

DEP SPECIFICATION

HUMAN FACTORS ENGINEERING – 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 the minimum acceptable Human Factors Engineering (HFE) requirements and gives recommendations for the design and layout of equipment and workspaces. The purpose of this DEP is to ensure the arrangement created in the design allows for efficient and safe access and manual handling during operation and maintenance under all normal, upset/emergency and weather conditions by the full range of potential personnel.

This is a revision of the DEP of the same number dated September 2011; 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 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.

1.3.2 Specific definitions

Term	Definition
Anthropometry	The measurement of body dimensions
Critical Task Inventory	An inventory of human tasks, identified by application of DEP 30.00.60.19-Gen., that are considered to be critical to asset integrity or process safety.

Term	Definition
HFE Technical Authority	The individual assigned as Technical Authority for HFE on the project in compliance with Business Unit and Group standards.
Human Factors Engineering	A multidisciplinary science that focuses on the interaction between the human and the work system in order to design human-machine interactions that optimise human and system performance. (ISO 6385)
Operating Aisles	Space for access to equipment and machinery requiring hands-on work by one or more individuals as well as for the use of mobile assisted lifting and transport devices
Thoroughfare	A thoroughfare is a walkway which is routinely used by people passing in both directions, e.g., main access ways or emergency escape routes.
Work platform	A level surface used for the operation, maintenance, inspection, repair, sampling and other phases of work in connection with the equipment or machinery
Walkway	A level surface used for moving from one point to another

1.3.3 Abbreviations

Term	Definition
DN	Diametre Nominal / Nominal Diameter
FFL	Finished Floor Level
HFE	Human Factors Engineering
NPS	Nominal Pipe Size
PPE	Personal Protective Equipment
RPE	Respiratory Protective Equipment
SCBA	Self Contained Breathing Apparatus

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 (6).

1.5 SUMMARY OF MAIN CHANGES

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

Section/Clause	Change
3.1.1	Table 1, Parameter C - Revised height from 2100 mm to 2300 mm to accommodate European industry and regulatory requirements. (Changed 84 inches to 90 inches in corresponding USC units.)
3.1.4	Table 4 (H) Overhead Clearance. Revised height from 2100 mm to 2300 mm to accommodate European industry and regulatory requirements. (Changed 84 inches to 90 inches in corresponding USC units) Added note to Table 4 – clarifying dimension to be used in USA is 2130 mm (84 in).
3.3.1	Table 11, Optimal Vertical Viewing Arc changed from 800 to 80°.

3.5.1	Head clearance on walkways – clarified different dimension applies depending on regional regulatory requirement. For European regulatory requirements, revised from 2100 mm to 2300 mm to accommodate European industry and regulatory requirements. For USA this dimension is 2130 mm (84 in).
3.5.3	Inserted minimum dimensional requirements for platforms.
3.5.3	Revised clear standing area in front of the ladder from 750 mm to 900 mm (in metric unit only) to accommodate European industry and regulatory requirements.
3.6.1	Revised reference for offshore (US GoM) from ENG0068SP to DEP 37.81.10.31-Gen.
3.6.2	Table 19. Number of editorial and dimensional changes
3.6.2	Removed requirement for three-tier handrails on flair stairs.
3.6.6	Revised requirement for guard/handrails on ramps 610 mm to 500 mm (in metric unit only) to accommodate European industry and regulatory requirements.
3.7.2	Dimension A: Inserted a Note providing clearance requirements if stretcher access is required.
3.8	Revised distance to the primary means of escape from 15 m (50 ft) to 25 m (82 ft) to eliminate conflict with other DEPs.
3.8	Revised length of dead-end from 7 m (23 ft) to 6.1 m (20 ft) to eliminate conflict with other DEPs and regulatory requirements.
5.8	Revised “pipe flange size DN300 (NPS 12)” to read “pipe line size DN300 (NPS 12)”
5.8	Revised “minimum vertical clearance of 460 mm (18 in)” to read “minimum horizontal clearance of 460 mm (18 in)”
5.12	Revised to only address manual sample points for volatile and/or toxic materials.
5.13	Revised the required height for guardrails from 610 mm to 500 mm (in metric unit only) to accommodate European industry and regulatory requirements.
5.13	Reduced size of exposed and unattended floor or deck openings from 300 mm (12 in) by 300 mm (12 in) to 100 mm (4 in) by 100 mm (4 in) because of personal safety considerations
6	Deleted reference to ENG0068SP and replaced with DEP 37.81.10.31-Gen.

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.

2. GENERAL DESIGN REQUIREMENTS

2.1 PROJECT DESIGN

Where a project/design solution deviates from requirements and data in this DEP, the designer shall obtain approval from the Principal, and is directed to the project or regional Human Factors Engineering (HFE) Technical Authority (TA) as detailed in the Project Controls and Assurance Plan (PCAP) or Discipline Controls and Assurance Framework (DCAF) Discipline Authorities Manual.

2.2 ANTHROPOMETRICS

For the purpose of this DEP, the default anthropometric data used is that of the 5th percentile female Southeast Asia and 95th percentile male Northern European population unless stated otherwise within the document. For variances, projects should seek the assistance of the regional HFE TA for support to establish region specific requirements/data.

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

2.3 SAFETY CRITICAL TASKS

It shall be the responsibility of the project to determine the classification/category of safety critical equipment and systems. Designers are directed to DEP 30.00.60.19-Gen. for details on identifying process safety critical tasks.

2.4 CONTROLS AND DISPLAYS

Where stated, the preferred dimensions shall apply to controls and displays that require precise, frequent, and/or emergency use/review.

2.5 LIFE-SAVING RULES

Workplaces shall be designed and laid out to support safe ways of working. Equipment shall not be laid out, or access provided in ways that will make any task (operational, inspection, maintenance or testing) easier or faster by violating a life-saving rule.

2.6 ACCESSIBILITY AND REACH

Items most critical to system operation and which require rapid maintenance shall be most accessible. When relative criticality is not a factor, items requiring most frequent access shall be most accessible. High-failure rate items shall be accessible for replacement without removing non-failed items.

The required reach distance for any given task will vary depending on the task requirements. Assistance of the regional HFE TA should be sought where the data provided may not be commensurate with the task requirements (i.e., manual handling).

At no time shall an operator or maintainer be required to stand on any surface not specifically designed to be used as a standing surface in order to see, reach or perform an anticipated manual operation.

The design of workspaces shall take account of all necessary tools, materials and test equipment required to be used in the workspace.

2.7 POSTURE

The design of workspaces shall take account of the number of personnel required to perform the task, the actions (physical movements and application of force) to be undertaken and the postures that operators will be required to assume.

Kneeling and squatting operator positions should be avoided as much as possible for tasks performed on a regular basis (>1/shift). It is only permitted for maintenance or non-routine and infrequent jobs and where such layouts are unavoidable. These postures should not be

used for tasks that require operators to assume them for extended periods of time or to handle heavy loads or manually apply significant forces.

2.8 PERSONAL PROTECTIVE EQUIPMENT

As PPE will be specified on a regional and case by case basis, the designer should refer to the appropriate Operations personnel, HSSE representatives and HFE TA to identify task/project specific PPE and any potential impacts this may have on design: i.e., breathing apparatus (BA).

3. WORKSPACE ENVELOPE - MINIMUM REQUIREMENTS

3.1 STANDING POSITION

3.1.1 Minimal working volume

As a minimum, adequate standing workspace shall be provided wherever an operator or maintainer is required to work. The minimum dimensions of this space shall be as shown in Figure 1 and Table 1.

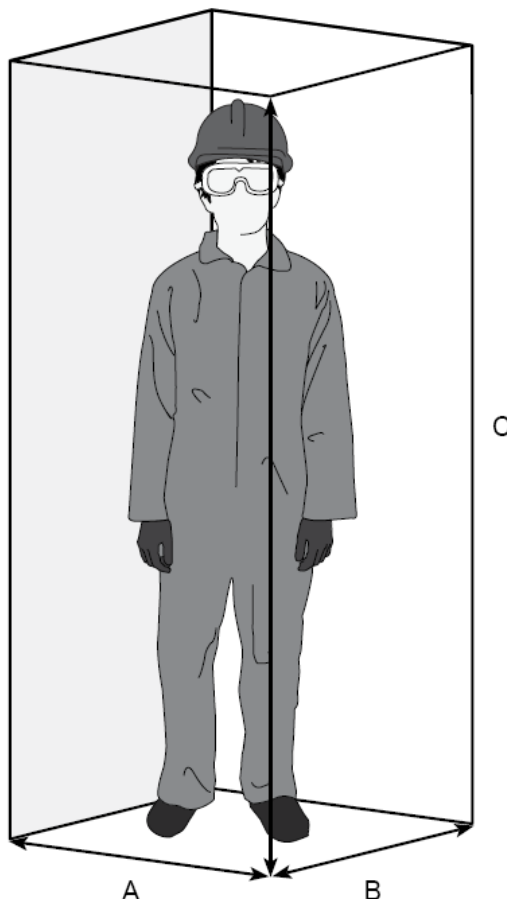


Figure 1 Minimal working volume in a standing posture

Table 1 Minimal working volume dimensions in a standing posture

Parameter		Minimum Dimensions*
A	Width	1000 mm (39 in)
B	Depth	1000 mm (39 in)
C	Height [§]	2300 mm (90 in)

NOTES: * There will be exceptions, e.g., for the purpose of determining sizes of muster areas or individual standing room at embarkation stations on offshore/marine facilities. The width and depth dimension should be reduced to 610 mm (24 in). Designers are directed to their regional HFE TA, for exceptions. These dimensions, furthermore, have been corrected for various types of PPE (i.e., Cold Weather clothing and SCBA).

§ For USA, this minimum height dimension shall be 2130 mm (84 in). For other regions, the Principal shall specify the appropriate dimension.

3.1.2 Standing and control surfaces

Displays, indicating instruments, mimic panels and controls mounted vertically or on flat vertical surfaces for use by standing operators shall be located as shown in Figure 2, and accompanying Table 2.

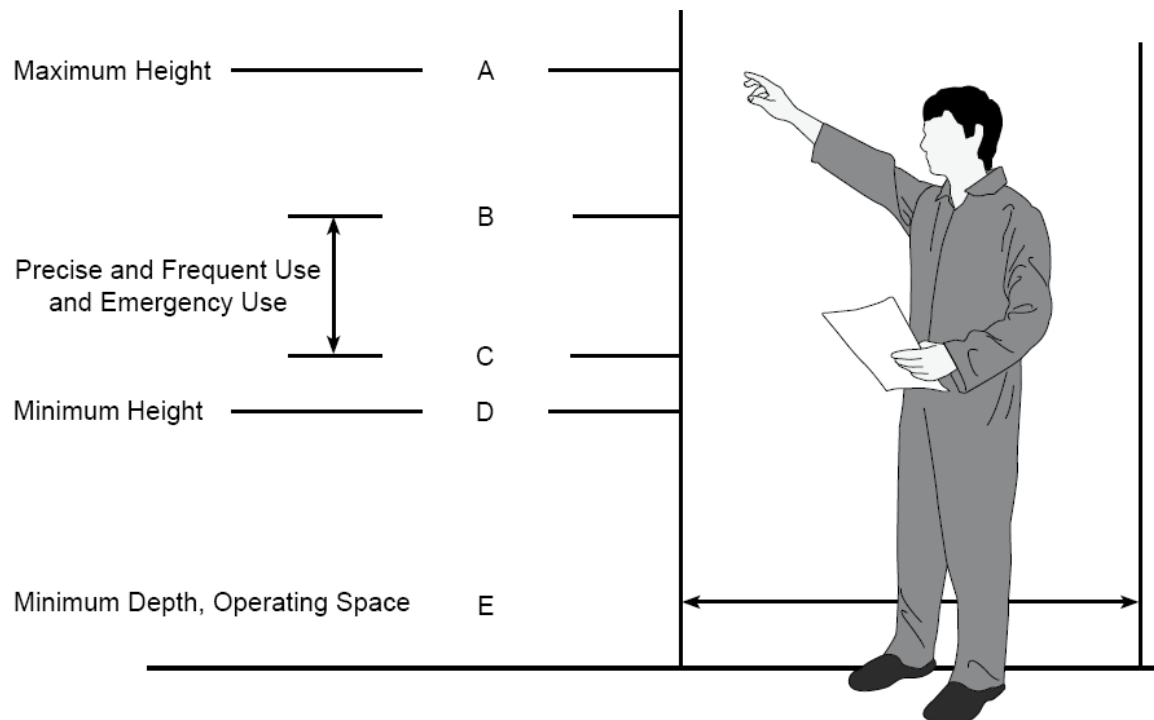


Figure 2 Control mounting height for standing personnel

Table 2 Control mounting heights – Standing

Parameter		Dimensions
A	Maximum reach height (Overhead pinch grip of 5 th percentile female)	1770 mm (70 in)
B	Preferred maximum reach height (Shoulder height of 5 th percentile female)	1160 mm (46 in)
C	Preferred minimum height (Hand grip height of 95 th percentile male)	870 mm (34 in)
D	Minimum height (Knee height of 95 th percentile male)	540 mm (21 in)
E	Minimum depth or clearance in front of panel/console/cabinet façade, where no work or interactions require the operator to squat or kneel down to a lower level	910 mm (36 in)

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

Maximum effective forward reach (i.e., ability to grasp and turn/push/pull forward) shall be 460 mm (18 in) from the front of the operator's body.

3.1.3 Standing and display surfaces

Displays, indicating instruments, and mimic panels mounted vertically or on flat vertical surfaces for use by standing operators shall be located as shown in Figure 3, and accompanying Table 3.

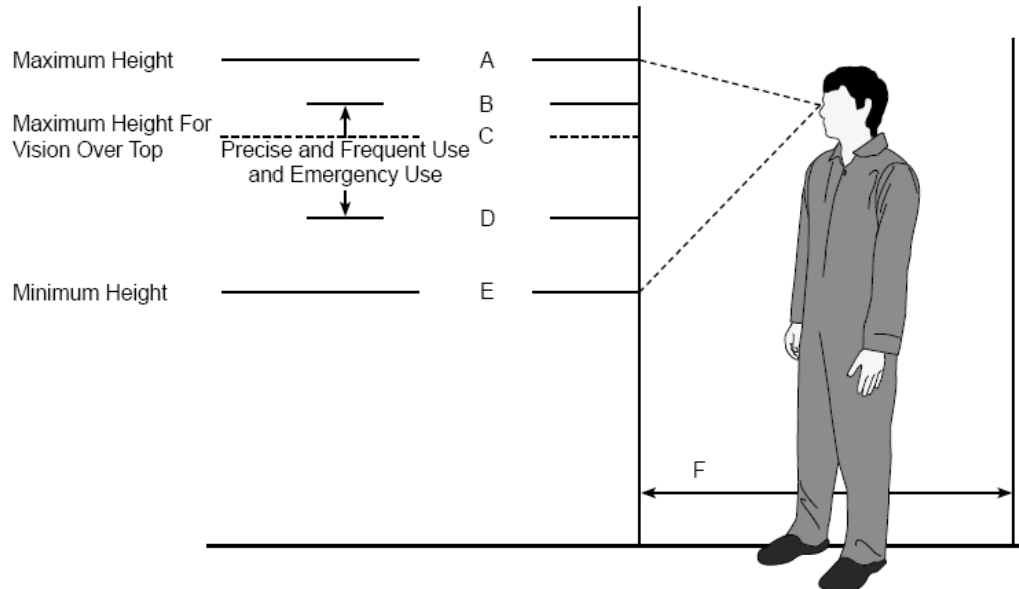


Figure 3 Display mounting height for standing personnel

Table 3 Display mounting heights – Standing

Parameter		Dimensions
A	Maximum height (Standing eye height of 5 th percentile female wearing shoes, upward viewing angle of 25° above horizontal and 830 mm (32 in) viewing distance)	1730 mm (68 in)
B	Preferred maximum height (Standing eye height of 5 th percentile female wearing shoes, upward viewing angle of 25° above horizontal and 500 mm (20 in) viewing distance)	1590 mm (63 in)
C	Maximum height for vision over the top	1460 mm (57 in)
D	Preferred minimum height (Standing eye height of 95 th percentile male wearing shoes, downward viewing angle of 55° below horizontal and 500 mm (20 in) viewing distance)	1390 mm (55 in)
E	Minimum height (Standing eye height of 95 th percentile male wearing shoes, downward viewing angle of 55° below horizontal and 830 mm (32 in) viewing distance)	1120 mm (44 in)
F	(Minimum depth or clearance in front of panel/console/cabinet façade, where no work or interactions require the operator to squat or kneel down to a lower level)	910 mm (36 in) for all regions

NOTE: 1. All standing dimensions include 25 mm (1 in) allowance for footwear.
2. Dimensions A to E are from FFL.

3.1.4 Standing and work benches

The dimensions of standing work benches shall comply with those shown in Figure 4 and Table 4.

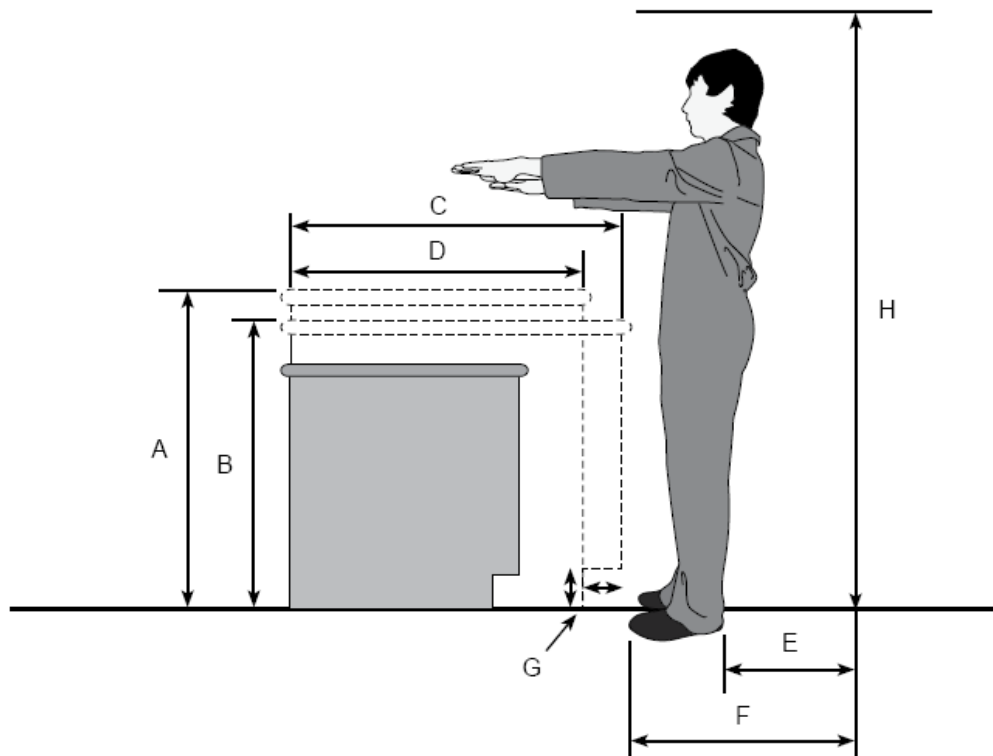


Figure 4 Standing workbench configuration

Table 4 Standing workbench dimensions

		Height Above Floor			Max Depth	
Standard Bench (Standing)	B	910 mm	(36 in)	C	1020 mm	(40 in)
Example: Laboratory bench or work bench in machinery shop for maintenance of valves.						
Tall Bench	A	1020 mm	(40 in)	D	910 mm	(36 in)
Example: Laboratory bench or work bench for fine detail inspection or maintenance.						
		Minimum			Preferred	
Passing Width behind Body	E	460 mm	(18 in)	E	610 mm	(24 in)
Working Space	F	810 mm	(32 in)	F	910 mm	(36 in)
Foot Space (square)	G	100 mm	(4 in)			
Overhead Clearance	H*	2300 mm	(90 in)			

NOTE: * Dimension "H" denotes the standing overhead clearance required for the height of the body in front of a work bench and is based on European regulatory requirements for headroom or clearance. For USA, this dimension shall be 2130 mm (84 in) minimum. For other regions, the Principal shall specify the appropriate dimension.

3.1.5 Standing and shelving

Workspace clearances required for use of shelves with full frontal access in offices and warehouses shall be as shown in Figure 5 and Table 5.

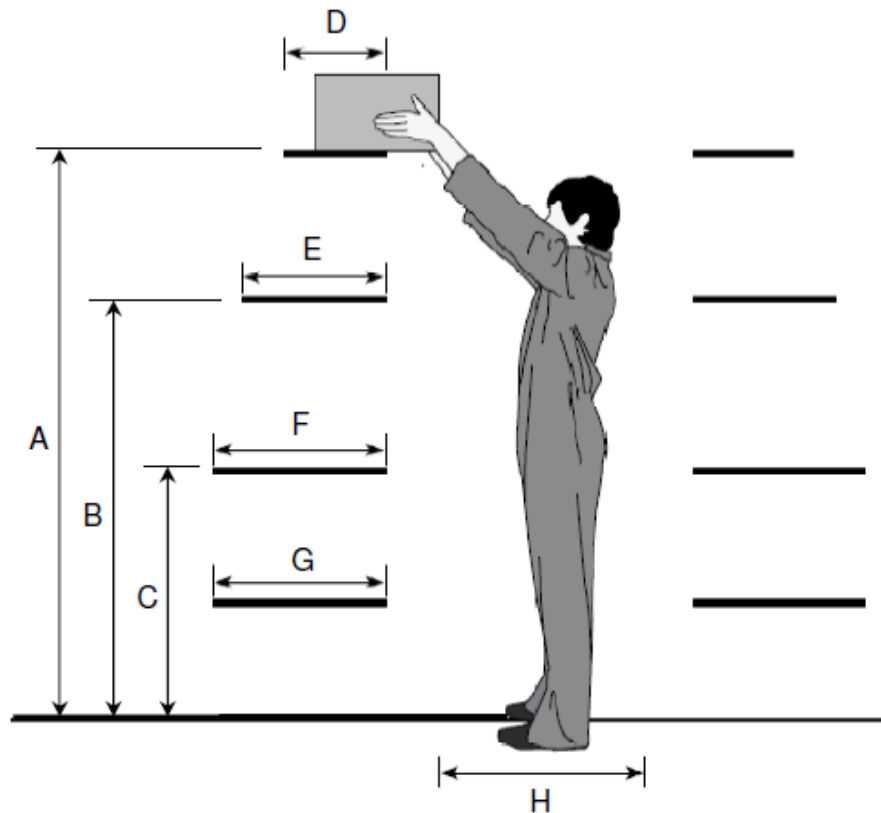


Figure 5 Workspace dimensions for shelves with full access

Table 5 Shelf heights and depths

Parameter		Dimensions
A	Maximum Shelf Height	1960 mm (77 in)
B	Intermediate Shelf Height	1630 mm (64 in)
C	Lower Shelf Height	1220 mm (48 in)
D	Depth of Shelves at A	360 mm (14 in)
E	Depth of Shelves at B	510 mm (20 in)
F	Depth of Shelves at C	610 mm (24 in)
G	Shelf Depth below C	610 mm (24 in)
H	Space Between Shelves	Shelf width plus 100 mm (4 in) or 660 mm (26 in), whichever is greater.

NOTE: Dimensions A, B and C are from FFL.

Shelves located above a cabinet shall be designed per Figure 6 and Table 6 below.

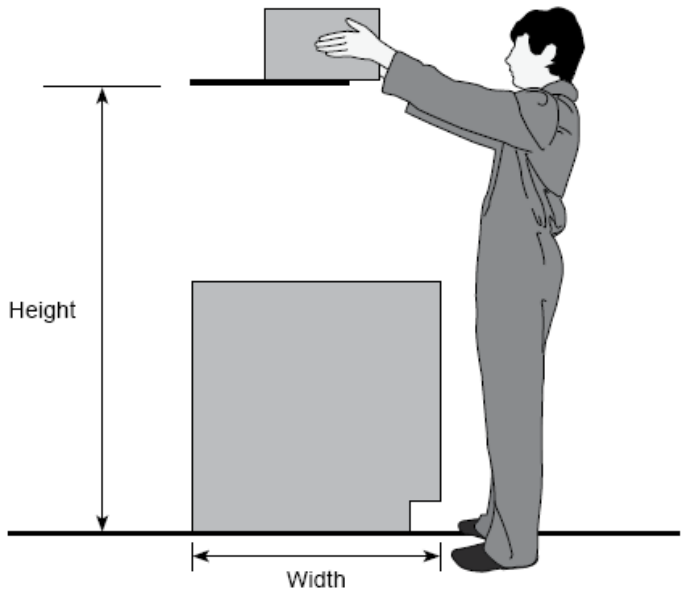


Figure 6 Shelving access above cabinets

Table 6 Shelf height in relation to cabinet width

Cabinet Width	Maximum Shelf Height (From FFL)
360 mm (14 in)	1910 mm (75 in)
610 mm (24 in)	1800 mm (71 in)
800 mm (31.5 in)	1700 mm (67 in)

Clearance required in front of lower shelves in order to place large items on them shall be as shown in Figure 7 and Table 7 below.

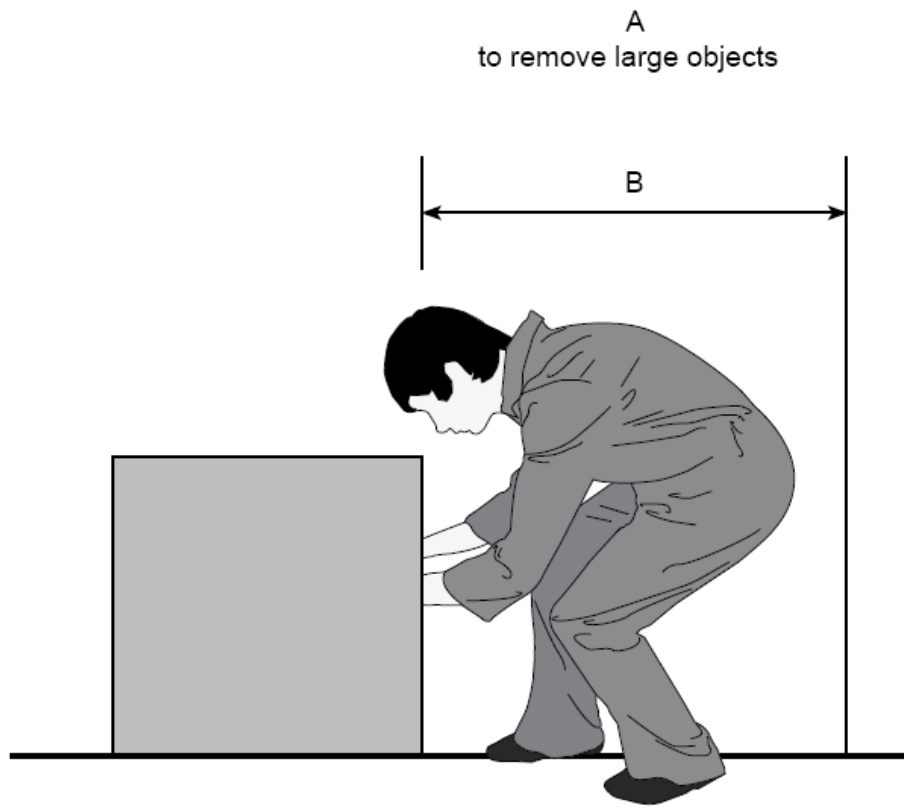


Figure 7 Front clearance requirements for lower shelves to remove large objects

Table 7 Access required for lower shelves and the removal of large objects

Parameter		Dimension
A	Space Required to Remove Large Objects	1020 mm (40 in)
B	Space Required to Access Lower Shelves	910 mm (36 in)