

DEP SPECIFICATION

HUMAN FACTORS ENGINEERING – PHYSICAL WORKSPACE DESIGN

DEP 30.00.60.20-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the minimum acceptable Human Factors Engineering (HFE) requirements and for the design and layout of physical workspaces and equipment globally for both onshore and offshore facilities. The purpose of this DEP is to ensure the design and layout of equipment and workspaces allowed for efficient and safe access for task activities during operation and maintenance under normal, upset/emergency and all weather conditions by the full range of potential personnel.

Application of this DEP enables the design and layout of equipment and physical workspaces, whether “stick built” or modular design, to comply with the Human Factors Engineering requirements contained in the Shell Group HSSE & SP Health Standard and the HSSE & SP Control Framework Health Manual.

This DEP does not apply to packaged units, which are covered by DEP 30.00.60.18-Gen., or control rooms which are covered in DEP 30.00.60.15-Gen.

Due to space constraints, hull spaces of floating offshore assets do not normally comply with the requirements of this DEP. Typically a project specific set of human factors design criteria are produced for the hull spaces of floating offshore assets.

This is a revision of the DEP of the same number dated September 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 authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in both onshore and offshore facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. 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 word **should** indicates a recommendation.

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

1.3.2 Specific definitions

Term	Definition
Accessible	An item is considered accessible when it can be operated, maintained, inspected, removed or replaced by the suitably clothed and equipped user with applicable body dimensions within the anthropometric range specified in this document. It includes the ability to reach such a device with all tools required to perform such operational attention or maintenance.
Anthropometric	Related to the measurement of body dimensions
Emergency egress	Refers to the means of escape, under emergency conditions, from any location. This includes platforms or areas that are at a different elevation to the primary operating level of the facility or to grade.
Exit access	That portion of an exit route that leads from any portion of a building or an open structure to an exit (NFPA 101). The exit access terminates at the closest riser of an exterior exit stairway, emergency escape ladders, or the start of a ramp or interconnecting walkway.
Exit access travel	Horizontal travel distance measured from the most remote point on a level to the exit. This includes the exit access.
Exit	That portion of an exit route between the exit access and the exit discharge. Exits include exterior exit stairways, exterior exit ramps, emergency escape ladders and interconnecting walkways between structures.
Exit Discharge	That portion of an exit route system between the termination of an exit and an area open to the outside air, leading to a place of safety.
Exit route (escape route)	A continuous and unobstructed path of exit or escape travel from the most remote point on a level to a place of safety. An exit route consists of three parts: The exit access; the exit; and, the exit discharge. (An exit route includes all vertical and horizontal areas along the route.)
Fall arrester	Protective equipment permanently fixed to a ladder used in combination with personal protective equipment (ISO 14122-4).
Fall protection	Technical measure to prevent or reduce the risk of people falling from a fixed ladder (ISO 14122-4). Devices include both safety cage and fall arrester (Ladder Safety Device as per 29 CFR 1910.27).
Handrail	One of the following: A single bar or pipe supported on brackets from a wall or partition, as on a stairway or ramp, to furnish persons with a continuous handhold in case of tripping (29 CFR 1910.21). Top element designed to be grasped by the hand for body support which can be used individually or as the upper part of a guard rail (ISO 14122-3).

Term	Definition
HFE Technical Authority	The individual assigned as Technical Authority for HFE on the project in compliance with Business Unit and Group standards.
HSSE Critical Equipment	An item of equipment or structure, or a system (including software logic), that acts as a barrier to prevent the uncontrolled release of a Hazardous Substance or release of energy leading to worst case credible scenario with RAM red, yellow 5A or yellow 5B Risk, or acts as a barrier to control or mitigate the effects of such a release. HSSE critical equipment is also known as Safety Critical Equipment or SCE.
Human Factors Engineering	A multidisciplinary science that focuses on the interaction between the human and the work system in order to design human-system interactions that optimise human and system performance (ISO 6385).
Ladder Safety Device	A ladder safety device is any device, other than a cage or well, designed to eliminate or reduce the possibility of accidental falls and which may incorporate such features as life belts, friction brakes, and sliding attachments (29 CFR 1910.21).
Operating Aisles	Space or walkway for access to equipment and machinery requiring hands-on work by one or more individuals and for the use of mobile assisted lifting and transport devices.
Platform	A level surface used for the operation, maintenance, inspection, repair, sampling and other phases of work in connection with equipment or machinery.
Railing (guard or stair)	A vertical barrier erected along exposed edges of a floor opening, wall opening, stairway, ramp, platform or runway to prevent falls of persons (29 CFR 1910.21). Device for protection against accidental fall or accidental access to a hazardous area, with which stairs, step ladders or landings, platforms and walkways may be equipped (ISO 14122-3).
Standing volume	Space required to operate a control, reach or access a component, or read an instrument, within the normal range of the standing posture.
Very Toxic (Substances)	Refer to DEP 01.00.01.30-Gen., for definitions of "very toxic - acute", "very toxic - chronic", and "very toxic - environment".
Walkway	A level surface used for moving from one point to another. May also be included as part of an exit or escape route.
Workspace	A physical space or location where work or operations are performed. This space should be defined based on human anthropometrics and operational or maintenance tasks to be performed

1.3.3 Abbreviations

Term	Definition
CFR	Code of Federal Regulations (USA)
DN	Diametre Nominal / Nominal Diameter

Term	Definition
HFE	Human Factors Engineering
HSSE & SP	Health, Safety, Security, Environment & Social Performance
MOV	Motor Operated Valve
MOC	Management of Change
NFPA	National Fire Protection Agency (USA)
NPS	Nominal Pipe Size
PPE	Personal Protective Equipment
RPE	Respiratory Protective Equipment
SCBA	Self Contained Breathing Apparatus
SOLAS	Safety of Life at Sea
TA	Technical Authority
VCA	Valve Criticality Analysis

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (5).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated September 2013 as well as DEP 30.00.60.13-Gen. dated September 2011. The following are the main, non-editorial changes.

This DEP has been extensively rewritten and the changes are too numerous to list.

Section/Clause	Change
3.8	The scope of this DEP has been changed to also include in (3.8) the detail HFE requirements for valves which previously were previously included in DEP 30.00.60.13-Gen.
All	Content has been rearranged and collated under three main topics: general workspace design requirements, equipment specific requirements and personal safety/work environment.
All	An effort was made to reduce duplication of content that is similar to content in other DEPs. Furthermore, prescriptive requirements were validated against regulatory and industry standards as well as scientific literature to ensure that they are fit for purpose and assurable.

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 WORKSPACE DESIGN REQUIREMENTS

2.1 ANTHROPOMETRICS

The default anthropometric data that was used for specifying dimensional requirements are that of the Northern European 5th percentile female and the 95th percentile male in order to provide for a range of users.

The minimum dimensions for standing space, although based on static anthropometrics, do allow to some degree for dynamic conditions as well as accommodation of summer clothing and light PPE, but do not include allowances for cold weather PPE or respiratory protection e.g., self-contained breathing apparatus (SCBA).

All standing dimensions include a 25 mm (1 in) allowance for foot-wear.

Dimensions, where appropriate and depending on the source data, have been rounded off to the nearest 10 mm (0.5 in).

2.2 MINIMUM VOLUMES

2.2.1 Standing volume

1. Standing space shall be provided for operators or maintainers in accordance with the minimum dimensions shown in Figure 1 and Table 1.

Figure 1 Minimum volume dimensions in a standing posture

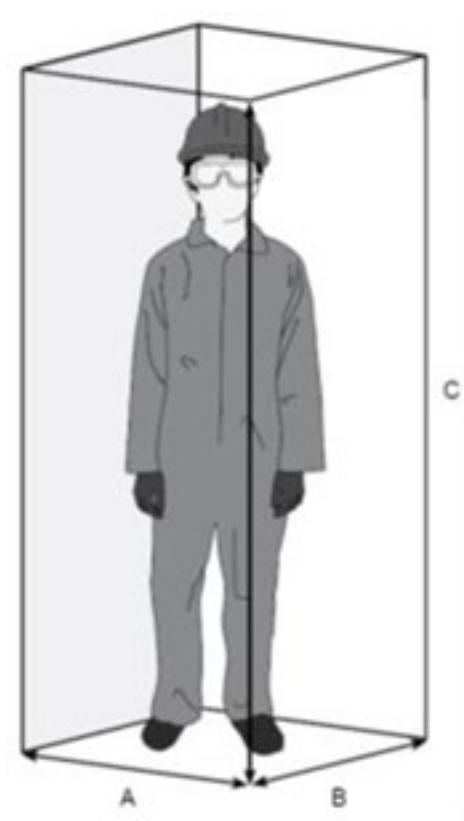


Table 1 Minimum volume dimensions in a standing posture

Parameter		Minimum Dimensions
A	Width	700 mm (28 in)
B	Depth	700 mm (28 in)
C	Height	2100 mm (84 in)

2. For the purposes of determining sizes of muster areas or individual standing room at embarkation stations on offshore/marine facilities, the width and depth dimension in Table 1 may be reduced to 610 mm (24 in).

2.2.2 Squatting/kneeling volume

1. Squatting/kneeling space shall be provided for operators or maintainers, having to interface with equipment located at a height of 810 mm (32 in) or below, in accordance with the minimum dimensions shown in Figure 2 and Table 2.

Figure 2 Minimum volume dimensions for a squatting/kneeling posture

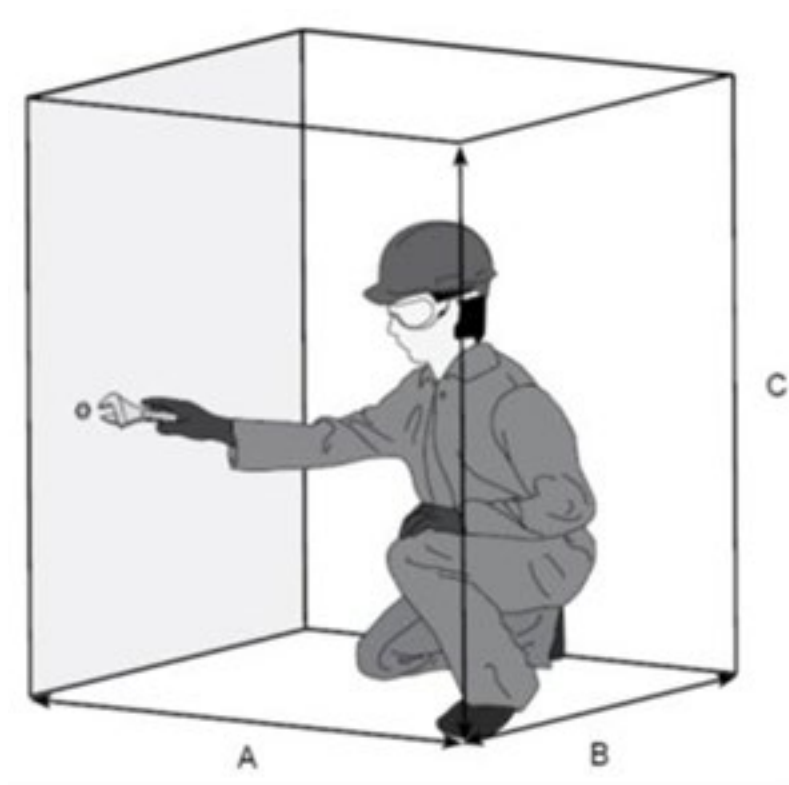
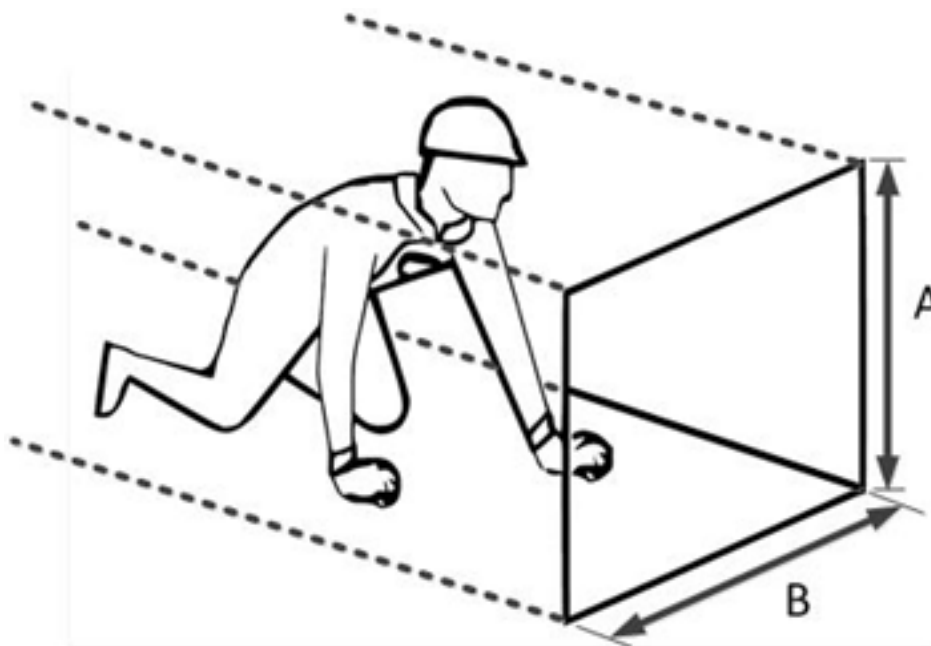


Table 2 Minimum volume dimensions for a squatting/kneeling posture

Parameter		Minimum Dimensions
A	Width	900 mm (36 in)
B	Depth	900 mm (36 in)
C	Height	1300 mm (51 in)

2.2.3 Supine, prone and crawling posture

1. Workspaces for supine, prone and crawling postures used for inspection purposes, shall be designed as per the clearance requirements specified in Figure 3 and Table 3.

Figure 3 Minimum cross-sectional area for supine, prone and crawling posture**Table 3 Minimum cross-sectional area for supine, prone and crawling posture**

Parameter		Minimum Dimensions
A	Height	900 mm (36 in)
B	Width	700 mm (28 in)

2. The acceptability of the postures in Figure 3 and Table 3 and maximum travel distance shall be subject to risk assessment outcomes and approval by the Principal.

2.3 HORIZONTAL ACCESS (WALKWAYS AND PLATFORMS)

2.3.1 Walkways

1. Walkway widths shall comply with the dimensions and applications shown in Table 4.

Table 4 Walkway widths

Application	Minimum Dimension
Walkways on packaged units or on vessel access platform (e.g., columns and pressure vessels) between the vessel piping or other obstruction and guardrail (Onshore or offshore)	700 mm (28 in)
Walkways other than those designated as stretcher accessible route, or connecting to stairs from any location in or on a structure or building (Onshore or offshore)	900 mm (36 in)
Operating aisles and walkways designated as a stretcher accessible route, from any location in or on a structure or building (Onshore or offshore)	1200 mm (48 in)

2. Head clearance provided above the walking surface shall be a minimum of 2100 mm (84 in) for the full length and width of all walkways, at the access point of an area and around equipment and valves where operators pass.
3. Walkways shall be kept free of all obstructions and protrusions (e.g., valve stems, piping steelwork).

2.3.2 Walking surfaces

1. Walking surfaces shall be as follows:
 - a. Flush (< 4 mm ($\frac{1}{4}$ in) change in elevation) at all joints to eliminate tripping hazards.
 - b. Provide traction for safe passage of workers through the use of serrated grating, standard finish concrete, paint or finishes with grit or slip resistance enhancements.
2. Unless solid flooring is required (e.g., for containment), grating shall be used when the presence of precipitation or wetting by operations or maintenance tasks is anticipated and in all cases where there is the potential for accumulation of liquids or loose solids that might increase the risk of slips and falls.
3. Checkered plate shall only be installed with the use of slip resistant enhancing coating or finishing.
 - a. For requirements on surface coatings on walking surfaces, refer to Section 8.2 in DEP 30.48.00.31-Gen.

Checkered plate does not provide sufficient slip resistance and requires additional surface treatment for improving the grip of footwear.

2.3.3 Elevated platforms

1. A permanent platform or standing surface shall be provided for all operational and non turn-around maintenance tasks not within reach or view, but requiring the use of both hands and unobstructed view.

Personnel should not have to stand on surfaces that were not specifically designed as a standing surface.

This will provide operators/maintainers with a stable standing surface that does not require them to stand on stair treads or ladder rungs while performing work.

Structural steel members in the base frame are considered inappropriate as standing surfaces.

Valve hand wheels greater than 120 mm (5 in) are considered to be a two-handed operation.

2. A permanent platform shall be provided for maintenance access to manways or other service openings and for temporary storage or lay down of blinds, vessel entry or for handling and storage of consumable materials such as catalyst or desiccants when 4.0 m (13 ft) or more above grade.

This is measured to center of manway or to the height of the required standing surface as appropriate.

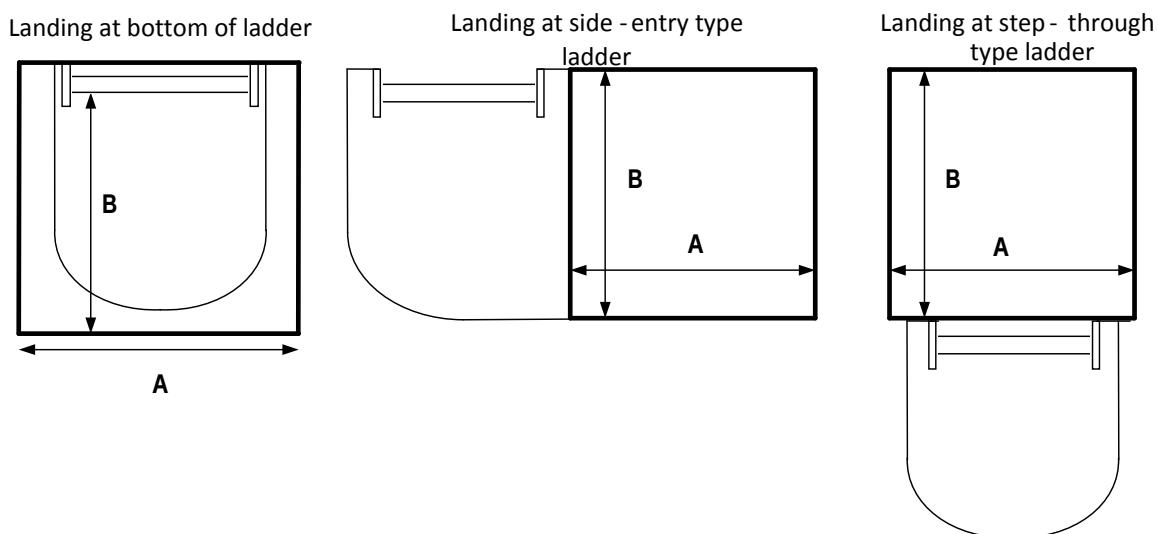
3. Free standing pressure vessels or furnaces that are located in the same area should have platforms and interconnecting walkways at the same elevation.

This requirement is to prevent the frequent requirement for personnel to change elevations which is an additional personal safety risk and results in excessive operational or maintenance time.

4. Platforms shall not be less than 760 mm (30 in) wide or the swing radius of a self-closing safety gate plus 460 mm (18 in) and 900 mm (36 in) deep with the following exceptions:

- a. platforms which are used exclusively for standing (e.g., just to reach a valve) shall be no less than 610 mm (24 in) wide and 750 mm (30 in) deep.
- b. landing platforms used to access a vertical ladder shall be no less than the following:
 - i. 610 mm (24 in) wide (See dimension A in Figure 4)
 - ii. 750 mm (30 in) deep or equal to the depth of the cage (See dimension B in Figure 4)

Figure 4 Landing platforms used to access a vertical ladder



5. Walkways on elevated platforms for vessels/columns/towers/spheres shall provide a minimum of 700 mm (28 in) clear access between any object (including insulation and cladding) and the guardrail; see dimensions D and E in Figure 5 and Table 5.
6. Platform's standing surface shall not be more than 1.2 m (4 ft) below the centre of manways.