

GENERAL SPECIFICATION

CIVIL WORKS

GS EP CIV 401

Minimum requirements for building design and construction

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1. Scope

This specification defines the minimum requirements for the design and construction of buildings and utilities located outside the restricted area according to the definition of the restricted area given in **GS EP SAF 221**: "Area within the boundaries of the installation, and hence under the control of Company, which is affected permanently by normal operation of the facility or exceptionally by the consequences of an emergency situation caused by a major failure".

When certain supplies and/or works may be of a particular nature, the Company reserves the right to modify or add to general specifications by using **particular specifications**.

Note: The present specification does not deal with gas for domestic use.

2. Reference documents

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

- When local national standards, regulations and codes exist, their particular requirements and those of the standards or codes to which they refer shall be applied, supplementing or amending the provisions of this document.
- If there are no mandatory national regulations, then preference is given to:
 - Total General Specification
 - International regulations, standards and codes.

In case of lack of international norms and standards, national norms and standards (mainly American, British and French) listed hereafter shall be applied.

In all cases the system adopted shall be coherent, i.e. the various texts shall present no incompatibility and shall respect the same philosophy (French, British, US or European). In case of discrepancies between documents the most stringent shall apply in the same philosophy.

In all cases, Contractor shall inform the Company of any deviation required and justify the changes. Such deviation shall be approved by the Company.

The list of norms and standards provided in this document shall not be considered as exhaustive. The Contractor shall respect the secondary standards and regulations, which cover the works described in the present 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
ASCE	Design of Blast Resistant Buildings in Petrochemical Facilities

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 202	Drainage and underground networks
GS EP CIV 301	Design of reinforced and prestressed concrete
GS EP CIV 402	Design and construction of oil field laboratory on production installations
GS EP CIV 405	Plumbing and sanitary for onshore and offshore installations
GS EP ELE 001	Electrical design criteria
GS EP ELE 031	Design of earthing and bonding systems
GS EP ELE 051	Design and installation of lightning protection
GS EP ELE 061	Minimum requirements for HV & LV cable sizing
GS EP ELE 081	Lighting
GS EP ELE 131	High Voltage switchgear and controlgear
GS EP ELE 133	G.I.S High voltage switchgear and controlgear
GS EP ELE 135	Low voltage switchgear assembly
GS EP ELE 137	Distribution boards
GS EP ELE 141	Power transformers
GS EP ELE 152	AC Uninterruptible Power Systems (UPS)
GS EP ELE 161	Electrical cables
GS EP HVA 100	HVAC Basis of design
GS EP MED 062	Hygiene in bases and living quarters
GS EP SAF 221	Safety rules for buildings
GS EP SAF 228	Liquid drainage
GS EP SAF 321	Fire pump stations and fire water mains
GS EP SAF 322	Fixed fire water systems
GS EP STR 901	Design rules and construction standards for ancillary structures of offshore installations
GS EP TEL 180	Engineering and installation of telecommunication network pre-cabling
GS EP TEL 410	Installation rules

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3. Requirements for design

3.1 Mapping Requirements

The general layouts of the site, buildings and 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).

3.2 Minimum dimension

Office's size shall be as standard as possible. Unless otherwise specified in particular specifications, the following dimensions apply 5 m long x 3.7 m wide for an office accommodating two employees with their standard office furniture. The design of the other rooms shall be based on the standard dimensions so that rooms can be formed of 2 x standard dimensions, 3 x standard dimensions etc. Meeting rooms, copying rooms, filling rooms, etc. shall have the possibility to be redefined to additional offices by using partition.

Unless otherwise specified in particular specifications, toilets shall be 1000 x 1500 mm (in offices, toilets shall be min. 900 x 1200 mm). Showers shall be 1000 x 2000 mm, divided into a wet area and a dry area.

Unless otherwise specified in particular specifications, workshop and warehouse buildings shall have a width of 15 m and a length of a multiple of 6 m.

Corridors when they are not used as means of egress shall have the minimum dimensions given in the **GS EP SAF 221** according to the classification of occupancy and the occupation load.

The minimum clear dimensions under **ceiling height** shall not be less than the minimum ceiling height of means of egress: 2.30 m. Unless otherwise specified, the following dimensions shall apply:

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Table 1 - Minimum ceiling height

	Industrial	This height shall depend on dimensions of equipment and handling space required
	Storage	This height shall depend on dimensions of equipment and handling space required
Computer room	Business	3 m min + 0.50 m mini between false ceiling, if any, and the roof framing members
Corridors	Business, Industrial, Lodging houses, Hotels	2.30 m min 2.50 m preferably
Electrical station	Industrial	2.30 m for Low and Medium Voltage* 200 + U(kV) cm, 250 cm mini for High Voltage*
Laboratory	Industrial	2.60 m (see GS EP CIV 402)
Office rooms	Business	2.50 m
Toilets	Business, Industrial, Lodging houses, Hotels	2.50 m

* See chapter 3.7 for the definitions of Low, Medium and High Voltage.

All height dimensions are to underside of ceiling or beams, whichever is the lower.

3.3 Building components

3.3.1 Floors

Floor of industrial and storage buildings such as workshop, warehouse shall be adapted to traffic, weight of component, etc.

For the installation of computers and other instrument or electrical equipment with cable connections at the bottom of the equipment, a special cavity floor shall be installed. Separate steel structures shall be provided to support electrical equipment and battery benches.

All floors exposed to weather, liquid spillage or washing-down operations shall be laid with adequate and effective drainage system.

The finished floor level shall be at least 150 mm above the pathway around the building.

3.3.2 Walls

3.3.2.1 External walls

External walls shall be designed to prevent condensation and to resist penetration of external moisture (due to rain or snow) into the inside of the building. If buildings are made of concrete blocks, the external surfaces shall be plastered and painted.

A damp-proof course shall be included in all walls over the full length at a minimum height of 150 mm above the finished grade level. Whenever necessary, termite barriers shall be provided in the construction.

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Industrial and storage buildings shall be made gas and water-tight when required.

Preventive measures shall be taken to avoid inflow of rain water or released flammable liquids. All openings for cables or piping shall be above groundwater level.

3.3.2.2 Interior walls and partitions

Floors, ceilings, windows, heating, ventilation, air-conditioning and electrical fittings shall be designed in such a way that partition walls can be built and demolished in future without undue damage to the building.

Partition walls installed in buildings shall be based on the standard module dimension specified in the particular specifications.

All plastered corners shall be protected against impact damage by an integral bullnose element.

A damp-proof course may be omitted for partition walls, if erected on the concrete floor, except for wash rooms and other wet rooms.

3.3.3 Roofs

3.3.3.1 Flat roofs

Roofs and curbs shall be made completely water-proof by any proprietary water-proofing treatment. The composite roof shall comply with criteria for thermal insulation and fire protection. Condensation shall be avoided. Where frequent roof traffic is expected, adequate walkways shall be provided.

In very dry (e.g. Middle East) areas, the roof shall be flat with run-off (nominal) slopes and surrounded by a curb. The build-up roofing felt shall be protected against direct sun radiation by means of a protective layer.

3.3.3.2 Pitched roofs

For pitched roofs, the plan shape shall be kept as simple as possible, without hips and valleys. The construction shall be such as to result in a completely water-proof roof.

Proper ventilation between roof and ceiling of laboratory buildings is required to prevent accumulation of vapours (toxic or inflammable).

In tropical areas, rainwater gutters and downspouts shall only be provided over entrances and other areas where people have to pass.

Under all outer roof lines without a roof gutter, adequate concrete gutter facilities shall be designed at floor level with concrete slabs on both sides to prevent erosion.

3.3.4 Doors

Doors shall comply with the required performance in terms of fire protection and explosion.

- **External** doors shall always open outwards and in the direction of the escape route.
- Weather stripping on **external** doors to maintain the climate inside the building and to exclude all dust and moisture infiltration.

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- All main entrances and all other entrances to buildings which are air conditioned and frequently used shall have airlocks with adequately separated doors to control the indoor temperature and to prevent sand accumulation in the case of desert conditions.
- If the dimensions of doors are unpractical for easy handling, a wicket door shall be provided for frequent passage of persons, i.e. in workshop doors.
- Where visibility is required, doors shall be glazed.
- Doors may be electrically operated but shall have a facility for quick disconnection of the electric driver after which easy manual opening shall be possible (balanced doors).
- In non-freezing areas, fire-fighting garages should not have doors in front of the fire-fighting vehicles. If doors are required for climatic reasons they shall be made of light material so that the fire truck can break them open in case the doors are locked during an emergency.
- Fixing of frames for doors to the building shall be such as to ensure solid, void-free, water-proof joints and shall be in accordance with the instructions of the Manufacturers of the door.
- Locks, handles, handle plates, barrel bolts, panic bolts, door stops, kick plates, and automatic door closers shall be provided as necessary. For doors to air locks, air conditioned rooms, pressurised rooms, main entrances to sanitary blocks, and for all fire-check doors, automatic door closers or self-closing doors shall be installed. For other external doors, door catchers shall be provided.
- Steel fittings for industrial buildings shall have a corrosion resistant finish.
- All fittings of the same kind shall be of one make and type.

3.3.4.1 Dimensions

The minimum clear width door opening shall be in accordance with **GS EP SAF 221**. Unless otherwise specified, the minimum dimensions shown below could be applied. All these dimensions shall be increased if required for installation of equipment in the buildings.

Table 2 - Minimum clear openings of external doors

Type	Applicability to the Company	Width x Height (mm)
Assembly	Conference or passenger rooms	Width = 5 mm to 10 mm/person Min 1120 x 2100
Hotels	Living quarters	Width = 5 mm to 10 mm/person Min 1120 x 2100
Lodging houses	Small living quarters	900 x 2100
Business	Offices, training rooms, ambulatory clinics	Width = 5 mm to 10 mm/person Min 1120 x 2100
Industrial	Processing facilities, workshops	Min 4000 x 4000 Large enough for the necessary equipment to pass through
Storage	Bulk oil storage, chemical storage, warehouses	Min 3000 x 3000 Large enough for the necessary equipment to pass through

When they are not used as means of egress the minimum dimensions for internal doors shown below shall apply. All these dimensions shall be increased if required for installation of equipment in the buildings.

Table 3 - Minimum clear openings of internal doors

Type	Applicability to the Company	Width x Height (mm)
Assembly	Conference or passenger rooms	1500 x 2100
Hotels	Living quarters	900 x 2100
Lodging houses	Small living quarters	900 x 2100
Business	Offices, training rooms, ambulatory clinics	900 x 2100
Industrial	Processing facilities, workshops	Min 4000 x 4000 Large enough for the necessary equipment to pass through
Storage	Bulk oil storage, chemical storage, warehouses	Min 3000 x 3000 Large enough for the necessary equipment to pass through

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3.3.5 Windows

Windows shall comply with the required performance in terms of fire protection and explosion.

- The number of windows and the sizes of the glass panes shall be restricted to the minimum required by local building authorities.
- Unless otherwise specified in particular specifications, the underside of all windows, where possible, should be min. 1000 mm above finished floor level.
- Unless otherwise specified, the maximum pane area should be 1 m² and the glass panes shall be fitted from the outside. All window openings shall be designed in such a way that only a minimum of different glass sizes is required.
- All **exterior** windows in heated and/or air-conditioned buildings shall be designed with weather-stripping as described for doors.
- Windows shall be designed to minimise heat gain and ultraviolet light transmission, this may be achieved by installation of sun protection devices and avoiding excessively glazed surfaces.
- Double glazing for large glazed areas is desirable. Hermetically-sealed double-glazing units shall be used when transparency needs to be combined with heat insulation.
- Where insect screens are required, they shall be easily removable and rustproof.
- When specifying special glazing, such as reflective mirror glass and heavily tinted glass, consideration shall be given to replacements and availability in the country in question.
- The fixing method shall ensure void-free and water-proof joints and shall be in accordance with the instructions of the Manufacturers of the glass and the compounds.

3.3.6 Changes in level

- All Changes in level shall be designed and located to meet the local fire authority requirements for means of egress in the case of fire. The proposed location shall be approved by the Company.
- Unless otherwise specified the specifications of **GS EP SAF 221** shall be applied. In addition, when the change of level is less than 53 cm, the ramp should be the preferred solution.

3.3.7 Dimensions for stairs

- Stairs shall be in accordance with **GS EP SAF 221** and **GS EP STR 901**.

3.3.8 Dimensions for ramps

- Ramps shall be in accordance with **GS EP SAF 221**.

3.3.9 Internal and external finishes

The **external** appearance of buildings shall be plain, yet in accordance with local customs and existing buildings (if applicable). Heat-reflecting, thermal insulating properties and low maintenance shall be the major considerations in the selection of all **exterior** finishes. The **external** finishes selected shall comply with the functional and imagery role play by the building.

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In order to facilitate easy maintenance of the building components: floors, roofs, ceiling and walls a minimum of different **internal** finishes shall be used in one building. The use of locally available material shall be considered.

The requirements for **interior** finishes shall comply with the classification established in the General Specification **GS EP SAF 221**.

Moisture-proof finishes shall be used in toilet rooms, bath facilities, kitchens and other areas exposed to humidity or water. Walls surrounding water closets, showers, bath tubs and urinals shall be finished with ceramic tiles, or specially designed sanitary partition walls.

3.4 Structure

Design shall guarantee the durability and performance of the structure under normal and extreme operational use and relevant maintenance.

3.4.1 Design documents

3.4.1.1 Calculation notes

Typical content of calculation note shall be the following:

- Table of contents
- List of revisions
- Purpose of the calculation note
- Sketches of the structure
- Assumptions
 - Loads
 - Load cases
 - Load combinations
 - Criteria to be complied with
- References to documents used (codes, standards, notes, etc.)
- General description of the calculation method, including formulas, sign, conventions, etc. When a computer software is used, the following additional information shall be provided:
 - Purpose of the software
 - Theoretical basis and calculation principles
 - Description of the model
 - Input data
 - Output results
 - Computer list attached as appendices to the notes (these list shall never constitute note by themselves).
- Stress or displacement calculations

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- Analysis of results
- Conclusions.

3.4.1.2 Drawings

Apart from all information necessary to build the structure, drawings shall include the following information:

- Unit used
- Co-ordinates system
- Type of concrete
- Concrete facing
- Construction tolerances
- Scales: scale shall range from 1/100 for general view (1/50 for reinforcement drawings) to 1/10 for details
- Construction joints
- Development and splicing length.

The drawings shall be accurate enough to completely define the works to be performed.

3.4.2 Design data

Structural design shall be based on the following data:

- Geotechnical data, the report shall contain sufficient description of field and laboratory investigation, subsurface conditions, typical test data, basic assumptions, recommendations, and final design.
- Material data, design shall be based on materials strengths which are available or obtainable on site. Common concrete compressive strength for structural members range from 20 to 40 MPa, measured either on cubic or cylindrical samples, as defined by the relevant code, reinforcing bars design is based on their yield strength, which is commonly taken between 240 and 500 MPa.
- Loading data. Unless otherwise specified, the loads detailed in the paragraphs below, applied on the structure shall be considered.
- Load combinations shall be made according to the relevant regulations/codes in use.

3.4.2.1 Dead Loads

The self weight of the various building elements comprising the structure shall be calculated, and used in the design. In case of lack of precise information, refer to **GS EP CIV 301**.

In office buildings or in other occupancies where partitions are likely to be subject to rearrangement or alteration, the minimum allowance for the weight of partitions shall be a uniform load equivalent of 1.00 kN/m².w.

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Dead load shall take into account the weight of building service equipment, including: plumbing, stacks, piping, heating and air conditioning equipment, electrical equipment, elevators, elevator machinery, flues, and similar fixed equipment.

3.4.2.2 Live Loads

The following minimum live loads shall be used.

Table 4 - Minimum live loads

	Type of building/room	Loads in kN/m ²
Business, Hotel, Lodging	Offices, first-aid buildings, guard houses, toilets, etc.	3
Assembly, Hotel, Lodging	Canteens, lunchrooms, training centres, corridors, stairs, halls	4
Business	Library (reading and stack), filling rooms	7
Industrial	Battery rooms, simulator room in training centre	10
Industrial	Mechanical, electrical, instrument workshop building (inclusive of covered area), workshop area in training centre, consumable store	20
Storage	Bulk store	40

If equipment has to be supported which would create a load exceeding those shown above, then the affected area shall be designed for the heavier load. The loads from equipment or machinery shall be derived from Manufacturer's data. If the equipment is a heavy rotating equipment, a detailed design and vibration analysis shall be made.

Live loads may also consist of concentrated and/or movable loads such as crane loads. Crane loads shall be assumed at their maximum values including lifting capacity as well as the maximum horizontal loads caused by braking or acceleration, the most unfavourable position of the crane or other moving loads shall be considered.

All possible loading conditions during erection and maintenance shall be taken into account. The loads of scaffolding, including the wind loads, due to erection and maintenance shall be taken into account for the design of the structure.

Temporary loads developed during tests, such as Hydrostatic Test, shall be considered in the design.

3.4.2.3 Environmental loads

3.4.2.3.1 Wind Loads

Wind loads shall be determined in accordance with the codes and standards in use. The design shall also include effects of pressure and suction. The wind can blow in any direction and the most unfavourable case shall be considered.