

**Access Systems  
for Off-Road Machines –  
SAE J185 JUN81**

SAE Recommended Practice  
Completely Revised June 1981

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# ACCESS SYSTEMS FOR OFF-ROAD MACHINES— SAE J185 JUN81

## SAE Recommended Practice

Report of the Off-Road Machinery Technical Committee, approved July 1970, completely revised by the Human Factors Technical Committee June 1981. The document conforms in all significant details with ISO 2867-1980. Rationale statement available.

**1. Purpose**—This recommended practice establishes guidelines for access systems primarily to aid in minimizing accidents and injury to personnel getting on, off, or moving about while servicing or preparing to operate off-road machines.

### 2. Scope

**2.1** Minimum criteria are provided for steps, stairways, ladders, walkways, platforms, handrails, handholds, guardrails, and entrance openings which permit ingress to and egress from operator, inspection, or service platform on off-road work machines parked in accordance with the manufacturer's instructions.

**2.2** This recommended practice pertains to off-road, self-propelled work machines used in construction, general purpose industry, forestry, and specialized mining machinery categories as defined in SAE J1116 (May, 1979). It also pertains to specialized off-road machines used in mining such as shovels, draglines, and drills not identified in SAE J1116.

**2.3** The minimum criteria established herein is based on one person using the access system at any one time.

### 3. Definitions

**3.1 Access System**—System provided on a machine for ingress and egress into and from an operator, inspection, or service platform to the ground.

**3.2 Alternate Egress System**—An alternate egress route to the ground for anticipatable emergency situations when the primary access system is not usable.

**3.3 Controlled Descent Device**—Device which can automatically lower a person without power at a fixed rate of speed as part of an alternate egress system.

#### 3.4 Entrance Opening

**3.4.1 Door Opening**—Fixed opening for ingress and egress to a compartment.

**3.4.2 Emergency Opening**—An egress opening from a compartment for use in emergencies when the primary opening is unusable.

**3.5 Foot Barrier**—A barrier to prevent a person's foot from slipping off the edge of a platform or walkway.

**3.6 Guardrail**—A device around the opened sides of walkways or platforms to protect a person from falling.

**3.7 Handrail and Handhold**—Devices that may be grasped by the hand for body support.

**3.7.1 Handrail**—A device which permits hand movement to a different location without removing the hand from the device.

**3.7.2 Handhold**—A device for single hand placement.

**3.8 Ladder**—A system consisting of a series of uniformly spaced steps that accommodate one or both feet.

**3.8.1 Vertical Ladder**—A ladder whose inclined angle from the horizontal is greater than 75 deg but not more than 90 deg.

**3.8.2 Inclined Ladder**—A ladder whose inclined angle from the horizontal is greater than 50 deg but not more than 75 deg.

**3.9 Ladder Safety Device**—Any device which minimizes or limits the length of falls from a ladder system.

**3.10 Operator's Platform**—Area from which the machine's travel and work functions are controlled.

**3.11 Platform**—A surface from which machine operation, servicing, inspection, or maintenance is performed.

**3.12 Ramp**—An inclined plane of 20 deg or less from horizontal without steps but may have cleats or other surface treatments for the purpose of traction.

**3.13 Rest Platform**—Platform used in conjunction with a ladder system for person to rest while standing without requiring use of hands.

**3.14 Riser Height**—Height between two consecutive steps or rungs measured from tread surface of lower to tread surface of upper step or rung.

**3.15 Stairway**—A device whose inclined angle from the horizontal is greater than 20 deg but not more than 50 deg consisting of four or more steps.

**3.16 Step/Rung**—Device for foot placement.

**3.17 Three Points of Support**—Features of an access system which permit a person to use two hands and one foot or two feet and one hand while ascending, descending, or moving about on the machine.

**3.18 Tread Depth**—Distance from the leading edge to back of step.

**3.19 Walkway**—A structure that permits walking between locations on a machine.

### 4. General Criteria

**4.1** Access and alternate egress systems' stepping and standing surfaces should comply without visible permanent deformation with all of the following minimum criteria:

(a) 4500 N uniformly applied force.

(b) 4500 N uniformly applied force per square meter.

(c) 2000 N concentrated force applied at any location through a 125 mm diameter disc.

**4.2** Handrails, handholds, and guardrails should be capable of withstanding a minimum force of 1000 N applied at any point from any direction without visible permanent deformation. Flexible devices shall not deflect more than 80 mm from their normal undeflected position with the test load applied.

**4.3** Roofs of machinery enclosures such as cabs and canopies which are used only for inspection platforms may comply only with paragraph 4.1 (c).

**4.4** Access systems should:

(a) Minimize probability of a user being inadvertently restrained by devices such as protrusions, controls, steps, or handles catching or holding body appendages or user's wearing apparel.

(b) Minimize protrusions that could trip or increase severity of injury in case of a fall.

(c) Provide smooth hand grasp surfaces.

(d) Prevent user contact with potential hazards such as extreme differentials in heat or cold, moving parts, electrical hazards, and sharp corners.

(e) Accommodate dimensionally a 95th percentile male through a 5th percentile female as defined in SAE J833a (June, 1974).

(f) Be obvious as to proper usage without special training.

(g) Permit a person to achieve three points of support if elevated more than 1 m.

**4.5** Two separate access systems or one access system and an alternate egress system shall be provided if the operator's platform is 3 m or higher from ground level.

**4.6** Step, walkway, and platform surfaces (including any machine or tool structural component used as part of an access or alternate egress system) should be slip resistant.

**4.7** Access system devices may be portable for convenient storage on the machine but should be positively secured when in the use position.

**4.8** Machines which have an access system where a person is not clearly visible to the operator shall have instructions posted at the entrance to the access system describing the method to secure permission to board.

### 5. Steps

**5.1** Steps should conform with the recommended dimensions in Table 1.

**5.2** Where lateral movement is necessary from the top step of a ladder to the next stepping surface, the vertical distance from the step to that surface should be no more than 300 mm.

**5.3** Steps are to be coordinated with properly positioned handrails to force the use of the proper foot.

**5.4** Wherever a foot may contact a moving part by protruding through the step, a shield shall be provided between the step and the moving part.

**5.5** Step design should minimize foot slipping laterally off the step.

**5.6** Rungs, round or flat, may be used on vertical ladders.

**5.7** Step tread surface should not be intended to be used as a handhold.

**5.8** Step design should minimize the accumulation of debris and aid in the cleaning of mud and debris from the shoe sole.

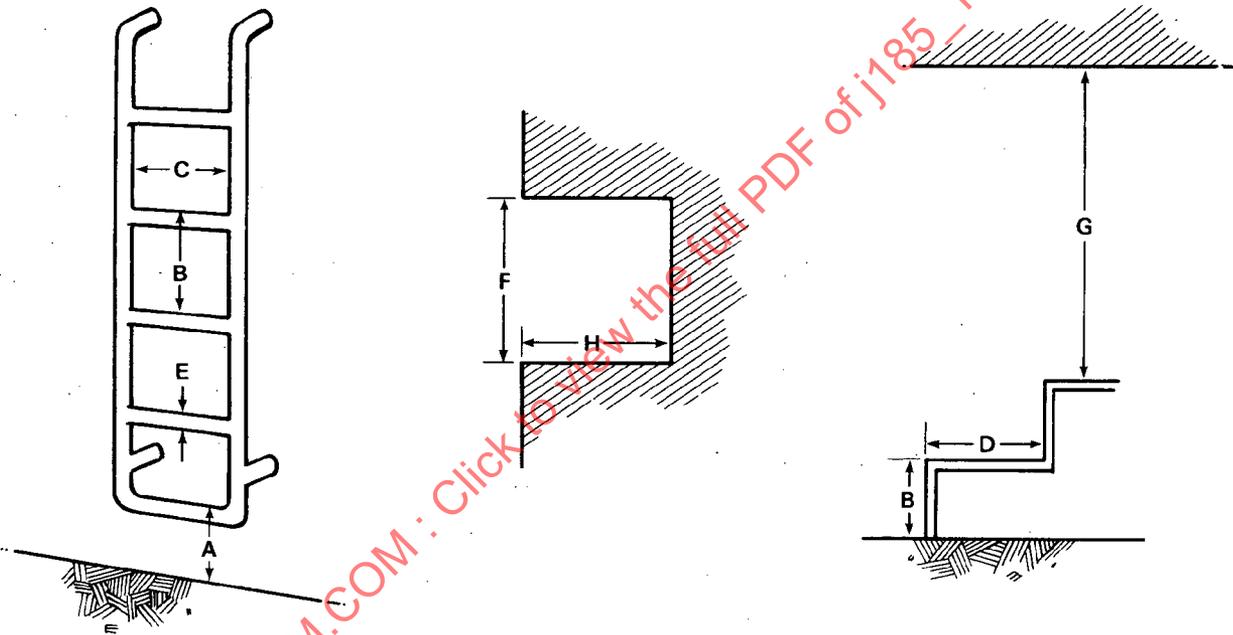
**5.9** Step design should provide natural foot placement while descending or the step should be clearly visible while descending.

**5.10** Flexibly mounted series of steps should be avoided. If used, the steps should not move more than 80 mm elastically in any plane when a horizontal force of 1000 N is applied to the outer edge of the first step from the ground (second step if the first step is free swinging). The first step from the ground may be free swinging.

The  $\phi$  symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

TABLE 1—STEPS

Dimensions	Minimum mm	Maximum mm	Preferred mm
A. Height of first step above ground or platform	—	700	400
B. Riser height	—	400	300
(1) Steps or ladders — See paragraph 6.5	—	400	300
(2) Stairways	—	250	180
C. Step width	—	—	—
(1) One foot	160	—	200
(2) Both feet	320	—	400
D. Tread depth	—	—	—
(1) Steps and ladders	130	—	200
(2) Stairways	240	—	300
E. Rung tread — dia. or width	19	—	60
F. Instep clearance	150	—	190
G. Head clearance above step	2000	—	—
H. Toe clearance	150	—	200



## 6. Ladders

6.1 Ladder steps should meet the criteria specified in Section 5.

6.2 Ladders which extend more than 6 m vertically above ground level should be equipped with a ladder safety device. Such a device shall not require continual manipulation for the user to ascend or descend the ladder.

6.2.1 Ladder safety devices which automatically provide user protection from falling are preferred.

6.2.2 Lower end of cage or other similar device, if used, should be a minimum of 2.1 m and a maximum of 2.5 m above ground or platform level.

6.2.3 Cage internal surface on a vertical ladder should not extend more than 760 mm from the steps nor should its internal width be more than 760 mm.

6.2.4 Cage on an inclined ladder should be sized as required to provide equivalent performance as required in paragraph 6.2.3 for vertical ladders.

6.3 A rest platform should be provided on ladders, preferably at least every 10 m but not to exceed 15 m of vertical climb.

6.4 Winding or spiral ladders shall not preferably exceed 2 m but not more than 3 m in vertical height without open-side guardrails.

6.5 Inclined ladder steps should be spaced such that two times the riser height plus the stride distance (the horizontal distance from the leading edge of one step to the leading edge of the next step) should preferably be no more than 600 mm but not to exceed 800 mm.

## 7. Stairways

7.1 Stairway steps should meet the criteria specified in Section 5.

7.2 Step tread depth on stairways should preferably be equal to or greater than the riser height. Successive riser heights and step tread depths are to be uniform.

7.3 Stairways should be provided with at least one handrail.

7.4 Guardrails should be provided on the open side or sides of stairways where a vertical drop from the stairway exceeds 3 m.

## 8. Handrails and Handholds

8.1 Handrails and handholds should conform with the recommended dimensions in Table 2.

8.2 Handrails should be appropriately spaced to provide continuous support to a moving person and should be placed within convenient reach.

8.3 The preferred cross section of a handrail and handhold is circular. A square or rectangular cross section with rounded corners is permissible.

8.4 Handrails and successive handholds should be placed parallel to the path of motion of the user. Handholds may be oriented vertically or horizontally but should be consistent within a given system.

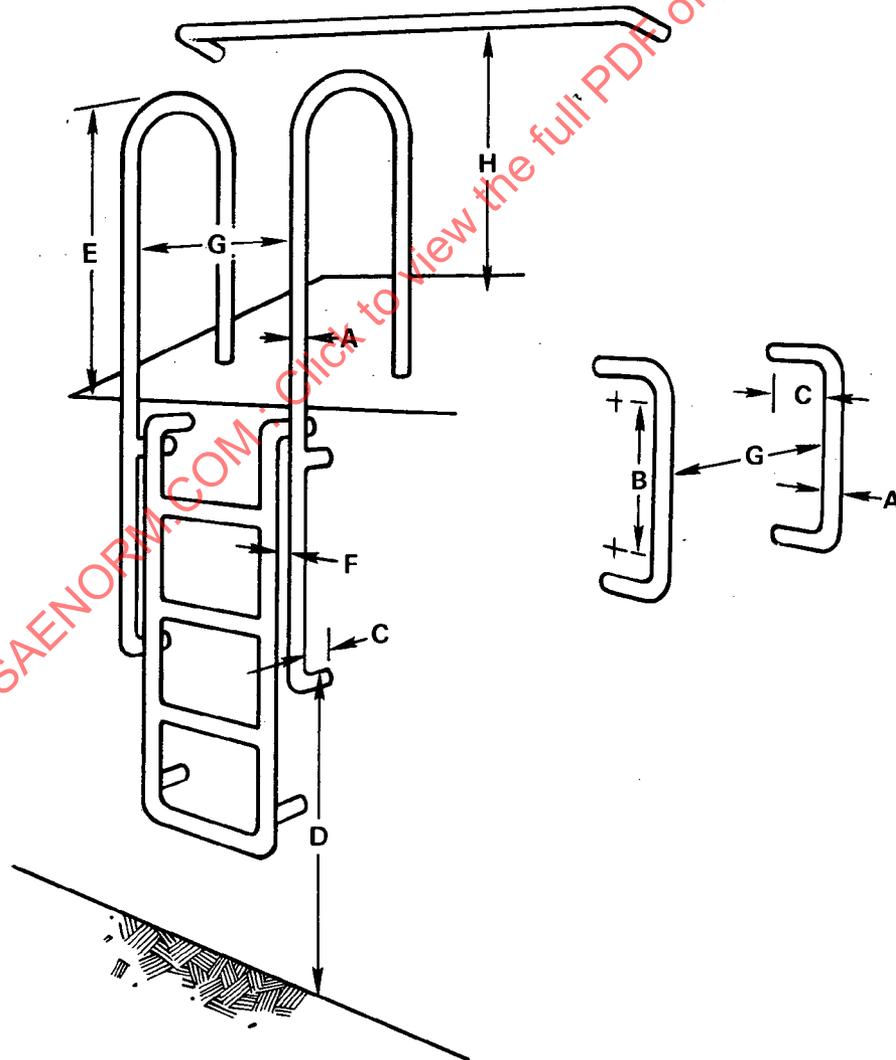
8.5 Any handrail or handhold on which the hand surface extends beyond the support should have a change of shape at the end of the hand surface to help prevent the hand from slipping off the end.

8.6 The use of handrails on a ladder system is preferred to handholds.

TABLE 2—HANDRAILS AND HANDHOLDS

Dimensions	Minimum mm	Maximum mm	Preferred mm
A. Width — dia. or across flats (1) Ladder, step, walkway (2) Stairway and ramp handrails	19 25	38 80	25 50
B. Length between bend radii for support legs of handholds	150	—	250
C. Hand clearance to mounting surface	75	—	—
D. Distance above standing surface	900	1600	—
E. Vertical continuation distance of handrail above step, platform, stairway, or ramp	850	960	900
F. Offset distance of handrail or handhold from edge of step	—	200	—
G. Width between parallel handrails (1) Ladder (2) Stairway and ramp	— 460	600 —	400 <sup>a</sup> —
H. Distance above walkway	850	1400	—

<sup>a</sup>600 mm if hip clearance is required.



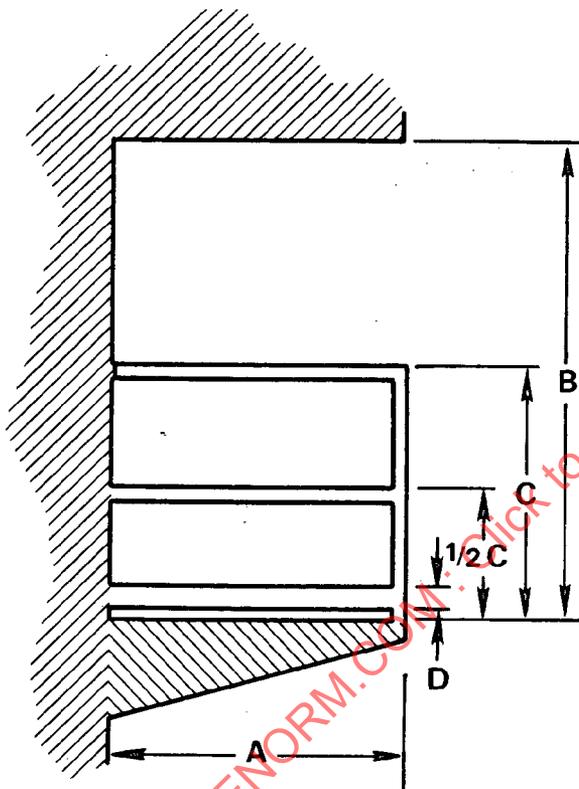
Where handholds are used, the spacing should correspond to the step spacing.

**9. Platforms, Walkways, and Guardrails**

9.1 Platforms, walkways, guardrails, and foot barriers should conform with the recommended dimensions in Table 3. A rail should be spaced midway between the top rail of a guardrail and the walkway or platform.

**TABLE 3—PLATFORMS, WALKWAYS, AND GUARDRAILS**

Dimensions	Minimum mm	Preferred mm
A. Width		
(1) Platform	380	600
(2) Walkway	300	600
B. Head clearance	2000	—
C. Guardrail height	1000	1100
D. Foot barrier height	50	100



9.2 Platforms and walkways should be provided with a handrail or a guardrail. A guardrail shall be provided if the vertical drop from the platform or walkway's surface is preferably more than 2 m but not more than 3 m.

9.3 Walkways used only for access to service and inspection platforms not more than 3 m above ground level may have a minimum width of 230 mm. Service and inspection may be performed from the walkway if it can be readily performed while maintaining three points of support.

9.4 Where an opening has been provided, other than at the end of a guardrail to provide ladder or step access, a safety bar or chain should be provided across the opening.

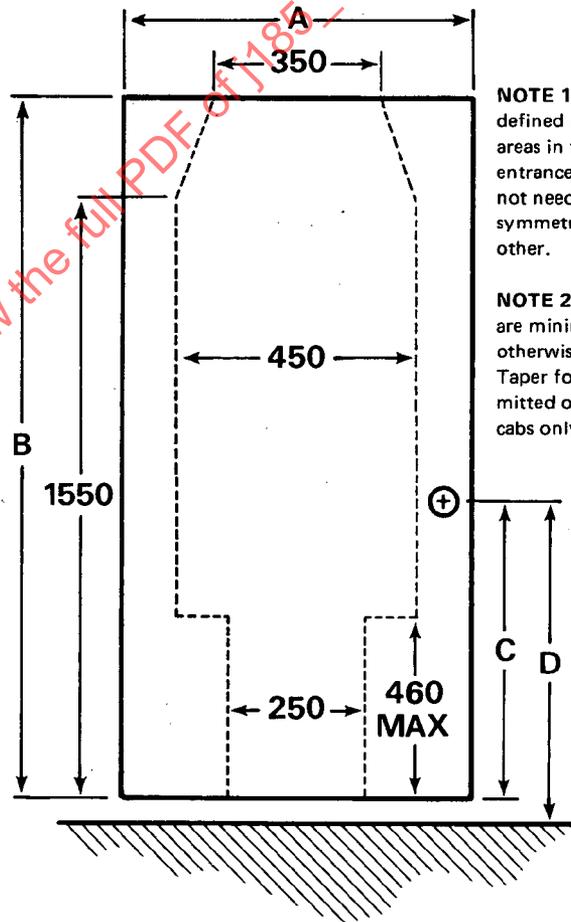
9.5 A foot barrier should be provided whenever a person's foot may slip from a walkway or platform into moving machinery or equipment that could create a hazard. The barrier also may be utilized to prevent material from sliding off the platform or walkway.

**10. Entrance Openings**

10.1 Entrance openings should conform with the recommended dimensions in Table 4.

**TABLE 4—ENTRANCE OPENINGS**

Dimensions	Minimum mm	Maximum mm	Preferred mm
A. Opening width — See paragraph 10.2	450	—	680
B. Opening height			
(1) Sit-down cab	1300	—	—
(2) Stand-up cab	1800	—	—
C. Height of internal door handle from floor			
(1) Sit-down cab	500	850	—
(2) Stand-up cab	800	1000	—
D. Height of external door handle above standing surface	500	1500	900
E. Emergency opening			
(1) Round (dia.)	650	—	—
(2) Square	600x600	—	—
(3) Rectangular	470x650	—	—



**NOTE 1:** The three defined minimum areas in the entrance opening do not need to be symmetrical to each other.

**NOTE 2:** Dimensions are minimum unless otherwise noted. Taper for head permitted on stand-up cabs only.

10.2 For entrances where a rectangular opening is not possible, the opening may be reduced to the minimum dimension indicated in the illustration in Table 4.

10.3 The entrance opening should be accessible directly from the access steps or from a platform or walkway.

10.4 The door should not sweep the area of the platform or the steps on which the person must stand to open the door.

10.5 An emergency opening for anticipatable emergencies should be provided in a cab surface different from the entrance door wall.

**11. Powered or Manual Actuated Access Devices**