

Fixed Access Ladders

Engineering Data Sheet 2-04

Revised: January 1997

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1. Legislative Requirements

1. Section 19 of the Regulations for Industrial Establishments states:

Where frequent access is required to equipment elevated above or located below floor level, permanent platforms shall be provided with access by a fixed stair or access ladder.

2. Section 18 (1) of the regulation states:

An access ladder fixed in position shall,

- a. be vertical;
- b. have rest platforms at not more than 9 metre (30 ft) intervals;
- c. be offset at each rest platform;

- d. where the ladder extends over 5 metres (16 ft) above grade, floor or landing, have a safety cage commencing not more than 2.2 metres (7 ft) above grade and continuing at least 90 centimetres (36 inches) above the top landing with openings to permit access by a worker to rest platforms or to the top landing;
- e. have side rails that extend 90 centimetres (36 inches) above the landing; and
- f. have rungs which are at least 15 centimetres (6 inches) from the wall and spaced at regular intervals.

3. Section 18 (2) of the regulation also states that:

Subsection (1) does not apply to an access ladder on a tower, water tank, chimney or similar structure which has a safety device which will provide protection should a worker using the ladder fall.

2. General

1. Fixed access ladders must be designed, constructed, installed and maintained so as not to endanger a worker, and must be capable of withstanding all loads to which they may be subjected.
 1. Structural design, including attachment methods should be performed by a Professional Engineer.
 2. The minimum design live load imposed by persons should be two loads of 1.1 kN (250 lb) each concentrated between any two consecutive attachments. Each rung in the ladder should be designed for a single concentrated live load of 1.1 kN (250 lb) minimum.
 3. Other loads, such as concentrated loads, loads due to ice, wind, rigging or impact, and dead loads, must be considered in the design.
 4. A safety factor of at least 4:1 should be applied in designing components for normal usage, and at least 10:1 for components supporting fall arrest systems.
2. All parts and surfaces of fixed ladder installations must be free of sharp edges, burrs, or other details that may be hazardous to the person using the ladder.
3. Prevention of unauthorized access may be achieved only by methods which do not compromise the safety or structural integrity of the ladder. For example:
 1. A smooth panel may be locked over the lower rungs.
 2. The bottom portion of an existing ladder must not be cut off for security purposes.
4. Design, condition and surface finish of rungs and side rails must permit secure foothold and handhold. Avoid highly polished surfaces which may become slippery, especially when wet. Avoid designs having rungs with sloping upper surfaces (a condition which may occur when a step-ladder is converted into a fixed ladder).
5. Where access is required to Heating, Ventilating and Air Conditioning (HVAC) or other equipment mounted on a roof or slung under a ceiling, the building design should ensure safe means of access for service or other personnel.
6. Roof access hatches served by fixed ladders must be at least 550 mm (21 5/8 in.) by 900 mm (2 ft 11 in.) on buildings more than 3 stories in building height, where the slope of the roof is less than 1 in 4.
7. When oversized clothing or equipment is anticipated (eg: self contained breathing apparatus), the ladder design should take such needs into consideration. However, dimensional extremes should be avoided to ensure that the ladder remains suitable for normal use.
8. Materials of construction shall be compatible with intended conditions of use. For example:
 - Aluminum ladders must not be used in caustic environments.
 - Ladders made of dissimilar metals should be protected against deterioration due to galvanic or electrolytic corrosion.

- Wooden ladders should not be used in humid environments, or should be protected against deterioration from exposure to moisture.
9. If the distance from the top of a parapet to the roof-top exceeds one rung-space (ie: max. 300 mm or 12 inches) a means of climbing to and from the top of the parapet should be provided.
 10. Fixed ladders should not be located in areas where the atmosphere creates or contributes to unsafe conditions. For example:
 - where ice may build up or steam may condense on a ladder,
 - where oil- or grease-laden air is present, such as cooking areas in commercial kitchens.

3. Rungs

1. The top of the uppermost rung of a ladder must be level with the top of the access/egress level or landing platform served by the ladder. Where there is a parapet, the access/egress level would be the roof if the parapet is cut to permit passage through the parapet. However, if the parapet is continuous, the access/egress level would be the top of the parapet.
2. Rungs should have a non-slip surface.
3. To accommodate functional or additional safety requirements, dimensions which exceed the minimum specified dimensions in Figures 1, 2 and 3 may be used provided sizes are increased from the minimum specified sizes to maintain the same factor of safety. In the design example attached (Fig. 1, "Typical Steel Access Ladder"), increasing the inside clear width of rungs from 400 mm (16") to 600 mm (24") would require an increase in the rung diameter from 20 mm (3/4") to 25 mm (1").

4. Side Rails

1. Any shape of side rail may be used that provides a uniform gripping surface for the hands of workers using the ladder, as long as the shape permits a power grip.
 1. Side rail shapes that do not permit a power grip should not be used.
 2. The same shape of side rails should be maintained for all ladders in the same length of climb.
2. The minimum size (cross-section) of side rails recommended in this section (4.2) are based on satisfying the design criteria of section 2.1 (above), assuming the maximum spacing of supports specified in section 6.2.4 (below).
 1. For different design loads or support spacing, the minimum size of side rails must be adjusted in accordance with recognized design practice.
 2. The same size (cross-section) of side rails should be maintained for all ladders in the same length of climb.
 3. The minimum size (cross-section) recommended for a steel ladder (subject to normal atmospheric exposures) is 10 mm x 65 mm (3/8 inch x 2½ inch) solid flat-bar stock.
 4. For different materials the minimum recommended size must be adjusted in accordance with recognized design practice.
3. Where it is not practicable to have fixed extensions of side rails above a landing, equivalent provisions must be arranged. Extensions integrated into guardrails, telescoping side rails, extensions incorporated into roof hatches, etc., may be accepted by this Ministry. **Centre-post extensions are not considered acceptable.**

5. Safety Cages

1. With an elevated access, a cage must be provided where the top of the ladder is greater than 5 metres (16 feet) above ground level, roof or floor and where there is a danger of a worker falling from the ladder to the ground level, roof or floor, even if the length of the climb is less than 5 metres (16 ft). (See Fig. 3 and 4.)
 1. An elevated access from a platform having 1.2 metres (48 inches) (or more) clearance between the ladder and any adjacent guard or rail, may utilize a standard cage (as per Figure 3).
 2. An elevated access from a platform having less than 1.2 metres (48 inches) clearance between the ladder and any adjacent guardrail should have a cage continuous with the guardrail on the side(s) with clearance less than 1.2 metres (48 inches) (Figure 4).
2. Cages should be provided with horizontal hoops or bands to help impede the fall of a worker.
3. Cages should not be less than 680 mm (27") in width and should extend not less than 680 mm (27") and not more than 760 mm (30") from the centre-line of the rung (measured on the climbed side of the ladder, horizontally and perpendicular to the rung). These restrictions do not apply to the bottom flare of cages.
4. The inside of cages must be free of obstructions.
5. Cages must be designed to withstand all loads to which they may be subjected.

6. Attachment & Anchoring

1. Structural soundness of the wall, member or piece of equipment to which the ladder is to be attached must be confirmed by a competent person, prior to installation of the ladder.
2. Attachment method (eg: through-bolting, anchoring, welding, etc.) must be rated for the intended structural service and for the type of wall, member or piece of equipment.
 1. Expansion anchors of all descriptions should be avoided with masonry walls, since anchor manufacturers' pull-out ratings are invariably given for poured concrete walls, and cannot be reliably attained in masonry walls.
 2. Through-bolted connections (or equivalent) must be used for masonry walls, and other walls for which there is no anchor manufacturers' pull-out rating. Generally, through-bolted connections should be used wherever practicable.
 3. Attachment and anchor bolts should have a minimum diameter of 12 mm ($\frac{1}{2}$ inch).
 4. Maximum spacing of attachment points for a steel ladder with side rails should be 3 m (10 feet). For different materials or extra loads, this maximum spacing must be adjusted in accordance with recognized design practice.
3. To provide an improved margin of safety, there should be two means of anchoring the top of the ladder. This may be accomplished by fastening the side rail extension above the top of the access/egress level to the structure, building or equipment.
4. Modifications to the attachment of the ladder to the structure, building or equipment should be approved by a professional engineer.

7. Platforms

1. Suitable platforms should be provided along a ladder where worker activity is anticipated and where lack of such a platform will incur significant additional hazard to workers. For example:
 - At the top of a ladder on a tower or similar structure, where work of significant duration can be anticipated (such as gathering of emissions information), a work platform should be provided.

- On a roof access ladder, just under the roof hatch, where it can be anticipated that workers encumbered with tools and/or supplies need to unlock a roof hatch, a rest or landing platform should be provided.
2. Rest platforms (per section 1.2.(b), above) may be used for this purpose, where practicable.
 3. Minimum total depth of the platform (from climbed side of ladder to guardrail) should be 760 mm (30 inches) and the minimum width of the platform should be 760 mm (30 inches).
 4. Self-closing safety gates should be provided on platforms next to a ladder, whenever worker activity near the ladder can be foreseen.

8. Inspection

1. Fixed access ladder installations must be periodically inspected by a competent person for rust, corrosion and structural integrity, and must be maintained in a good condition, not likely to endanger any worker. These inspections should be conducted at least once per year.
2. Records of inspections and maintenance to fixed access ladder systems should be maintained.

9. References

ANSI A14.3 - 1992

American National Standard for Ladders, Fixed - Safety Requirements.

USDOL - OSHA

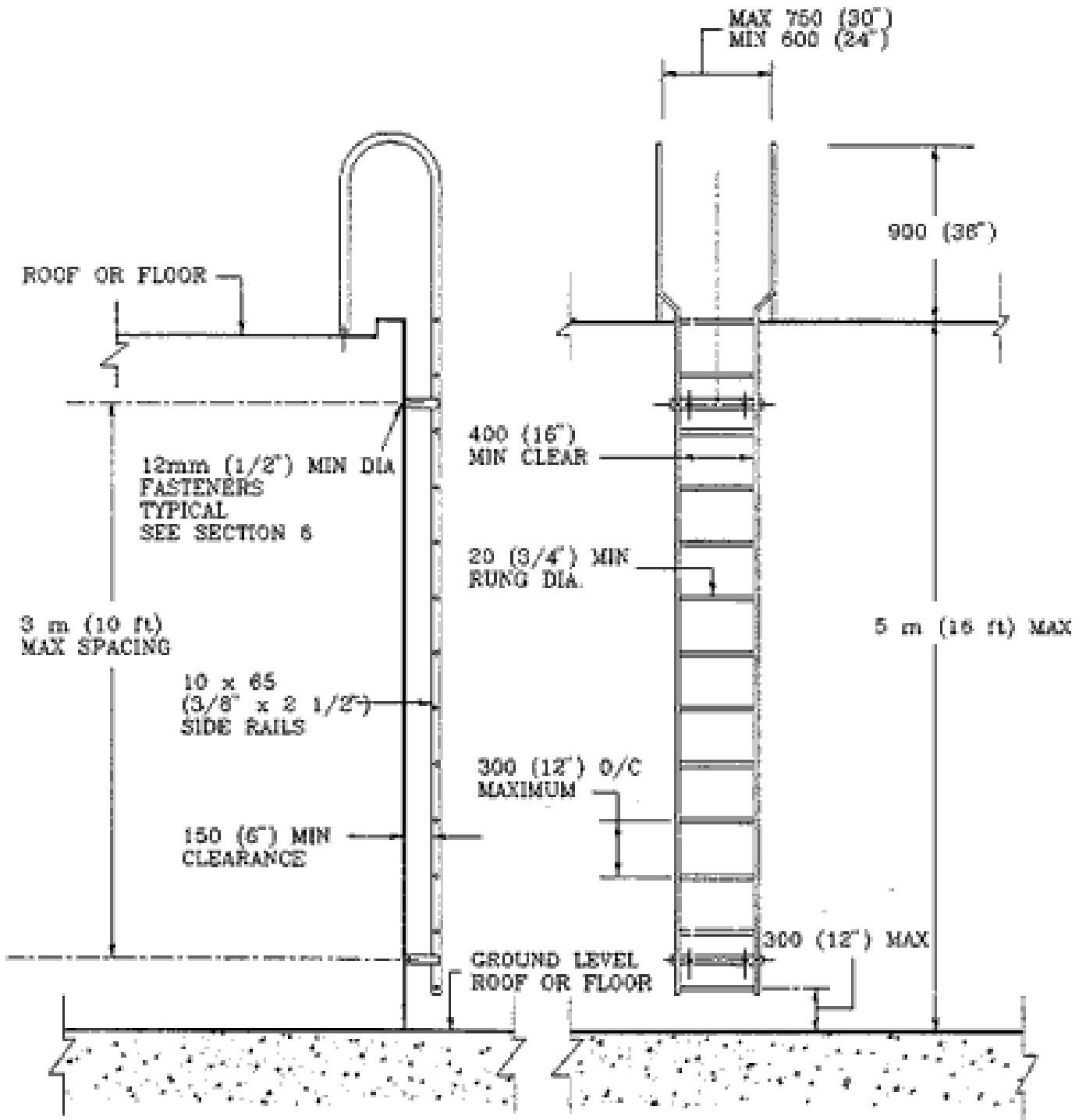
1910.27 Fixed Ladders

O.B.C. - 1990

Ontario Building Code

Figure 1. Typical Steel Access Ladder

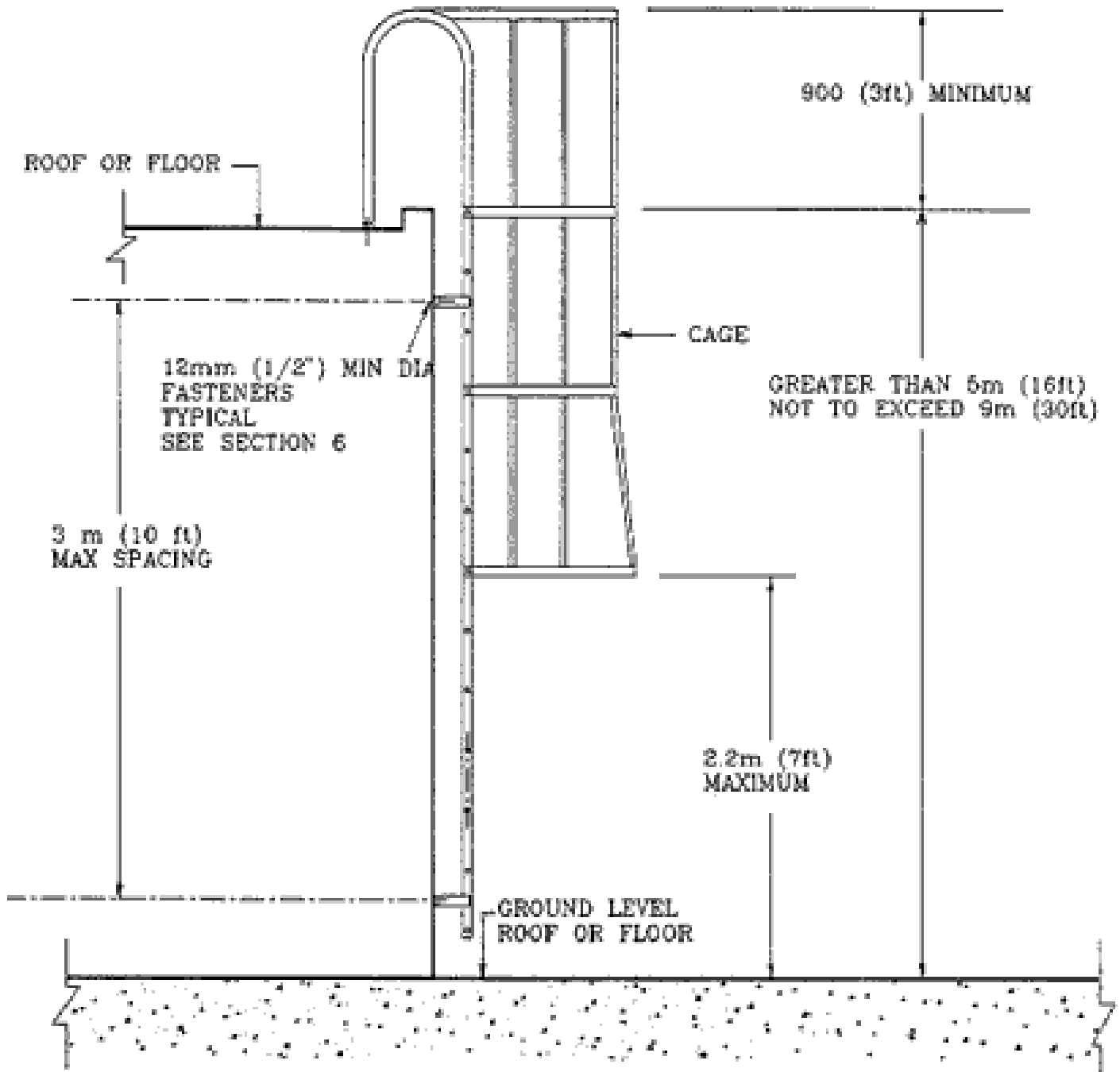
General Arrangement: Cage Not Required



Fixed Access Ladders

Figure 2. Typical Steel Access Ladder

General Arrangement: Cage Required



Fixed Access Ladders

Figure 3. Typical Steel Access Ladder—Elevated Access

General Arrangement: Cage Requirement for Wide Landings

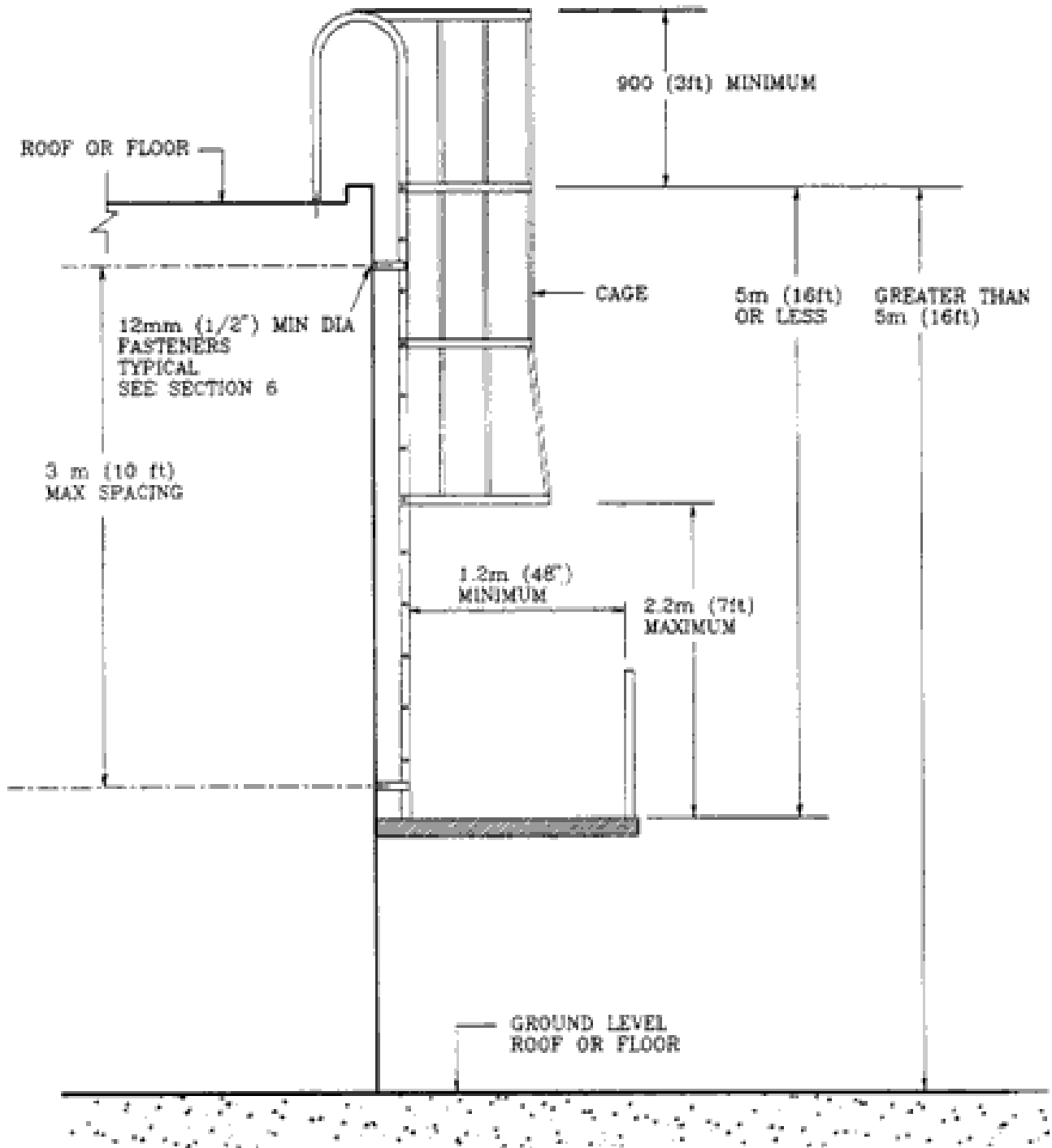
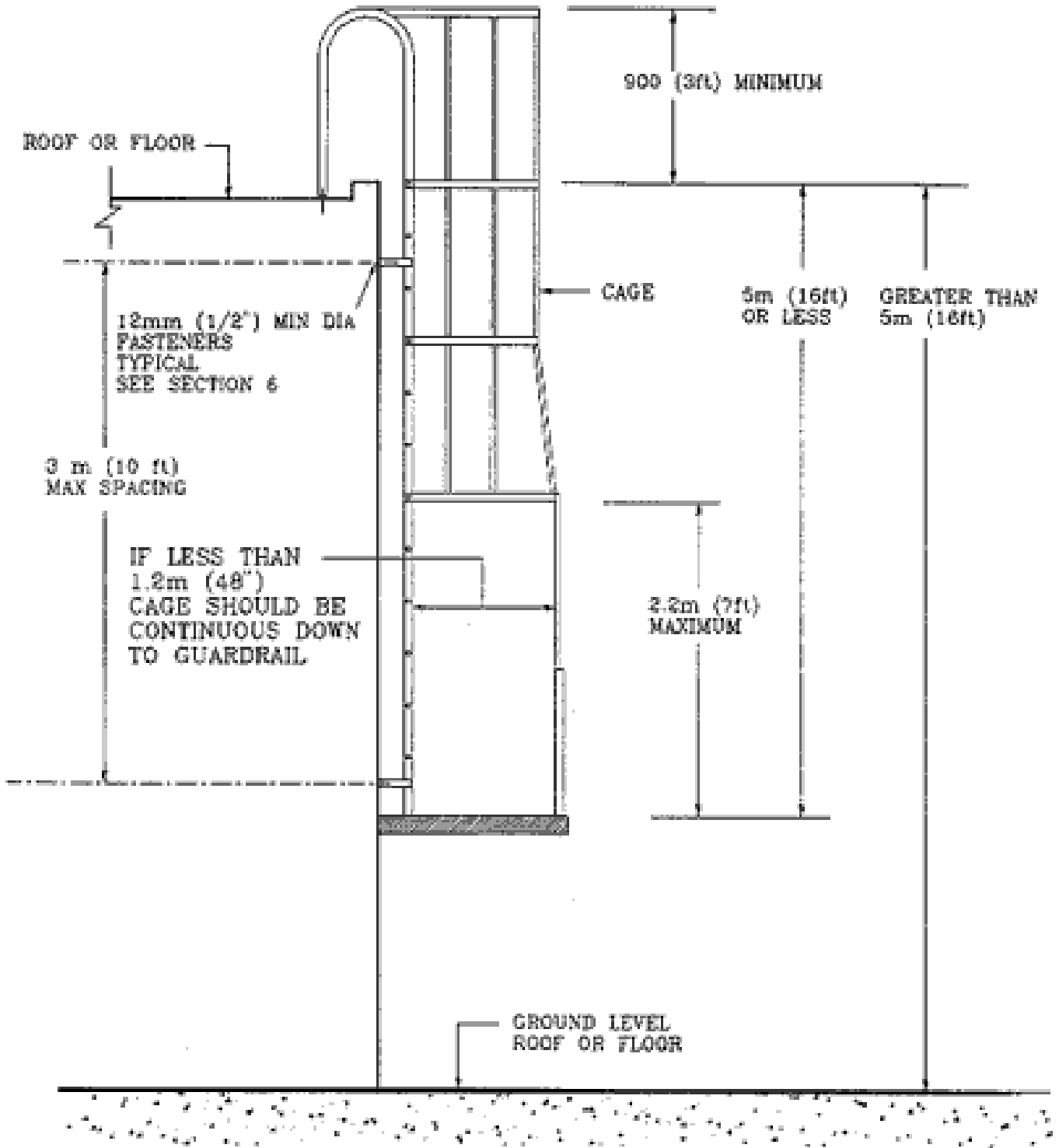


Figure 4. Typical Steel Access Ladder–Elevated Access

General Arrangement: Cage Requirement for Narrow Landings





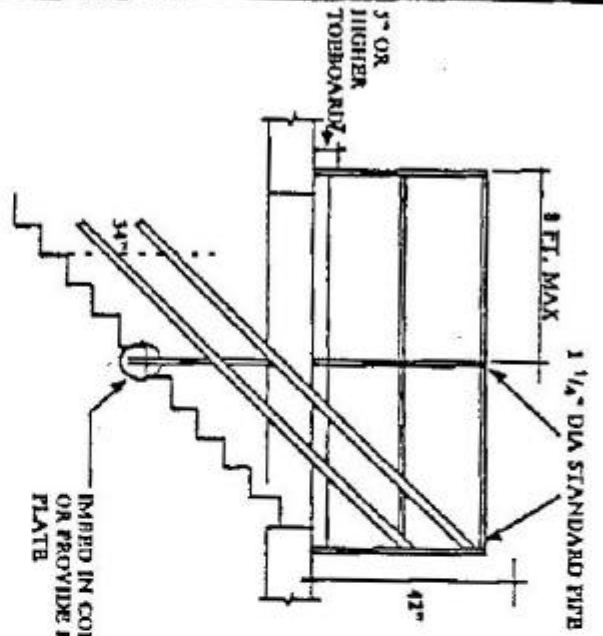
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Labour

Ministère
du Travail
de l'Ontario

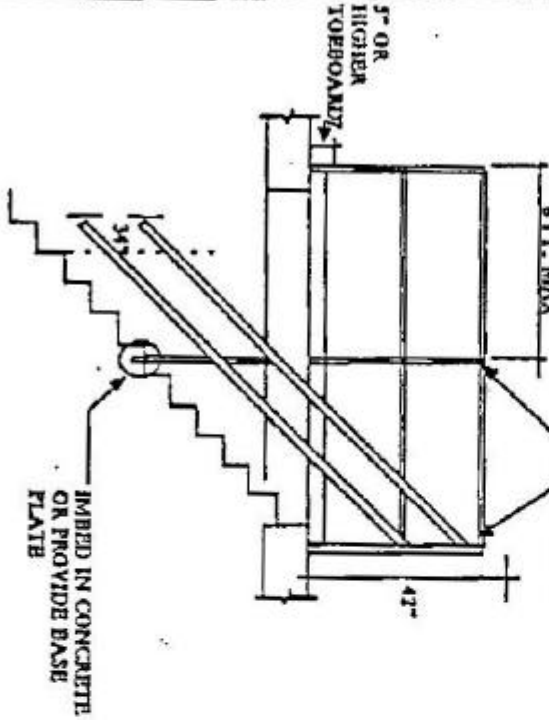
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et de la sécurité
dans l'industrie

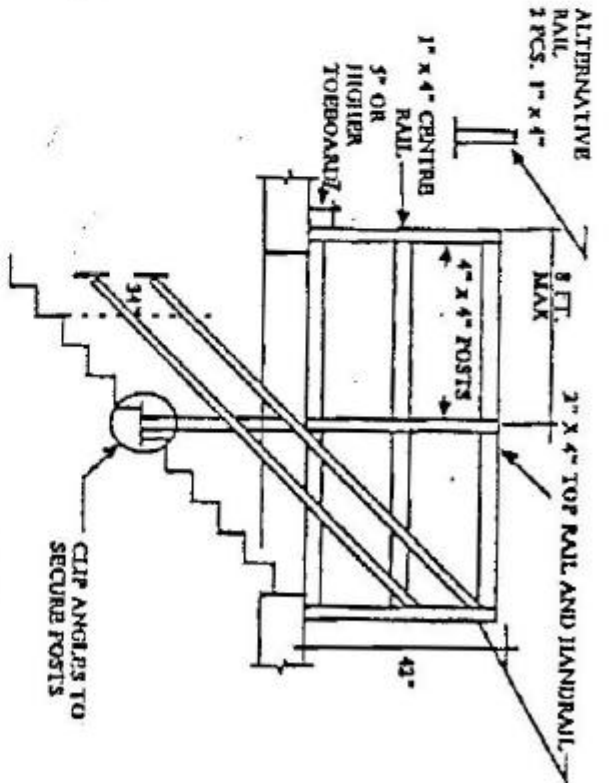
ITEM-4 (TYPE STEEL RAIL) (2) (SUBS) (SHEETS)



• TYPICAL PIPE RAILING •
1 1/2" x 1 1/2" x 3/16" < MIN.



• TYPICAL STRUCTURAL STEEL RAILING •



• TYPICAL WOODEN RAILING •

• NOTES •

1. GUARDRAILS TO BE SECURELY ANCHORED TO FLOOR. WHEN USED AROUND LATCHWAYS, ONE OR MORE SIDES MAY BE HINGED ON IN SOCKETS.
2. CENTRE RAIL TO BE MIDWAY BETWEEN FLOOR AND TOP RAIL. IF SPACE BETWEEN FLOOR AND TOP RAIL IS FILLED IN (SOLID OR WIRE SCREEN), TOEBOARD AND CENTRE RAIL MAY BE OMITTED.
3. IF WIRE SCREEN IS USED BETWEEN FLOOR AND TOP RAIL, NO IS G.A. OR HEAVIER WIRE AND NOT OVER 2" MESH IS TO BE USED.

RAILINGS AND TOEBOARDS

X	Original/ Original Revision Revision	Date/Date	Subject/Objet	Page/Page
		JUNE 1980	ENGINEERING DATA SHEET NO. 2-05	1 of/da.

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