



Exploration & Production

GENERAL SPECIFICATION

STRUCTURAL

GS EP STR 901

**Design rules and construction standards
for ancillary structures of offshore installations**

06	10/2009	Revised sections 2, 3.4.1, 4.6 & 4.10
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03	10/2004	Revised section 3.4.1 - Anodes fixing and 3.7.5 - Landing stage (Addition of standard for surfer landing on boat-landing (on jacket) and on supplies, tugs and FPSO)
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1. Scope

This document defines the minimum requirements to be applied in the design and construction of standard ancillary structural elements on petroleum installations.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Where national regulations exist, their provisions and those of the standards and codes to which they refer shall be mandatorily applied, supplementing or amending the provisions of this document.

If there are no mandatory national regulations, the international standards and codes shall be applied.

COMPANY may accept proposals for recommendations based on international standards and codes or national or foreign standards and codes (the reference documents, if any, shall be stated).

Standards

Reference	Title
CAP 437	Offshore helicopter landing areas
ICAO - Annex 14	Volume II Heliports
ISO 1460	Metallic coatings. Hot dip galvanized coatings on ferrous materials. Gravimetric determination of the mass per unit area.
ISO 1461	Metallic coatings - Hot dip galvanised coating on fabricated iron and steel articles
ISO 14122-3	Safety of machinery - Permanent means of access to machinery - Part 3: Stairs, stepladders and guardrails
ISO 14122-4	Safety of machinery - Permanent means of access to machinery - Part 4: Fixed ladders
NF EN 131-2: 2003-11	Ladders - Part 2: Requirements, testing, marking

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

The provisions of this document shall be applied in light of the supplementary documents issued by COMPANY, including:

- Job specification
- Data sheets
- Articles and clauses; list of tasks
- Quality assurance provisions.

Reference	Title
GS EP STR 102	Design of offshore topside structure

3. Technical and operational definitions

3.1 Floors and bulkheads

3.1.1 Stiffened plate for floors and bulkheads

Free space between the stiffeners or corrugation troughs shall be less than 100 times the thickness of the plate.

3.1.2 Decking plate

Flat plate shall be used. Where specifically required, tear plate with a minimum relief of 1.5 mm is allowed.

In circulation areas, flat plate with anti-slip paint shall be used.

If floor plate is discontinuous under equipment (i.e. not required for maintenance, etc.) then it shall extend sufficiently under the equipment and be provided with kick-plates to avoid any risk of injury.

3.1.3 Grating

- Unless otherwise arranged and justified, the normal steel grating shall comprise 30*5 mm load-bearing bars serrated on a maximum 24 mm pitch (20 mm ball test) and galvanized to 700 g/m² (ISO 1460/ISO 1461 or equivalent).
- **Composite** material gratings shall not be allowed on evacuation routes, in areas which are accessible to crane use, or which are served by overhead runway beams. In other

areas such as secondary access, equipment access platforms and small mezzanines which are not subject to heavy maintenance, composite material gratings may be used.

- In case composite material gratings are used, they shall comply with **GS EP STR 102** requirements and Particular Project Specification.
- Use of composite material gratings may be contemplated in water treatment modules subject to heavy condensation in warm environment.
- Use of composite material gratings may be contemplated but subject to COMPANY approval in areas where (corrosive) chemical handling takes place.
- Composite material gratings may be used on boat landings and spider decks (i.e. upper level of jacket) with the exception of muster area if any, and subject to COMPANY approval.
- Whenever used, the composite material elements shall fulfil the standards set for one in steel (i.e. they shall have the same load-bearing capacity and achieve sufficient rigidity). They shall be made of fire retardant material, certified to a recognized fire standard according to the risks present, and be U.V. resistant.
- When composites material gratings are used on an installation, sufficient spare parts need to be specified and provided.
- Due attention shall be paid to composite material gratings penetrations details so as to avoid weakening the panels.
- Gratings under flare burners; the gratings and guard rails may be of heat-resisting steel if necessary.
- If floor plate or grating is discontinuous under equipment (i.e. not required for maintenance, etc.) then it shall extend sufficiently under the equipment and be provided with kick-plates to avoid any risk of injury.

Grating panel fixings: the project documentation shall specify the type of fixing selected with the following conditions:

- **Mooring blocks:** minimize the random risks of loosening and loss of mooring blocks in transportation and normal operation.
- **Electrically welded stud bolts:** The corrosion-resistant coating shall be carefully reworked after welding, according to an approved procedure.

- **Steel pins:**

HILTI X-BT fasteners may be used to fix grating on secondary or non-structural steels ≥ 8 mm thick.

The HILTI X-BT system is composed of:

- Power actuated tool DX 351 BTG M8
- Drill tool X-BT 4000 A
- Drill Bit TX-BT 4/7-110
- Fastener Pin X-BT M8-15-6 SN12R
- Grating Disk X-FCM R with different depths to accommodate grating height.

Similar steel pins shall be subject to qualification tests, ABS or/and Lloyd's Register approval and COMPANY approval.

HILTI XCR fasteners or similar ones are not allowed.

Steel pins shall not be used in areas of the splash zone and subject to wave loading.

Steel grating shall be welded in areas of the splash zone and subject to wave loading.

Subject to COMPANY approval, in areas of the splash zone and subject to wave loading, composite material gratings may be fixed preferably by non metallic fasteners (with strips) or by HILTI X-BT fasteners or similar approved steel pins. Stainless steel (AISI 316 as a minimum) bolted clamps may be used also to fix composite material gratings but subject to COMPANY approval.

Steel pins shall not be used:

- On high strength steel with $F_y > 400$ MPa (S420 in particular and above)
- On special and first category members. Bolted clamps or tack-welding shall be used.

Stair treads shall not be fixed by steel pins (vertical shear, no inspection/replacement...). Only bolts are acceptable.

HILTI X-BT fasteners or similar approved steel pins shall be installed no closer than 10 mm from the edge of a flange or cut-out and no closer than 20 mm between fasteners.

HILTI X-BT fasteners or similar approved steel pins shall be located clear of primary structure welds by a minimum distance of 100mm.

Typical grating fixation drawing and layout of the steel pins/fasteners location shall be issued and submitted to COMPANY for approval.

Any damaged coatings shall be repaired above and below the impact areas in accordance with an approved procedure.

Instructions of HILTI X-BT or similar approved steel pins Manufacturer shall be fully applied. A copy of these documents shall be part of the construction yard dossier.

Every day, before the first application, qualification tests at yard shall be performed to calibrate the power and high precision cartridge in accordance with the instructions of HILTI X-BT or similar approved steel pins Manufacturer, in order to control the tools and cartridges as insufficient or excessive power is very detrimental for this kind of fasteners.

All the users on the yard of the HILTI X-BT or similar approved steel pins shall be trained by Manufacturer engineer and have record of the training done.

- **Spot welding:** The corrosion-resistant coating shall be carefully reworked according to an approved procedure. Areas in which dismantling is necessary (maintenance, equipment transfer areas) shall be defined and fixing types specified.
- **Other:** to be specified.

For any bolted fasteners, redundancy shall be provided to avoid that failure of two fastenings does not lead to total collapse or unstability or danger for personal injury.

Large hole in grating plates for crossing of pipes flanges shall be edged with 150*6 mm plate. Small hole shall be edged with 30*5 mm plate.

For all levels located inside areas that may be subject to wave loads, the gratings and fixings shall withstand all hydrodynamic forces, slamming in particular.

3.1.4 Service hatches on wells

These shall be of the same type as the main decking.

They shall be designed to ensure that they cannot pass through the opening.

Opening dimensions: square with a side of 0.8 m or rectangular with a diagonal greater than 1.1 m and a width greater than 0.6 m.

3.1.5 Penetrations through class A and/or H bulkheads or floors

These penetrations shall comply with the specifications and satisfy the tests according to resolution A754 of the "IMO" (International Maritime Organization) and SOLAS, and the systems shall be approved by an authorized certification authority.

Penetrations through blast walls is prohibited unless the systems shall be approved by an authorized certification authority or justified by detailed structural analysis (or testing) to demonstrate integrity of the structure (and its welds) globally and in detail around the penetration.

3.1.6 Splash protection/Flameproof/Fire wall

Splash protection wall for separating the drilling area from the production area should be made of ribbed 316L stainless steel cladding panels, welded, bolted or rivetted together (minimum 1 mm thick).

Flameproof wall: comprising materials which must be mechanically resistant and proof to the passage of flames and hot or combustible gases. To be considered flameproof, it must be at least 1.6 mm thick if made of 316L stainless steel and 4 mm thick if made of steel.

Fire wall: comprising materials which must be mechanically resistant and proof to the passage of flames and hot or combustible gases, and provide thermal insulation limiting rises in temperature on the side opposite from the fire.

3.2 Skidding beams on the drilling rig

The beams incorporated into the deck (mainly Africa) shall be designed to support the use of jacks and a locking system. For this:

- The top of the top sill shall be located 100 mm above the decking
- The top sill shall have a constant thickness of 50 mm
- The skidding beams shall extend at least 9.45 m beyond the centre line of the limit wells.

3.3 Bracing

For guy wires made of steel rope (galvanized); the ends shall be fitted with a clew iron or equivalent at each end, so they can be replaced. The guy wires shall be continuous for the greasing apparatus. If made of 316L stainless steel, they shall not be subjected to heat and sprinkling.

3.4 Equipment fixings

3.4.1 Anodes (fixings)

Anodes shall, wherever possible, be installed in a substantially vertical plane of the structure (note that anodes must be installed in casings and sumps too).

- Doubler plates: connection of anodes to jacket structure shall be made via doubler plates, with a thickness greater than twice the thickness of the anode tube, and with a fillet weld size of 0.7 x doubler plate thickness.
- Doubler plates shall be 35 mm more (all around) than the dimension of incoming brace foot print and shall have 50 mm radius corner.

- Anode connections shall be designed for all applicable load cases, including fatigue induced by vibration during pile/CP driving, fatigue during transportation and for installation loads (launching).

The anode tube shall be welded onto the doubler plate by a full penetration weld.

3.4.2 Riser fixings

Risers should be fixed to the structure by collars. A coating of 8 mm thick Neoprene or similar according to the temperature of the riser in service shall be inserted between the riser and the collar (coating hardness: 60 to 70 Shore).

The fixing shall:

- Immobilize the riser horizontally but not axially, except at the anchor point
- Not damage the coating on tightening, on movement due to axial or radial expansion
- Be provided with nut locks
- Have electrical continuity.

Provision for future risers: the diameter of the riser is liable to change. The provision shall comprise greased plates and retaining plates.

3.4.3 Skid-mounted equipment

Skids shall be bolted, clamped or welded.

To avoid corrosion in airgaps, a sealing weld is recommended.

A recommended solution is to use suitable stand-offs. These stand-offs, tall enough to be painted, shall be adjusted to compensate for any horizontal misalignment of the supporting beams. It shall be performed a pre-installation survey of levelness, and subsequent shimming of supports for large multi-support items of equipment and buildings.

3.4.4 Helistation

To provide at least four anchoring points to anchor a helicopter in accordance with [CAP 437](#). These anchoring points, unless otherwise stipulated in the project documents, shall be flush mounted, partially flush mounted or surface mounted. If surface mounted, the device shall comply with the applicable regulations (height and marking conditions).

3.4.5 Supports for small items

Supports for cable, instrument air and other small items such as junction boxes, heat shields and lighting fixtures shall avoid trip hazards and intrusion into the work areas, shall minimize obstruction of primary structures inspection, and generally shall minimize the number of small connections to main structure (particularly to flanges of primary girders).

3.5 Protection

3.5.1 General

Generally they should be a protection against swinging loads around lay-down areas, and against trolley impact at vulnerable locations along maintenance routes.

3.5.2 Transformers

Protection is required around the transformers:

This 1.8 m high protective enclosure shall comprise panels that can be removed at appropriate points to allow maintenance work and transformers to be replaced, with an open-worked mesh that does not allow ingress of items bigger than 5 cm.

Panels made of steel wire mesh shall preferably be galvanized after production to prevent corrosion, particularly around welds fixing the wires.

3.5.3 Protection of flowlines against falling objects

Flowlines should be routed in such a way that they are protected by the beams of the structure.

Flowlines arranged on a pipe rack shall be protected by a drill pipe deflector made of steel plate at least 15 mm thick and set at an angle of 15°.

3.6 Identification plate

The dimensions and markings shall be defined in the project specifications.

The panels shall be made of corrosion-proof, rigid materials.

The strength and fixings of the panels shall satisfy the design conditions of the structure.

3.7 Personnel access and protection

3.7.1 General

Contractors shall supply safe access provision for all temporary activities associated with construction or installation, whether these tasks are within the Contractor's scope or others. In particular it shall include access to points of rigging attachment, access to controls, and for hook-up of moorings and flow lines, etc.

Such access for offshore use should preferably be of welded construction, but if of scaffolding should comply to recognized standards applicable to the application.

All access for personnel involved in rigging operations, over-sea working, and other exposed positions shall be provided with secure safety rails and other anchoring points for fall-arrest systems. Scaffolding is typically not acceptable for such anchoring points.

3.7.2 Staircases

They shall be conform to the local regulations, to [ISO 14122](#) requirements and as a minimum shall comply with the following requirements.

These shall be classified in two categories:

- **Main staircases:** These shall satisfy the following conditions of use:
 - Frequent use
 - Access to a level occupied by numerous personnel
 - Preferred route for the evacuation of personnel and injured crew-members.
- **Secondary staircases:** these shall satisfy the following conditions of use:
 - Access to a sparsely populated level
 - Emergency staircase for isolated personnel
 - Individual, infrequent passage, without load.

The incline shall be as follows:

- 38° for Living Quarters
- 38° to 40° for main staircases of a production or wellhead platform
- 38° to 42° for secondary staircases of a production or wellhead platform.

The incline of main staircases shall be uniform throughout the same complex.

- **Flights:** maximum height 3 m for a single straight flight for main and helideck staircases and 4 m for a single straight flight for secondary staircases. For more than 4 m, the height of a flight shall not exceed 3 m per flight, and intermediate rest stages shall be provided. The length of the intermediate rest stages shall be 1200 mm. In the splash zone and where required for long flights and on hinged stairways, small cross bracings between the stringers shall be provided to limit the lateral buckling and displacements.
- **Staircase headway:** vertical headroom between the staircase and any obstacle. This shall be greater than 2.4 m for main staircases and 2.3 m for secondary staircases.
- **Staircase width:**

Type of area served	Main staircases	Secondary staircases
Drilling platform	1.00 m (1)	0.80 m
Production platform	1.00 m - 1.20 m (1)	0.80 m
Accommodation quarters	TBA	TBA

Note 1: For escape routes: 1200 mm.

- **Size of staircase stages:** Size of turning stages shall be large enough to allow stretcher to pass.
- **Loads:** staircases in areas that may be subject to heave shall withstand, in addition to the gravity and traffic loads, all hydrodynamic forces, slamming in particular.
- **Staircase treads:** Basic solution of metallic grating; the non-skid nosings shall be made of two ribbed reinforced bars protruding 1 cm upwards. Alternative solutions may be proposed and documented, such as Flowforge "Cardorundum nosing" or equivalent.

The nosing line shall be at least 50 mm below the top of the string.

3.7.3 Hand rails

3.7.3.1 "Fixed" handrails and "removable" handrails

They shall be conform to the local regulations and as a minimum shall comply with the following requirements.

The minimum height of the handrails shall be 1100 mm. The maximum width of the clear opening between the horizontal rails and also with the top of the kick-rail shall be 500 mm.

All handrails shall be fitted with a 150 x 6 mm kick-rail leaving at the bottom a maximum clear opening of 10 mm. The maximum spacing between the uprights shall be 1500 mm. The clear opening between two handrails shall be between 50 mm and 75 mm.

A general drawing shall define the locations of removable or fixed handrails.

Removable handrails shall be provided around the handling and lay-down areas. For temporary open hatches, intermediate sockets and removable posts with 3 lines of chains shall be provided where required.

The minimum free space behind the upper handrail shall be 100 mm.

3.7.3.2 Handrails shall be installed

- At the first level of jackets where removable handrails fixed with one bolt shall be provided on both sides of the walkways.
- Around the edge of all floors, hatches and staircase openings. Where openings along a wall or equipment are equal or less than 200 mm, a kick rail shall be provided, and are higher than 200 mm, handrails with kick rail shall be provided.
- For walkways or service levels on a main floor.
 - If the difference in level is equal or less than 0.5 m, handrail not required
 - If the difference in level is greater than 0.5 m, handrails required on both sides.
- For accommodation quarters, the internal upper handrail of the internal and external stair cases shall be continuous to provide a guide line in the obscurity. For the internal stair case, at least a single rail shall be provided and duly fixed along the wall.

3.7.3.3 Handrail characteristics

Handrails shall normally be made of steel. A composite material may be proposed for small access platform limited to one or two people, subject to the following conditions:

- Composite material handrails are prohibited around main decks, close to areas dangerous in case of failure (holes etc.), on main floors, stair openings and intensive handling areas.
- Installation areas shall be specified on drawings and approved by COMPANY.
- Whenever used, the composite elements shall fulfil the standards set for one in steel (i.e. have the same load-bearing capacity and achieve sufficient rigidity). They shall be made of fire retardant material, certified to a recognized fire standard according to the risks present, and be U.V. resistant.
- When composites material handrails are used on an installation, sufficient spare parts need to be specified and provided.
- Technical characteristics and loading and calculation conditions shall be submitted for approval, in particular with respect to the risks of impact and fire and shall comply as a minimum with [ISO 14122](#).
- The use of bolts for fixing handrails to the structure is not recommended, unless special corrosion protection measures are required.

When made of steel, the following shall be provided:

- A top rail of schedule 40 1.5" pipe
- A mid rail of schedule 40 1.5" pipe
- A kick rail secured to 150 x 6 mm flat uprights, 1 cm above the floor
- Uprights of schedule 40 1.5" pipe, no more than 1.5 m apart.

For FPSO hull and main deck, shipyard standard shall be submitted for COMPANY approval.