

DEP SPECIFICATION

PORTABLE BLAST RESISTANT MODULES

DEP 34.17.10.33-Gen.

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design of pre-engineered and manufactured portable blast resistant modules (BRMs), rated for a peak side-on, over-pressure of 55 kPa (8 psi) and duration of 100 ms, used as portable occupied buildings. The general principles are to be used for BRMs of different blast ratings, although the loads would change.

The Principal may specify additional requirements.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual DEM 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2013; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Area Classification	Division of a plant or installation into hazardous areas and non-hazardous areas and the sub-division of hazardous areas into zones. NOTES: 1. Area classification shall be in accordance with DEP 80.00.10.10-Gen. or DEP 80.00.10.13-Gen. 2. For the installation of electrical equipment in hazardous areas, IEC 60079-14 shall apply.
Blast load	Load generated by an explosion.
Non-Hazardous Area	Area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.
Portable Blast-Resistant Modules (BRM)	An engineered onshore portable building that is specifically built to a blast rating of ≥ 55 kPa (8 psi). It is modelled as a B9 building type in the Shepherd Process Risk tool. Sanitary facilities are excluded unless integral within occupied BRM. Note that use can be temporary for construction/maintenance or permanent as operational facilities.
PRT	Process Risk Tool, a tool to assess vapour explosions risk at petrochemical processing facilities, e.g., SHEPHERD, FRED.
SHEPHERD	Software Risk Tool for Explosion Exceedance
Zone 2	Area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur, it will exist for a short period only.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (11).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2011. The following are the main, non-editorial changes.

Section/Clause	Change
All	DEP500 update to clarify requirements and separate "shall" statements.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL

2.1 LOCATION OF PORTABLE BRMs

1. The location of portable BRMs SHALL [PS] be assessed and approved using a Process Risk Tool (PRT) or other methodology specified by the Principal, and in accordance with DEP 34.17.10.35-Gen.

2.2 BASIC DESIGN REQUIREMENTS

1. The civil engineering of the BRMs shall be in accordance with the requirements of this DEP, and national and/or local building regulations.
 - a. Unless otherwise specified and/or agreed by the Principal, the more stringent requirements shall be followed.
2. A general arrangement drawing showing the internal layout of the BRM shall be prepared in close consultation with the Principal.
3. A recognised (registered) engineer, if required by national and/or local authorities, shall be engaged to design and coordinate the BRMs and their installations.
 - a. The choice of architect shall be subject to prior approval of the Principal.

2.3 FLOOR ELEVATION

1. The floor elevation of portable BRMs shall be at least 150 mm (6 in) above surrounding grade to avoid flooding.
2. Portable BRMs SHALL [PS] not be elevated or placed on piers, exposing the bottom of the module to blast pressures.
3. Sufficient anchoring SHALL [PS] be provided to avoid overturning and significant lateral movement in the event of a blast load.

This might require the provision of a concrete foundation slab.

2.4 ENTRANCES AND EXITS

1. Portable BRMs shall have at least two entrances/exits.
2. The doors shall be positioned so that at least two sides of the BRM contain a door.
3. Where it can be demonstrated that the BRM will not tip over under 1.5 x the design blast loading, the doors may be located on a common wall but near opposite ends.
4. At least one door shall be of the emergency type, fitted with panic hardware.
5. The total number and location of emergency exit(s) shall comply with the building and fire codes applicable at the site of installation.
6. All entrance/exit doors SHALL [PS] open outwards.
7. The approach to the main entrance shall allow full access for operations and maintenance, the preferred solution being a ramp with a slope of not more than 1 in 8 with a non-slip finish on the top surface.

2.5 PROVISIONS FOR DISABLED PERSONS AND TOILETS

1. Provisions for disabled persons and toilets shall be provided if required, as specified by the Principal and/or in accordance with the local building code.

2.6 BUILDING USE CONSIDERATIONS

2.6.1 Managing risks due to building deflections

1. The Contractor shall consider the building response (large and sudden roof and wall deflections) in the placement and anchoring of hardware and furnishings.
2. Objects close to, or attached to, the roof or exterior walls shall be prevented from becoming a hazard.

2.6.2 Placement of heavy exterior equipment

1. Exterior equipment, such as air conditioners or condensers, shall be mounted on the walls.
2. The effect of this equipment shall be included in the structural analysis of the BRM under blast loading.

2.6.3 Interior equipment and furnishings

1. Tall, heavy objects (e.g., lockers, tall filing cabinets and tall bookshelves) shall be placed away from exterior walls.
 - a. If this cannot be avoided, the objects shall be anchored or shall be located so that there is a clearance between the object and exterior walls larger than the calculated wall deflection or 150 mm (6 in), whichever is greater.
 - b. If the exterior wall is covered by drywall on the inside face, the space separation between the two panels may be factored into these spacing requirements, provided the interior drywall panel does not deflect with the exterior panel when subjected to a blast load.
2. Shock sensitive equipment shall be mounted on interior walls, rather than on the inside of exterior walls.
3. Shock sensitive critical equipment shall not be mounted on the inside of exterior walls.
4. The interior walls shall have sufficient structural strength for fixing this equipment.
5. Heavy interior equipment, such as video monitors, shall not be hung from the ceiling.

3. STRUCTURAL CONSIDERATIONS

3.1 GENERAL

1. Portable BRMs SHALL [PS] be designed for a combination of blast loading with all other applicable loading conditions; gravitational, wind, etc.
2. The gravitational, wind, and other applicable loading conditions shall be applied as specified in:
 - a. DEP 34.00.01.30-Gen.
 - b. DEP 34.17.00.32-Gen.
 - d. DEP 34.17.00.31-Gen.
3. The design live loads for the floor shall be 3 kN/m² (0.44 psi) or as indicated by local requirements.
4. Portable BRMs may be designed using the methods provided in ASCE 41008.