

GENERAL SPECIFICATION

STRUCTURAL

GS EP STR 710

Onshore Blast Resistant Buildings
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1. Scope

This general specification defines the general design and construction principles for new onshore Blast Resistant Buildings. It applies to all construction project of new building in Company sites where a degree of blast resistance is required.

This general specification does not cover the determination of blast wave parameters. Those are here considered as an initial input.

A blast resistant building may have to face (and be designed to) other accidental threats, such as external fire, flammable/toxic gas ingress. Specific additional design requirements for these events could therefore be applicable to a specific blast resistant building. Contractor shall ensure all relevant accidental events are provided prior to starting blast design.

2. Reference documents

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

Where there are national regulations, 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, international regulations, standards and codes shall be applied.

If there are no applicable international standards and codes, the national standards and codes shall be chosen from those listed below according to the projects in hand and shall be defined in the job specification.

In the absence of a specific exemption, duly justified by the Contractor and agreed by the Company, codes and standards of different origins may not be used in whole or in part.

If certain points in these regulations need to be clarified, the Contractor shall describe and justify the changes and/or additions to be made so that they can be adapted to the nature and environment of the structure. Such proposals shall be considered acceptable only when they have been examined and approved by the Company.

A definitive list of regulations, standards and codes proposed by the Contractor shall be taken from the reference documents defined in this specification and the project's job specification.

Only the main standards are mentioned; the Contractor shall be responsible for compliance with any secondary standards. The list provided in this document should not be regarded as exhaustive.

In this document, Euronorms and Eurocodes are the basement but Contractor may propose other corpus of Codes and Standards and will be note as "relevant codes" in this text.

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External Documents

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

Reference	Title
ASCE guide	Design of blast-resistant buildings in petrochemical facilities
ASTM A325	Standard specification for structural bolts, steel, heat treated, 120/105 ksi minimum tensile strength
ASTM A36/A36M	Standard specification for carbon structural steel
ASTM A563	Standard specification for carbons and alloy steel nuts
ASTM A572/A572M	Standard specification for high-strength low-alloy columbium-vanadium structural steel
ASTM F436/F436M	Standard specification for hardened steel washers inch and metric dimensions
EN 10025-2	Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels
EN 10029	Hot rolled steel plates 3 mm thick or above. Tolerances on dimensions, shape and mass
EN 1992 (All parts)	Eurocode 2 - Design of concrete structures - All parts
EN 1993 (All parts)	Eurocode 3 - Design of steel structures - All parts
ISO 898 (Parts 1; 2)	Mechanical properties of fasteners made of carbon steel and alloy steel - Parts 1; 2

Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and addendums, is the latest revision published.

Reference	Title
GS EP CIV 300	Reinforced and prestressed concrete - execution
GS EP STR 510	Onshore Structure - Design
GS EP STR 520	Onshore Steel Structure - Material and Fabrication

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3. Applicability

This specification is applicable to the following engineering tasks:

- Preliminary and basic design
- Development of Project Particular Specifications
- Detailed design when PPS do not exist
- Expertise.

4. Definitions of terms

For the purpose of this document, the following terms and definitions apply:

Company	Any entity of the TOTAL Group mentioned in the contract or the order.
Contractor	Individual or company assigned the work contract. The Contractor may be responsible for carrying out the execution studies.
Engineering Company	Individual or company that performs the services corresponding to the studies and/or for ordering the works that are the subject of this specification. The engineering company may be responsible for carrying out the civil works execution studies. The engineering company may be the general Contractor or Company.
Blast Resistant Building	Building that is designed to resist accidental blast load(s) with required structural performance limits, as per response levels definition indicated in paragraph 8.1.
BRM	Blast Resistant Modular Building
DIF	Dynamic Increase Factor
DLF	Dynamic Load Factor
MDOF	Multiple Degrees of Freedom Systems
SDOF	Single Degree of Freedom Systems
SIF	Strength Increase Factor

5. Extent of supply

The extent of the supply is described in the order. It comprises all the constraints due to the application of the regulations and those due to the proximity of the existing works or units, operating or otherwise.

Unless otherwise stipulated in the order, all the execution documents necessary to the completion of the works (design notes, execution drawings, parts lists, etc.) are prepared and supplied by the Contractor or the Engineering Company.

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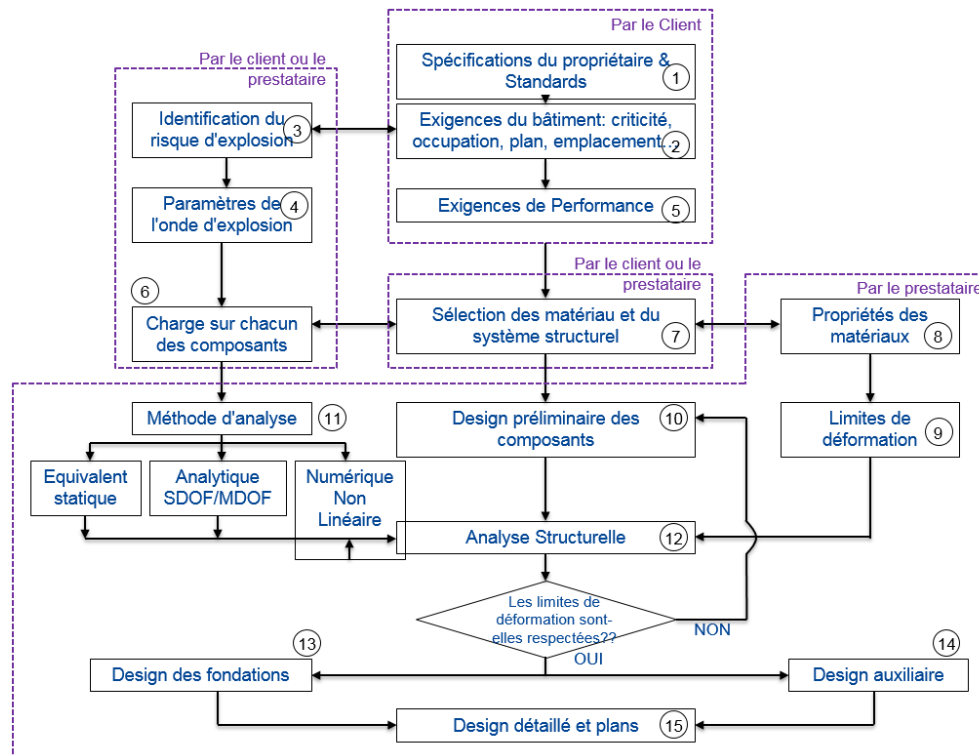
6. General requirements

General requirements for Blast Resistant Buildings design and construction are included in **GS EP CIV 300**, **GS EP STR 510** and **GS EP STR 520**.

7. General design process

The overall process involved in the evaluation and design of buildings for explosion hazards is illustrated in Figure 1. This flowchart shows fifteen basic steps in the overall blast assessment and design process, as follows:

- a. Define scope: steps 1 and 2 are to define the requirements and needs for the building.
- b. Analyze explosion hazards: steps 3 and 4 are to identify the explosion scenarios to be used to quantify the design blast overpressures.
- c. Select performance requirement and associated response limits: step 5 is to define expected building behaviour during blast loading.
- d. Determine blast loads: step 6 is to determine the blast loadings for the various components of the building.
- e. Select structural system and material and response criteria: steps 7, 8, and 9 are to choose the structural materials and systems for the building and the associated structural properties and response limits consistent with the performance requirements for the building.
- f. Perform structural analysis and component design: steps 10 to 12 are to select and perform the level of structural calculations appropriate for the particular situation.
- g. Finalize and detail design: steps 13 to 15.

Figure 1 - Blast resistant design process


Steps 1 to 5 are out of the scope of the present specification and are only briefly described in chapter 8. The present specification addresses steps 6 to 15.

The free field blast parameters and the building performance requirement are the 2 essential inputs to carry out the design of a blast resistant building that are described in the next paragraph.

8. Preliminary inputs

8.1 Buildings requiring blast resistant design

The decision regarding blast resistant design is made by Company according to Company HSE requirements.

The steps followed in the decision making process are:

- Classification of buildings, considering their occupancy and functionality(ies)
- Application of preventives measures such as hazard reduction (inventory and process control, occupancy limitation ...), appropriate siting (spacing from potential explosion sources)
- Determination of blast accidental load(s) at building location, either by prescriptive requirements, either by deterministic approaches
- Application of acceptability risk criteria
- Determination of structural performance requirements, pending on building classification.