. 2.7-1 and 2.7-3. Due to the potential presence of H_2S, the piping system is compliant with sour service requirements (ISO 15156).

PROCUREMENT

Material and equipment

We have taken responsibility of procuring specific material and equipment with long lead times, covering the whole scope from equipment specification, procurement, expediting, transportation and logistics, customs clearance, and traceability.

INSTALLATION OF EQUIPMENT

Equipment and systems

All equipment meant for installation has been reviewed upon reception so as to determine specific requirements laid out by the manufacturer that might need to be accounted for prior to installation. Actions have been taken to follow up on such instructions, on a case by case basis, and as deemed necessary.

MECHANICAL TESTING

Equipment and systems

Statutory requirements in terms of mechanical testing or load testing have been followed up to ensure compliance with the relevant standards. Where necessary, calibrated equipment such as manometers or weight cells which are needed to carry out these tests have been sourced and made available.

COATING SURVEY

Steelwork and painting

As part of a broader scope of inspection carried out by Frosio certified personnel, we liase and ensure compliance of the inspection with contractual requirements. In addition, we provide insight into critical areas where coating application can be more troublesome and require closer verification.

MECHANICAL COMPLETION

Equipment and systems

From developing mechanical completion checklists, to sourcing and providing specific equipment to measure and verify parameters of interest. We also provide additional information of interest, such as sounding tables to verify capacity of the storage tanks and calibrate the level transmitters.

PRECOMMISSIONING

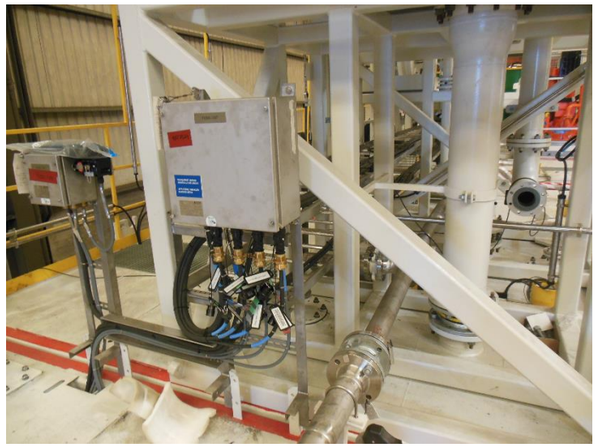
Equipment and systems

During functional testing and precommissioning we assist and take responsibility to ensure that necessary resources such as watter (in sufficient capacity to fill the storage tanks) or power supply (with sufficient power at the desired voltage and frequency) are available thorough the duration of the tests.

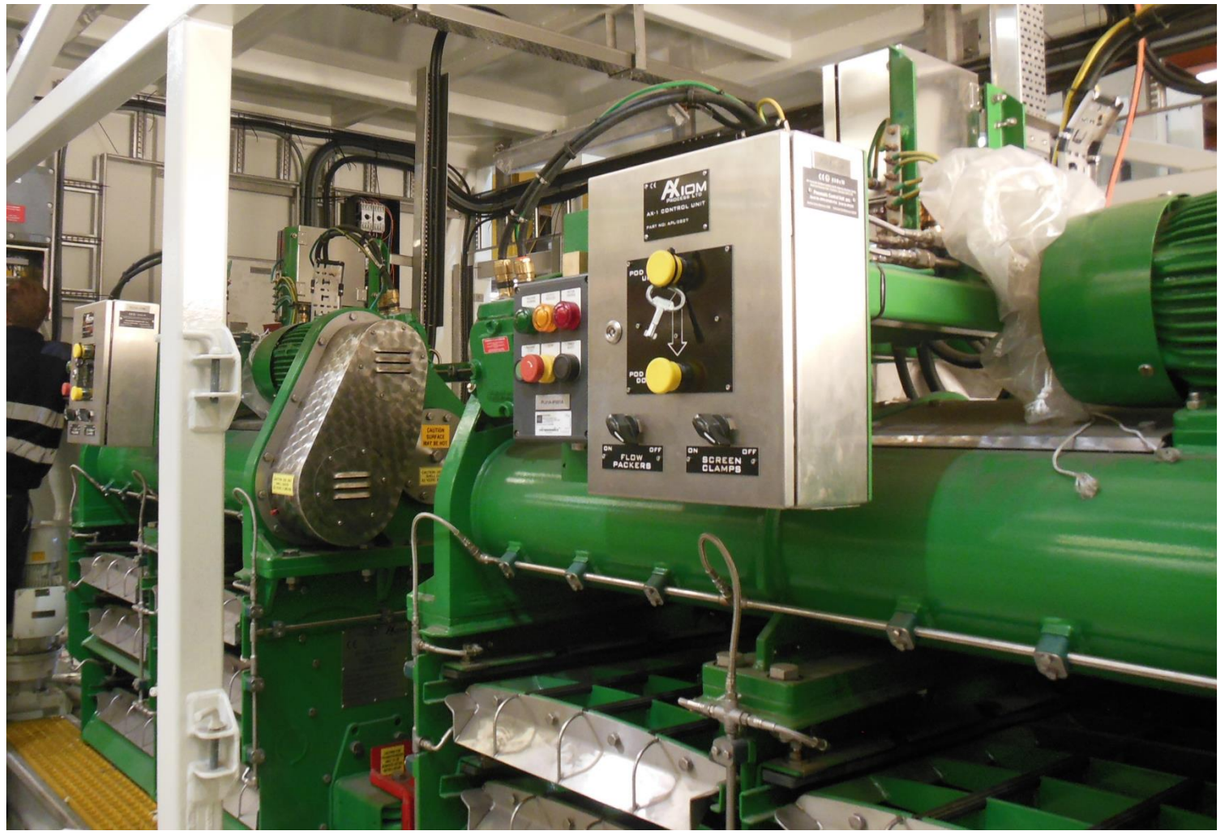
Photo left

Pump discharge manifold and associated piping package undergoing assembly and installation.

Photo top
Overall view of modular drilling mud handling and treatment system.



Second photo
Detail view of junction boxes, piping and appurtenances located on main deck.



Small photo left
Detail view of VFD control panels (supplied by others).

Small photo right
Detail view of piping and appurtenances located inside drilling mud tank.

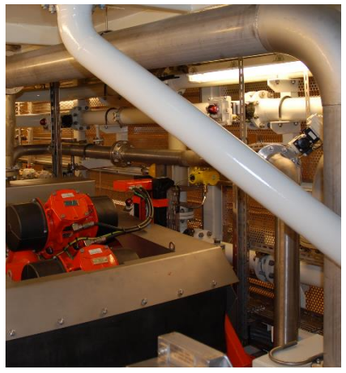


Photo bottom
Detail view of removable piping skids located on side wall during mechanical completion.

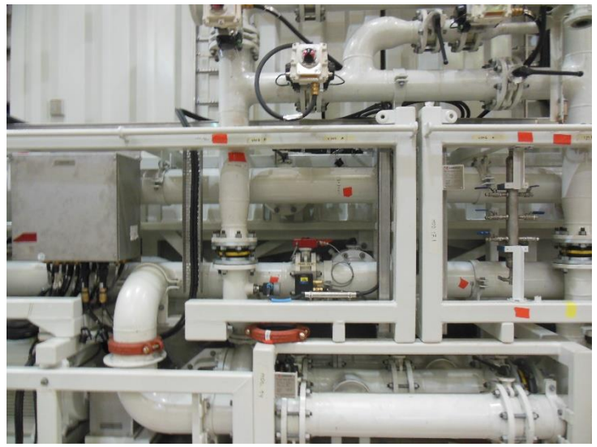


Photo above
Miscellaneous drilling mud treatment equipment.

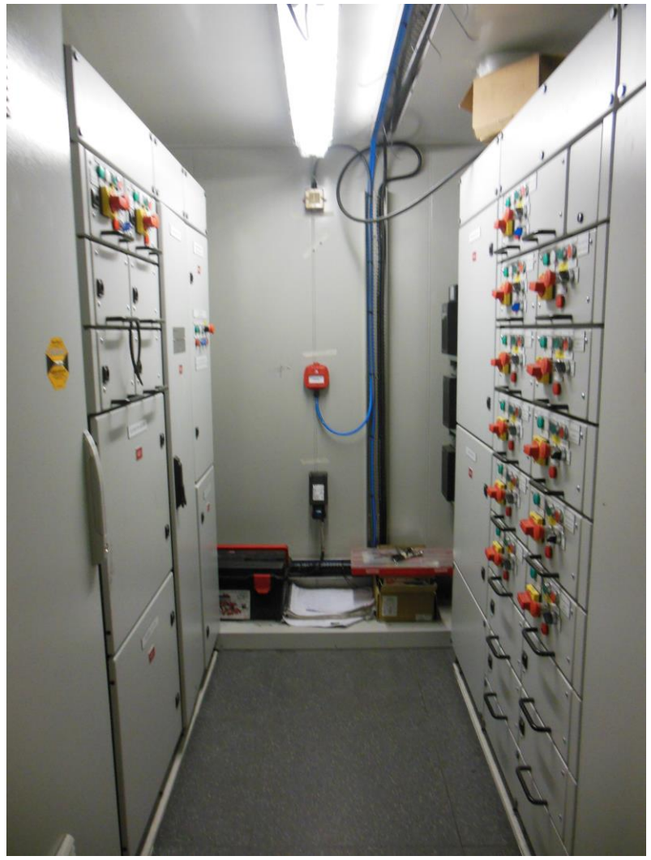


Photo top left
Interior of LER room with ongoing electrical installation activities.

Photo bottom left
Interior of LER room with ongoing insulation and electrical grounding activities.

Photo right
LER room being lifted onboard a cargo vessel for transportation.

DRILLER CABINS & **LOCAL EQUIPMENT ROOMS**

Engineering & technical assistance

Designed so as to be permanently installed onboard production vessels, or to be transported to the installation site as temporary equipment, Local Equipment or LER rooms have to comply with strict zone classification requirements as well as general requirements imposed by the relevant rules for classification. All units are engineered to function within Zone 2 or Zone 1 hazardous areas, fire rated to A60 and fitted with fire and gas detection systems for integration with the installation site.

Closely related to the design of LER rooms, driller cabins must account for additional HSE factors derived from the continuous presence of operators. In a nutshell, designs must result in an adequate working environment where noise and vibrations are suppressed, temperature and humidity are controlled to comfort levels, lighting is precisely tuned, and ergonomy factors play a significant role.

DESIGN OF DRILLER CABINS

Design compliant with rules for classification of offshore drilling and support units and meant for permanent operation onboard the unit

DESIGN OF DRILLER CABINS

Design compliant with rules for classification of offshore drilling and support units and meant for permanent operation onboard the unit

Besides driller cabins and LER rooms meant for permanent operation onboard the unit, we can also design temporary modules compliant with Norsok Z-015 requirements capable of operating within a Zone 1 classified area.

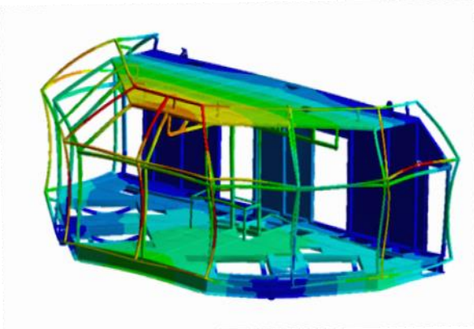
These modules can be customized depending on specific requirements, based upon a series of templates we can build upon.

Please get in contact for more details.

We have designed and assessed the existing design of driller cabins customized for specific drill floor arrangements, for both land rigs and floating drilling units.

Apart from the structural design, our scope of supply includes the architectural design, fire protection (both passive and active), ventilation and pressurization, gas detection, lighting, as well as additional considerations related to ergonomy and HSE.

Due to their location at the drill floor, driller cabins typically operate within a Zone 1 classified area, with a safe area generated inside through positive pressurization. Additional safety considerations such as the installation of explosion proof equipment inside can be identically accounted for.



DESIGN OF DRILLER CABINS

Structural analysis of primary structure during lifting operation

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