



Exploration & Production

GENERAL SPECIFICATION

CIVIL WORKS

GS EP CIV 203

Design of harbour

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1. Scope

This general specification is to define the Engineering CONTRACTOR scope of work. This specification may be subject to modification or addition if the COMPANY so considers necessary.

The harbour, which is dealt with in this specification, shall be used by the COMPANY for its sea or river installations and possibly to ensure commercial traffic, after agreement has been reached between the COMPANY and the government of the country in question.

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.

When local national standards, regulations and codes exist, all design, engineering, materials and construction shall conform to their latest requirements, which complete or modify the present specifications.

In case of lack of obligatory local national standards, international norms and standards will be applied.

In case of lack of international norms and standards, national norms and standards listed hereafter will be applied.

In all cases the system adopted shall be coherent, i.e. the various texts shall present no incompatibility. Any dispute shall be resolved by basing works on the most stringent text for the CONTRACTOR and at his expense.

The list of specifications and norms quoted is not exhaustive: the CONTRACTOR shall respect the secondary standards and regulations, which cover the works described in the present specification.

Certain specifications and norms may be indicated with an issue date. This is for information only and on the understanding that the most recent issue shall be used.

Standards

Reference	Title
ISO 8385	International standards and codes Ships and Marine Technology - Dredgers - Classification
NF EN 1992	European standards and codes Eurocode 2 : Design of concrete structures
NF ENV 1997-1	Eurocode 7: Calcul géotechnique - Partie 1: Règles générales (Geotechnical design, Part 1: general rules)
NF ENV 1998-5	Eurocode 8: design provisions for earthquake resistance of structures and National Application Document - Part 5 : foundations, retaining structures and geotechnical aspects

Reference	Title
EN 10248	Hot Rolled Sheet Piling of Non Alloy Steels - Part 1: Technical Delivery Conditions - Part 2: Tolerances on Shape and Dimensions
EN 10249	Cold Formed Sheet Piling of Non Alloy Steels - Part 1: Technical Delivery Conditions - Part 2: Tolerances on Shape and Dimensions
EN 13383	Armourstone
	French Standards and Codes
NF A 05-251	Corrosion par les sols - Evaluation de la corrosivité - Ouvrages en acier enterrés (palplanches et pieux) (Corrosion by soils - Corrosion evaluation - Buried steel structures (Sheet piles and piles))
FD A 45-025	Produits en acier - Palplanches laminées à chaud en aciers non alliés - Dimensions et caractéristiques des sections (décembre 99) (Steel products - Hot rolled steel piles - Sections dimensions and characteristics)
FD A 45-035	Produits en acier - Palplanches laminées à froid en aciers non alliés - Dimensions et caractéristiques des sections (décembre 99) (Steel products - Cold rolled steel piles - Sections dimensions and characteristics)
	American Standards
ASTM A328/A328M	Specifications for Steel Sheet Piling
ASTM A690/A690M	Specification for High-Strength Low-Alloy Steel H-piles and Sheet Piling for Use in Marine Environments
ASTM A857/A857M	Specifications for Steel Sheet Piling, Cold-Formed, Light Gage
ASTM D5313	Test Method for Evaluation of Durability of Rock for Erosion Control under Wetting and Drying Conditions
ASTM D5519	Test Method for Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM D5779	Test Method for Field Determination of Apparent Specific Gravity of Rock and Man-Made Materials for Erosion Control
ASTM D6092	Guide for Specifying Standard Sizes of Stone for Erosion Control
ASTM F1244	Specification for Berths, Marine
ASTM F1309	Practice for Installation Procedures for Fitting Chocks to Marine Machinery Foundations

Reference	Title
	English standards and codes
BS 3900-F10	Methods of Test for Paints - Determination of Resistance to Cathodic Disbonding of Coatings for Use in Marine Environments
BS 6349-1	Maritime Structures - Code of Practice for General Criteria
BS 6349-2	Maritime Structures - Design of Quay Walls, Jetties and Dolphins
BS 6349-3	Maritime Structures - Design of Dry Docks, Locks, Slipways and Shipbuilding Berths, Shiplift and Dock and Lock Gates
BS 6349-4	Maritime Structures - Code of Practice for Design of Fendering and Mooring Systems
BS 6349-6	Maritime Structures - Design of Inshore Moorings and Floating Structures
BS 6349-7	Maritime Structures - Guide to the Design and Construction of Breakwaters
BS 7361-1	Cathodic Protection - Code of Practice for Land and Marine Applications
BS 8005-4	Sewerage - Guide to Design and Construction of Outfalls
ISO 17 357	Ships and Marine Technology - Floating Pneumatic Rubber Fenders

Professional Documents

Reference	Title
	French documents
LCPC	Recommandation pour le choix des paramètres de calcul des écrans de soutènement par la méthode aux modules de réaction - Note d'information technique (1984) (Recommendations on parameters choice for retaining diaphragms by reaction modulus method)
Recommandations TA 95	Tirants d'ancrage - (Anchorage ties) - Comité Français de la mécanique des Sols
SETRA	Choc de bateau sur une pile de pont (BT n° 10-1975) (Ship chocks on a bridge pier)
AFPS	Recommandation AFPS 90 pour la rédaction de règles relatives aux ouvrages et installations à réaliser dans les régions sujettes aux séismes (tome 1: 1990, tome 2: 1993, tome 3: 1994, publiés aux Presses de l'ENPC) (Recommendations for rules concerning structures and installations to be constructed in seismic regions)
Rock Manual 2007	The use of rock in hydraulic engineering

Reference	Title
ROSA 2000	French Recommendations « Recommandations pour les Ouvrages en Site Aquatiques 2000»
SNPE Ingénierie	Guide de sécurité pour la conception de salles de contrôle résistant à l'explosion dans les raffineries de pétrole et sur les sites pétrochimiques. 1994 (Security guide for control rooms design relative to blast in oil refinery and petrochemical estates)
US Army Corps of Engineer	American documents Coastal Engineering Manuel, EM1110-2-1100

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP CIV 101	General earthworks
GS EP CIV 102	Dredging and Filling up
GS EP CIV 300	Reinforced and Prestressed Concrete
GS EP CIV 301	Design of Reinforced and Prestressed Concrete
GS EP CIV 500	Special foundations
GS EP GEO 201	Offshore geophysical surveys
GS EP ENV 120	Environmental impact assessment onshore activities

3. Scope of work

The Engineering CONTRACTOR shall carry out all surveys, physical enquiries, operational and financial analyses, and any other task described within this document necessary in order to reach the objectives defined in Section 1 hereabove.

The CONTRACTOR may be responsible for the control of harbour works.

The COMPANY shall inform the CONTRACTOR of his working conditions, depending upon the type of harbour and the project requirements.

4. Preliminary studies

4.1 Preliminary definition of requirements during construction work and operational phases

The COMPANY shall provide to the CONTRACTOR a description of the anticipated traffic for the planned harbour. The COMPANY shall distinguish the traffic induced by its planned onshore installations to that generated by their construction. It shall also provide a list of vessels likely to be using the harbour, with their type, senses (importation or exportation) and frequency.

In case an agreement need to be reached between the COMPANY and the Government whose territory the harbour is to be located on, the COMPANY shall provide to the CONTRACTOR all the information related to the traffic that will use the COMPANY harbour (commercial, fishing, customs, etc.).

From this information, the CONTRACTOR shall start his basic studies:

- Study of the present and forecast evolution in the construction of the types of vessels likely to use the new harbour in order to select required dimensions

This study shall particularly be made for oil tankers, methane carriers, container ships or RO/RO ships

- Summary study of the number of berthing spots, manoeuvring spaces, area of ground space for each type of traffic, and basic data concerning the development of any industrial estates.

4.2 Collection of available data on natural conditions

The COMPANY shall provide to the CONTRACTOR the basic marine and topographic charts required for the studies. These charts shall cover a coastal area of several tens of kilometers. As a general rule 1/50,000 or 1/100,000 scales shall be used for areas with no harbour development and larger scales for areas where development already exists.

The COMPANY shall supply general meteorological information about the area. This information shall concern rainfall, winds, and probability of fog and ice.

The COMPANY shall also provide all available documents related to topography, geology, geomorphology, seismic conditions, nautical conditions, tides, bathymetry, currents (including river data in case of estuaries), salinity data and sea roughness.

4.3 Investigation about possible locations

From his basic research study and the documents available about natural conditions, the CONTRACTOR shall perform a preliminary determination of acceptable sites.

This research shall take into account evaluation of social and economical environment: presence of qualified manpower, existing networks, etc.

The comparison between these possibilities and the requirements previously defined, plus site surveys shall enable the CONTRACTOR to select several suitable locations for the harbour.

The CONTRACTOR shall include preliminary studies on harbour onshore traffic, environmental impact of harbour installations, and security.

For each one of the selected sites, the CONTRACTOR shall propose one or several harbour arrangements in sketch form.

If wave characteristics are perfectly known for some sites, the CONTRACTOR shall present a simplified mathematical model of the harbour sea roughness.

4.4 Comparison of the selected solutions

At this stage of studies, the CONTRACTOR shall provide an intermediate report giving the reasons for his choice. He shall also make an approximate cost estimate (30% close) for the works and maintenance to be carried out for each solution.

The COMPANY shall decide which one(s) of the solution should be studied in more detail. With the CONTRACTOR assistance, the COMPANY shall define the basic project solution, i.e. the solution that best suits all the requirements. The other harbour arrangements shall be considered as alternate project solutions.

The refined definition of these harbours will be part of the second design phase, the pre-project.

5. Pre-project studies

5.1 Refined definition of requirements

5.1.1 COMPANY requirements

These requirements shall be defined in liaison with the COMPANY logistic specialists.

The CONTRACTOR shall make himself aware of the COMPANY requirements by studying the documents, which the latter has provided. He shall identify the large groups of merchandise and make up a plan of the traffic over at least ten years.

The CONTRACTOR shall also study the evolution in the characteristics of vessels likely to use the new harbour.

From these elements, he shall determine:

- The number of docking points that shall be required by the various types of traffic
- The maximum characteristics of vessels for each type of docking point
- Storage and handling facilities.

Following this, he shall determine the total number of docking points required (number of each type). In order to do so he shall define, for each type of quay, the maximum allowable waiting time for the vessels generally used by the COMPANY. From this he shall be able to determine the number of points required to handle the planned traffic.

In case the selected site is an existing harbour that belongs to the COMPANY, the CONTRACTOR shall carry out a survey on the current traffic and its handling. From these

statistics he shall make a schedule of the traffic for each type of merchandise, including both current and planned traffic.

The CONTRACTOR shall make sure in the first place that the harbour, which exists, may or not be put to better use. The solution may be found by investing in new equipment but also by improving the organisation.

He shall thus decide upon the maximum rate of occupancy for the quays and, taking into account the selected handling methods, he shall check if the available arrangement is sufficient.

Should this not be the case, he shall proceed as for a new harbour, by successive iterations until he gets the number of places required.

Where the harbour shall include a methane carrier berth (LNG, LPG, etc.), the CONTRACTOR shall especially pay attention to the problems linked with the evolution of these vessels, the dangers involved with such traffic and incompatible surroundings.

Moreover he shall work closely with the CONTRACTOR in charge of onshore installation studies.

5.1.2 General requirements related to local Government

In case there is an agreement between the COMPANY and the local Government for the use of the harbour, the COMPANY shall provide to the CONTRACTOR a copy of this agreement.

The CONTRACTOR shall study the traffic induced by the agreement from the documents provided to him. He shall carry out the same sort of analysis as described in the previous Section.

Unless otherwise indicated in the agreement, the CONTRACTOR shall ensure, that under all circumstances, the COMPANY traffic shall be given priority.

5.1.3 Requirements related to the harbour

The CONTRACTOR shall study harbour tug requirements. He shall determine their number and characteristics. He shall also list all the service vessels required for the correct operation of the harbour. He shall define the characteristics of the service quay. He shall also study the possibility to install dry dock facilities for the maintenance of these vessels.

The CONTRACTOR shall also define water, electricity and telecommunication requirements for the harbour.

5.2 Operational requirements

5.2.1 Delivery date and life duration of the structures

The COMPANY shall inform the CONTRACTOR of the delivery date and the planned life duration of the structures.

5.2.2 Limit of unavailability

The COMPANY shall inform the CONTRACTOR of the limit for unavailability of the structures.

5.2.3 Possibility of work in shifts

The COMPANY shall inform the CONTRACTOR of the possibility to work in shifts.

5.2.4 Particular requirements for certain types of vessels

In the case of creation of a methane carrier berth, the COMPANY must provide to the CONTRACTOR references from similar studies.

5.2.5 Maximum unit loads to be handled

The COMPANY shall inform the CONTRACTOR of the maximum unit loads to be handled.

5.2.6 Special safety requirements

The CONTRACTOR shall pay particular attention to safety problems related to methane carriers and especially for the installation of their docking facility within the general harbour layout and the fire fighting arrangements.

5.3 Collection of data

The COMPANY shall provide to the CONTRACTOR:

- Topographic and bathymetric surveys (1/1000 scale). These surveys shall be carried out from marks taken from geodesic points; points on which all further works shall be based
- Wave characteristic measurements. The CONTRACTOR shall inform the COMPANY of the required lapse of time for collection of data and information on the methods to be used. He shall then establish a wave calculation theory for the project. He shall also estimate the residual roughness of the harbour site
- Current and tide measurements
- Measurement of coastal movements if any. Should the latter exist, the movement of seabed materials and various sediment origins shall be studied
- Sedimentation, salt contents of water and turbidity measurements
- Meteorological measurements
- Geological and geotechnical surveys, both offshore and onshore. The COMPANY shall make a geological and geotechnical survey over the harbour area. It shall determine the nature and characteristics of materials to be dredged and the foundation soil on which structures shall be set
- Seismic conditions
- Research for natural materials suitable for use in construction
- The geological and geotechnical documents supplied by the COMPANY shall enable, as indicated in the general specifications, SP SUR, to identify natural deposits for material in the surrounding harbour area (quarries, gravels pits, etc.). The CONTRACTOR shall determine, as stipulated in **GS EP CIV 101**, if these deposits may be economically made use of.

From these data, the CONTRACTOR shall define and submit to COMPANY for approval the water level references (high reference level, low reference level) and the design project swell.

From these data, the CONTRACTOR shall make a State of Requirements (SoR) of the project of harbour.

These data shall be list in the Eurocode forms in order to be use with the French Recommendations **ROSA 2000**.

5.4 Master plan and pre-sizing of structures

5.4.1 Master plan

At this stage, which marks the end of the second phase in studies, the CONTRACTOR shall submit an intermediate report to the COMPANY. This report shall take into consideration all the studies described hereabove and shall result in a drawing in which the CONTRACTOR shall define the location and functional use of structures.

5.4.2 Protective structures

From wave studies, the CONTRACTOR shall define the location and profile of protective structures.

The CONTRACTOR shall carry out the pre-sizing of these structures taking into account geotechnical data with the French Recommendations **ROSA 2000**. The ports, costal and river shore protections shall be design with the Rock Manual 2007.

In particular, he shall determine:

- In the case of a riprap dyke:
 - The dredging of the natural soil
 - The shape and constitution of base layer and the risk of scouring
 - The shape and constitution of core and filter layers
 - The shape, nature, minimum weight and density of riprap for the shell
 - The design of capping.
- In the case of vertical dyke:
 - The swell effects on the structure, including choice of theoretical design method
 - The foundation design, including risk of scouring and protection
 - The shape and constitution of the dyke.

Other specific types of protective structures (breakwaters, pervious vertical dykes, etc.) shall be analysed by the CONTRACTOR by means of scale models (see § 5.5.2.).

The CONTRACTOR shall evaluate settlements of the protective structures.

The CONTRACTOR shall define methods of construction - by earth or seaway - and origin of materials to be used.

The CONTRACTOR shall define a program of survey during construction work and operational phases.

5.4.3 Access channels and water surface

The CONTRACTOR shall define the outline of access channels and shall try whenever possible to make them rectilinear.

Depending on the reference vessels previously selected according to their categories he shall determine the width and depth of these channels. He shall take into account vertical vessel movements due to the swell, squatting due to wind, survey data, any sedimentary deposits between two dredgings and dredging tolerances. Finally he shall determine the net clearance depth depending on the nature of the seabed.

The CONTRACTOR shall analyse the possibility to install wet docks with lock gates.

The CONTRACTOR shall also study the manoeuvre areas.

These manoeuvre areas shall include:

- Area required for deceleration
- Area required for swinging.

In general these water surfaces shall be sheltered.

Positioning and dimensioning of these elements must be in accordance with the navigation standards of the country in which the project is located. In case these do not exist, IALA standards shall be used (International Association of Marine Aids to Navigation and Lighthouse Authorities).

5.4.4 Berthing structures

The CONTRACTOR shall define the location and basic design of berthing structures. He shall study cross-section profiles adapted to foundation conditions and working situations. He shall carry out pre-sizing, study the stability conditions. For this purpose, the CONTRACTOR shall identify all the functions of the structures (berthing, mooring, retaining earth or equipment, etc.) and the relevant actions.

The CONTRACTOR shall define the shape and constitution of these structures in accordance with the **ROSA 2000** requirements.

He shall also define the system of fenders to be fixed onto the berthing structure, estimating as well as possible the berthing speed. He shall make provisions for the potable water, firewater, electricity and ships telecommunication systems.

5.4.5 Handling platform

The CONTRACTOR shall define requirements for handling platform and workshops, for each type of berth, according to the nature of the traffic and the handling method selected.

The CONTRACTOR shall define road system circulation, rail service and connections to existing services in accordance with local laws.

In his pre-project, he shall determine dimensions for handling platform and define the rainwater evacuation network. The earth platform surfacing shall be defined by the CONTRACTOR and submitted to the COMPANY for approval. The CONTRACTOR shall then proceed with pre-sizing.

In the case where night shift work shall be planned, he shall make provisions for lighting.

5.4.6 Handling equipment - Service equipment

The CONTRACTOR shall define the main characteristics and the amount of equipment required to deal with the traffic. He shall also include a report explaining the handling principles and the movements of each device.

He shall also include a definition of the service equipment.

5.4.7 Navigational aids

The CONTRACTOR shall study the buoyage system for access channels. His studies shall be in compliance with the standards of lighthouse and navigational aids department, or equivalent,

of the country in which the project is located. In case these do not exist, IALA standards shall be used (International Association of Marine Aids to Navigation and Lighthouse Authorities).

In all cases, the CONTRACTOR shall act in compliance with the local administrative authority which is responsible for the area.

With the COMPANY agreement, he shall study the amount and location of radioelectric navigational aids in conjunction with the local authority.

5.4.8 Installations

Harbour installations shall include:

- Harbour master control, technical block
- Safety, fire-fighting and rescue building
- Workshop/garage
- Electricity generator installations
- Potable water installations
- Internal road system
- Potable water network, fire water from the sea networks, electricity and telephone networks
- Housing accommodation and general living quarters
- Customs office and/or police station with customs storage area
- Fence and guardhouse.

In case of a methane carrier berth, the following shall be added:

- LNG tanks
- Piping for connecting vessels to the various parts of the installation
- Gas recuperation circuits
- Circuit for LNG intake with pumps
- Regasification group
- Flare
- Secondary installations such as control room and terminal control, liquid nitrogen storage, inert gas production, etc. required for the operation of the general installation.

Characteristics to be provided by the CONTRACTOR for each installation shall be dealt with in particular specifications issued by the COMPANY.

5.4.9 Impact on the environment

The CONTRACTOR shall study the impact of works and operations on the following environmental aspects:

- Biological aspect

- Chemical aspect
- Sedimentary aspect.

Particular specifications shall define what type of studies the CONTRACTOR shall need to carry out particularly, mathematical models to simulate sediments and components transports.

These studies shall include an economical estimation of the ecological damage. These studies shall be in compliance with specification **GS EP ENV 120**.

5.5 Examination of other solutions

5.5.1 Alternative projects

In parallel with the basic project, the CONTRACTOR may establish one or several alternatives which shall be installed in other selected sites, or which may alter the basic solution.

For all the solutions studied, he shall give the costs for installation and maintenance. He shall also carry out an analysis of the advantages and disadvantages of the various solutions from an operation and maintenance point of view.

5.5.2 Scale models

It is recommended that the CONTRACTOR uses results obtained from studies made on scale models to justify the general layout of the harbour, the stability of protective structures and also to study any problem that may arise for the transportation of sedimentary material. It shall be compulsory that he presents a mathematical model of sea roughness.

If the use of physical models is absolutely necessary, the CONTRACTOR shall submit a proposed contract with a highly qualified laboratory to the COMPANY for approval.

6. Establishing the project

6.1 Project

Once the pre-project has been approved, the CONTRACTOR shall establish the project for infrastructures, superstructures and secondary harbour installation works.

He shall request that the COMPANY provides all the complementary site studies required to establish the project.

He shall perform a quantity survey of the structures and establish the total cost of the developments, including maintenance costs.

For the harbour equipment, the CONTRACTOR shall determine the detailed characteristics of machines to be bought and after enquiries with MANUFACTURERS he shall give prices.

6.2 Mapping Requirements:

The general layouts of the harbour and marine facilities shall be geo referenced using the Project Coordinate Reference System parameters provided by COMPANY.

The following features shall be included on each charts, but not limited to:

- A title, a graphic scale (Bar scale) and Numeric scale, specify the drawing format for which the numeric scale is applicable, a legend

- The projected Company Coordinate System Grid, the geographic coordinate system ticks and Local Engineering Grid, when applicable
- A situation Map
- The reference of the source drawings
- Full Company Coordinate system parameters, transformation parameters between the Company Coordinate system and the Local Engineering Grid when applicable

The native files shall be provided in AUTOCAD or MICROSTATION and PDF formats. The CAD files shall be georeferenced using the project coordinate system and structured thus:

- Separate layers for each feature type (contours lines, elevation roads, etc...)
- Continuous lines (e.g. contours lines) shall be drawn as continuous 2D or 3D polylines

CONTRACTOR may also propose to provide data in GIS formats (as ESRI shapefile or Geodatabase).

7. Invitation to tender

7.1 Elements to be included in the invitation to tender file

So as to enable the selection of Construction CONTRACTORS, the CONTRACTOR make up an invitation to tender file for the basic project.

These documents shall be made up in great detail so as to avoid, as much as possible, any unforeseen difficulty during the works.

The invitation to tender file shall include the following technical elements:

- Particular specifications, including test definitions for materials and works procedures
- Drawings
- Price list frame
- Detailed estimate frame
- List of recommended work equipment
- Forecast schedule for works
- Instruction for security during construction works and operational phases.

The CONTRACTOR shall also provide back-up data, for COMPANY use only, namely in particular:

- Estimate and explanatory report
- Information on price composition, etc.

These lists are not exhaustive and shall be subject to COMPANY approval.

7.2 Assessment of the offers made

Following the assessment of the offers made, the CONTRACTOR shall provide a technical file, in which he shall advise the COMPANY with respect to the aptitude of the bidders to carry out the works, as well the relative advantages of the offers made.