

# GENERAL SPECIFICATION

## CIVIL WORKS

### GS EP CIV 650

#### Floating Concrete Structure

|      |         |                                   |
|------|---------|-----------------------------------|
|      |         |                                   |
|      |         |                                   |
|      |         |                                   |
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## 1. Scope

The purpose of this document is to highlight the specificities of floating production facilities in concrete. **GS EP STR 651** provides the General Principles for a F(P)SO design made in steel. The present GS is highlighting the issues relative to the use of concrete material.

Therefore, this document describes Company interpretation of General Specifications as applicable to Floating Production Unit (FPU) and/or Floating LNG Unit (FLNG). It can be considered as a master Specification giving the rules for applying the other GS.

Concrete materials requirements are described in **GS EP CIV 300**.

Concrete design requirements are in **GS EP CIV 301**.

**GS EP STR 102** gives requirements for the design of offshore topside structures.

**GS EP STR 661** gives requirements for the mooring design.

The first example of Concrete FPU was N'Kossa barge started up in 1996 in Congo.

For concrete floating pontoon used in harbor for marine facilities, this GS is applicable also.

This GS will be the foundation of the Project Particular Specification that the designer shall write in accordance with the State Of Requirement and the Basis of Design of the project.

## 2. Reference documents

The reference documents listed below form an integral part of this General Specification.

### External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

| Reference                           | Title                                                                                                |
|-------------------------------------|------------------------------------------------------------------------------------------------------|
| <a href="#">ACI 440.5</a>           | Specification for construction with Fiber-Reinforced Polymer Reinforcing bars                        |
| <a href="#">ACI 440.6</a>           | Specification for Carbon and Glass Fiber-Reinforced Polymer Bar Materials for Concrete Reinforcement |
| <a href="#">ASTM C876</a>           | Standard Test Method for Corrosion Potentials of Uncoated Reinforcing Steel in Concrete              |
| <a href="#">CAN/CSA-S6-06</a>       | Canadian Highway Bridge Design code                                                                  |
| <a href="#">CIRIA C674</a>          | The use of concrete in maritime engineering 2010                                                     |
| <a href="#">CAN/CSA-S807-10</a>     | Specification for Fibre-Reinforced Polymers                                                          |
| <a href="#">DNV-OS-C101</a>         | Design Of Offshore Steel Structures                                                                  |
| <a href="#">DNV-RP-B401</a>         | Cathodic Protection Design                                                                           |
| <a href="#">EN 1991 (All Parts)</a> | Eurocode 1 - Actions on structures - All Parts                                                       |
| <a href="#">EN 1992 (All Parts)</a> | Eurocode 2 - Design of concrete structures - All Parts                                               |

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| Reference             | Title                                                                                                   |
|-----------------------|---------------------------------------------------------------------------------------------------------|
| ISO 12696             | Cathodic Protection of steel in concrete                                                                |
| ISO 14001             | Environmental management systems                                                                        |
| ISO 14484             | Performance guidelines for design of concrete structures using fibre-reinforced polymer (FRP) materials |
| ISO 16204             | Durability - Service life design of concrete structures                                                 |
| ISO 19900             | General requirements for offshore structures                                                            |
| ISO 19901 (All Parts) | Specific requirements for offshore structures - All Parts                                               |
| ISO 22966             | Execution of concrete structures                                                                        |
| ISO 2394              | General principles on reliability for structures                                                        |
| ISO 9001              | Quality Management Systems - Requirements                                                               |
| AFGC Recommendations  | Ultra High Performance Fibre-Reinforced - June 2013                                                     |

**Total General Specifications**

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

| Reference     | Title                                                                                             |
|---------------|---------------------------------------------------------------------------------------------------|
| GS EP CIV 300 | Reinforced and prestressed concrete                                                               |
| GS EP CIV 301 | Design of reinforced and prestressed concrete                                                     |
| GS EP COR 103 | Design of cathodic protection of offshore floating structures                                     |
| GS EP COR 350 | External protection of offshore and coastal structures and equipment by painting                  |
| GS EP EXP 311 | Plant integrity - Minimum inspection requirements                                                 |
| GS EP STR 102 | Design of offshore topside structure                                                              |
| GS EP STR 601 | Floating Unit Integrity Management System Requirements                                            |
| GS EP STR 602 | F(P)SO - Requirements for the Certification of Compliance with International Maritime Conventions |
| GS EP STR 651 | General principles for a F(P)SO design                                                            |
| GS EP STR 652 | F(P)SO - Steel hull design requirements                                                           |
| GS EP STR 661 | FPSO - Design requirements for mooring and anchoring systems                                      |
| GS EP STR 901 | Design rules and construction standards for ancillary structures of offshore installations        |

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### 3. Definitions

- **SoR** is the Statement of Requirement.
- **BoD** is the Basis of Design.
- **FPU** is a Floating Production Unit. (No Storage facilities).
- **CFPU** is a Floating Production Unit made in Concrete.  
For simplicity, we use the abbreviation CFPU throughout this document for Concrete FPU.
- **LPG**: Liquefied Petroleum Gas.
- **LNG**: Liquefied Natural Gas.
- **Hull**: includes hull structure, marine systems and any other equipment located inside the hull.
- **Topsides**: corresponds to the facilities located above hull used for process, utilities and other related functions.
- **Turret**: corresponds to the structural, mooring and riser support parts of a turret.
- **Appurtenances**: FPU specific elements including their foundations which are protruding from the hull not normally existing on ships (such as risers supporting structures, boat-landings, mooring support structures, topsides stools, protectors, flare foundations...). Most of the time, these appurtenances will be in steel and designed in accordance **GS EP STR 651** excepted topsides stools that could be in concrete.
- **Fore** or **bow** refers to the end of hull where flare and possibly turret are located. The CFPU is generally towed by this end. Note that for interpretation of ship rules during towing, the end from where the CFPU is towed shall be treated as a bow. Moreover, for interpretation of ship rules on site, the end facing the prevailing waves shall be treated as a bow as well.
- **Bow Area** covers the hull deck area where usually towing equipments are installed.
- **Aft** or **stern** refers to the bow opposite end, where living quarter is generally located.
- **Hull deck**: refers to the uppermost continuous deck of the hull. The term of main deck, sometimes used for process deck shall not be used.
- **Process deck** is the Topside lower deck.
- **Process tank**: refers to hull compartment dedicated to process function such as wash tanks, settling tanks. If usually in CFPU, no process tank is in the design, it's anticipated the possibility for designer to considerer the possibility to install such storages in the hull.
- **LQ: Living Quarter** includes the Hotel / Catering functions, the helideck and usually the Central Control Room. LQ level are numbered from the level corresponding to the process deck level (A deck) upwards to roof level below the helideck. In contrary of steel hull, LQ for CFPU is not in the same contract and interfaces shall be managed.
- **Lay-down Area**: The Laydown Area is an area situated in front of the LQ dedicated for the temporary storage of goods/spares/consumables which are transferred onboard the CFPU by one of the pedestal cranes.