



4.0 LADDERS

4.1 SECTION CONTENTS

This section provides guidance for the design, and use of fixed ladders. Designs for both steel and wood construction are included in this section. Steel construction is preferred and should be considered first. Use of wood should be minimized. See Section 1.5 of this manual for additional guidelines.

4.2 All Fixed Ladders	2
4.3 Steel Fixed Ladders	4
4.4 Fall Protection Features	9
4.5 Wooden Fixed Ladders	13
4.6 Notes and References	14

NOTE: An asterisk (*) after a section of text indicates that the information in that section is new or revised as of September 1996.

Fed-OSHA 1910.27**4.2 ALL FIXED LADDERS****A. GENERAL REQUIREMENTS FOR ALL FIXED LADDERS****Chevron Guidelines**

1. The minimum design live load shall be a single concentrated load of 200 lbs.
2. The weight of the ladder and attached appurtenances together with the live load shall be considered in the design of rails and fastenings.
3. The number and position of additional concentrated live-load units of 200 lbs. each as determined from anticipated usage of the ladder shall be considered in the design.
4. The minimum clear length of rungs or cleats shall be 16 inches.
5. Rungs and cleats shall be free of splinters, sharp edges, burrs or projections which may be a hazard.
6. Side rails which might be used as a climbing aid shall be of such cross sections as to afford adequate gripping surface without sharp edges, splinters, or burrs.
7. The perpendicular distance on the climbing side of the ladder from the centerline of the rungs to the nearest permanent fixed object shall be 30 inches for a ladder with a pitch of 90°.
8. The perpendicular distance on the back side of the ladder from the centerline of the rungs to the nearest permanent fixed object shall be 7 inches, except when unavoidable obstructions are encountered.
9. The step across distance from the nearest edge of the ladder to the nearest edge of equipment or structure shall not be more than 12 inches or less than 2-1/2 inches.

(continued next page)

1. Fixed ladders may be used for access to elevated tanks, towers, and similar structures, overhead traveling cranes, etc., where the use of fixed ladders is common practice. (See *Figure 4.1* for summary.)
2. Fixed ladders may be used for secondary access, escapes, maintenance access to platforms or other access which are used infrequently or where stairways are impractical (See Section 3.2 A).
3. The design load shall be determined by the anticipated usage of the ladder, but not less than a single concentrated live load of 200 lbs.
4. The weight of the ladder and attached appurtenances together with the live load shall be considered in the design of rails and fastenings.
5. Fixed ladders may not be used as a substitute where stairways are required. (See Section 3.2 A.)
6. Slide poles are not acceptable.
7. Ladders should be vertical whenever possible. Where clearance problems require the ladder to be sloped, the slope shall not exceed 15° forward and shall not slope backward under any circumstances. Fixed ladders shall be straight throughout their length.
8. Ladders should be oriented so that a person faces the structure or vessel while climbing. Side access ladders are preferred to the front access style.

PLATFORM HEIGHT	STEEL STRINGER SIZE		DROP BAR	HOOP GUARD	CAGE
	2 x 1/2	2-1/2 x 1/2			
1. Less than 30"	Required				
2. 30" or greater and less than 10'	Required		Required		
3. 10' or greater and less than 12'	Required		Required	Required	
4. 12' or greater and less than 20'		Required	Required	Required	
5. 20' or greater and up to 30'		Required	Required	Required	Required
6. NOTE: Long ladders require rest platforms every 30 feet.	Not acceptable for typical plant use. Use offset sections with rest platforms.				

Figure 4.1 Ladder Requirement Summary

NOTE: The requirements for drop bar, hoop guard, cage, and offset rest platform are applicable to both steel and wooden ladders in general use. However, special use ladders and emergency only use ladders may have alternate requirements. Refer to applicable code and regulation or consult with safety engineer.



Fed-OSHA 1910.24

9. Ladder rungs, side rails, and supports shall be free of splinters, sharp edges, burrs, and projections.

10. Ladder width:

- 16 inches minimum width between rails (stringers).

11. Landings:

- 30 x 30 inch minimum landing area is required for the base of ladders. This clear area shall extend **vertically** through the climbing space, **except when cages are installed**.*
- Landing area with minimum opening of 30 inches and minimum length of 30 inches measured at the centerline of the opening is also required at top of ladders or offset platforms.
- (Coordinate layout of landings for ladders during foundation design to avoid interferences.)

12. Clearances:

- 7 inches minimum clearance behind the ladder rung centerline is required throughout the length of the ladder. Common problems are conduit, stiffening rings, foundations, field routed small piping, etc.
- Exceptions: The edge of top landing is not included in this requirement (see *Figure 4.6*). Unavoidable **structural members** may infringe upon this clearance if confined as shown in *Figure 4.2*.*

13. Rung Spacing:

- Rung spacing shall be 12 inches center to center and shall be uniformly spaced throughout the length of the ladder.
- The height between the bottom rung and grade may be 6 to 18 inches.

Note: Max. 14 inches allowed in California.

14. Ladder Guard:

- A barrier should be placed on the back side of ladders that can be inadvertently climbed on the wrong side.

15. Platform Rung:

- One rung of the ladder shall be located at the level of the platform landing.

16. See *Figure 4.1*, "Ladder Requirement Summary", for cages, hoop guards, and drop bars requirements.

17. Refer to Section 1.4 B, "Conditions Which Require Secondary Egress from Industrial Buildings and Structures."*

10. A clear width of at least 15 inches shall be provided each way from the centerline of the ladder in the climbing space.

11. One rung of the ladder shall be located at the level of the landing laterally served by the landing.

12. Ladder rungs shall be equally spaced throughout including the first rung below the landing.

13. Ladder extensions shall extend 3 1/2 feet (42 inches) above parapets and landings.

14. Clearance between rails on step through ladders shall not be less than 18 inches nor more than 24 inches.

✚ Chevron Interpretation

Chevron adopted a 30 inch clearance prior to the OSHA Standard. The 30 inch clearance is consistent with ANSI A 14.3.

15. For side-step or off-set ladder sections, the side rails and rungs shall be carried to the next regular rung beyond or above the 3 1/2 foot (42 inch) minimum.

Cal-OSHA 3277

1. The vertical distance of the first rung from ground level may be as high as 14 inches.

Steel Fixed Ladder Details

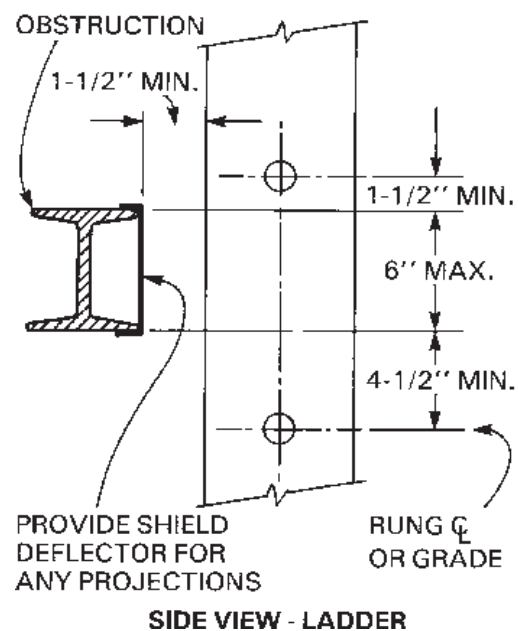


Figure 4.2 Clearance for Unavoidable Obstructions at Rear of Fixed Ladders.

Fed-OSHA 1910.27

1. Ladder wells shall have a clear width of 15 inches measured each way from the centerline of the ladder.
2. Smooth-walled wells shall be a minimum of 27 inches from the centerline of the rungs to the well wall on the climbing side of the ladder. There shall be a minimum of 30 inches on the climbing side where other obstructions on the climbing side exist.

Note: See general OSHA requirements in Section 4.2.

1. All rungs shall have a minimum diameter of 3/4 inch, except when protection of deterioration is required.

B. REQUIREMENTS FOR LADDERS IN WELLS

1. Ladder wells shall have a clear width of 15 inches measured each way from the centerline of the ladder.
2. There shall be a 30 inch minimum clear distance on the climbing side of the ladder to fixed objects.*

4.3 STEEL FIXED LADDERS

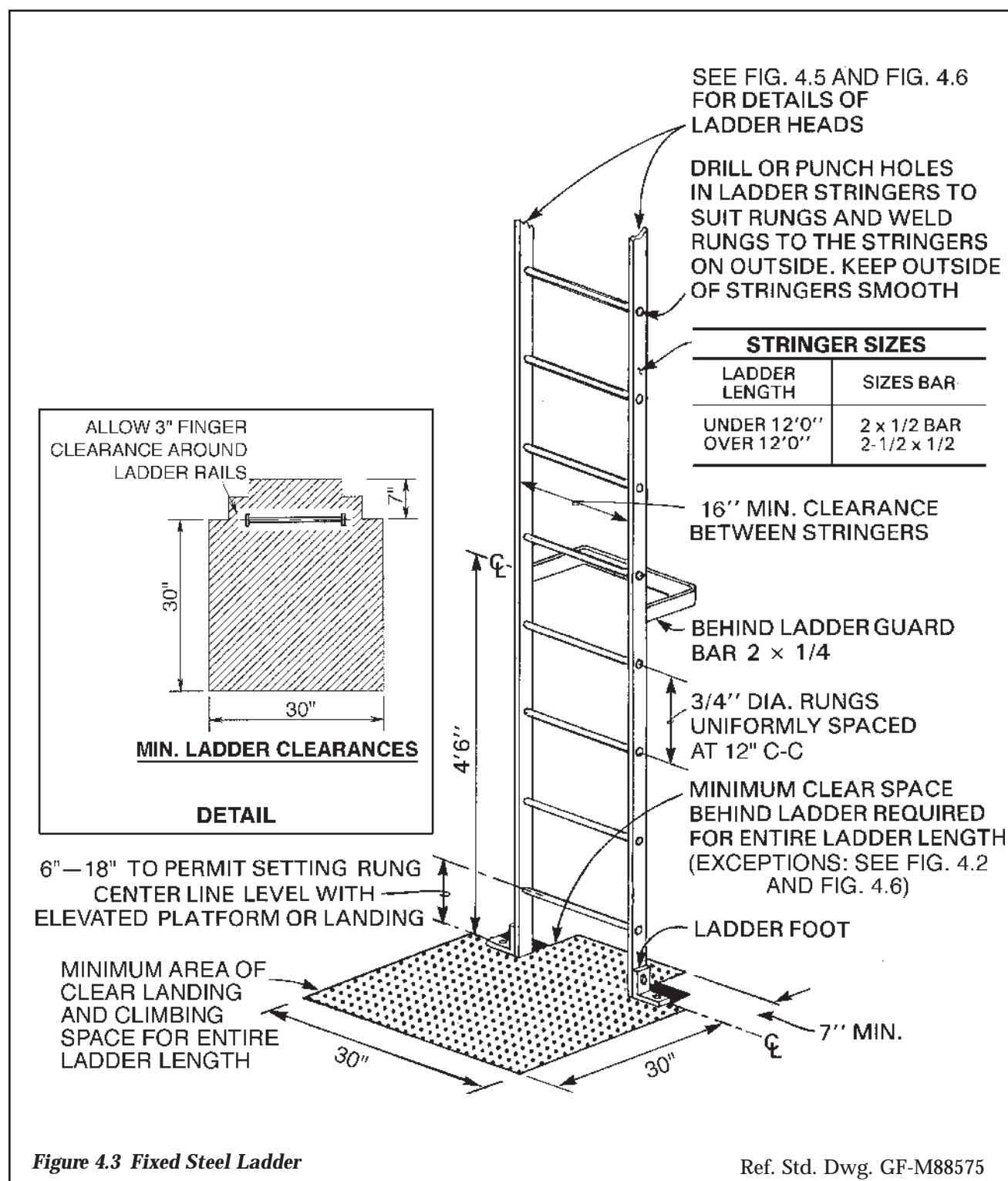
A. SPECIFIC REQUIREMENTS FOR STEEL FIXED LADDERS

Chevron Guidelines

1. Platforms which access the same ladder flight should be separated by 2 feet minimum elevation change. See *Figure 4.3* for details.
2. For details of ladder heads, see *Figures 4.5* and *4.6*.
3. For details and comments of hoop guards and drop bars, see Section 4.4.

Suggested Fabrication Details

4. Ladder feet may be braced **at landing** or to the structure or equipment. (See Std. Dwg. GF-M88575.)*
5. Fabricate ladder 12 inches longer at base than anticipated length required. Trim base at installation.*



Fed-OSHA 1910.27**B. INDIVIDUAL RUNG LADDERS****Chevron Guidelines**

Note: See general OSHA requirements in Section 4.2.

1. The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end.

1. See Chevron Guidelines in Section 4.2 and *Figure 4.4*.
2. Ladder rungs should be made of steel, protected from corrosion, and made non-slip.
3. The design load shall be determined by the anticipated usage, but not less than a single concentrated live load of 300 lbs.
4. Rungs welded to side of columns and towers are similar. The ends of each rung welded to the supporting structure shall be designed to support the maximum load on the rung.

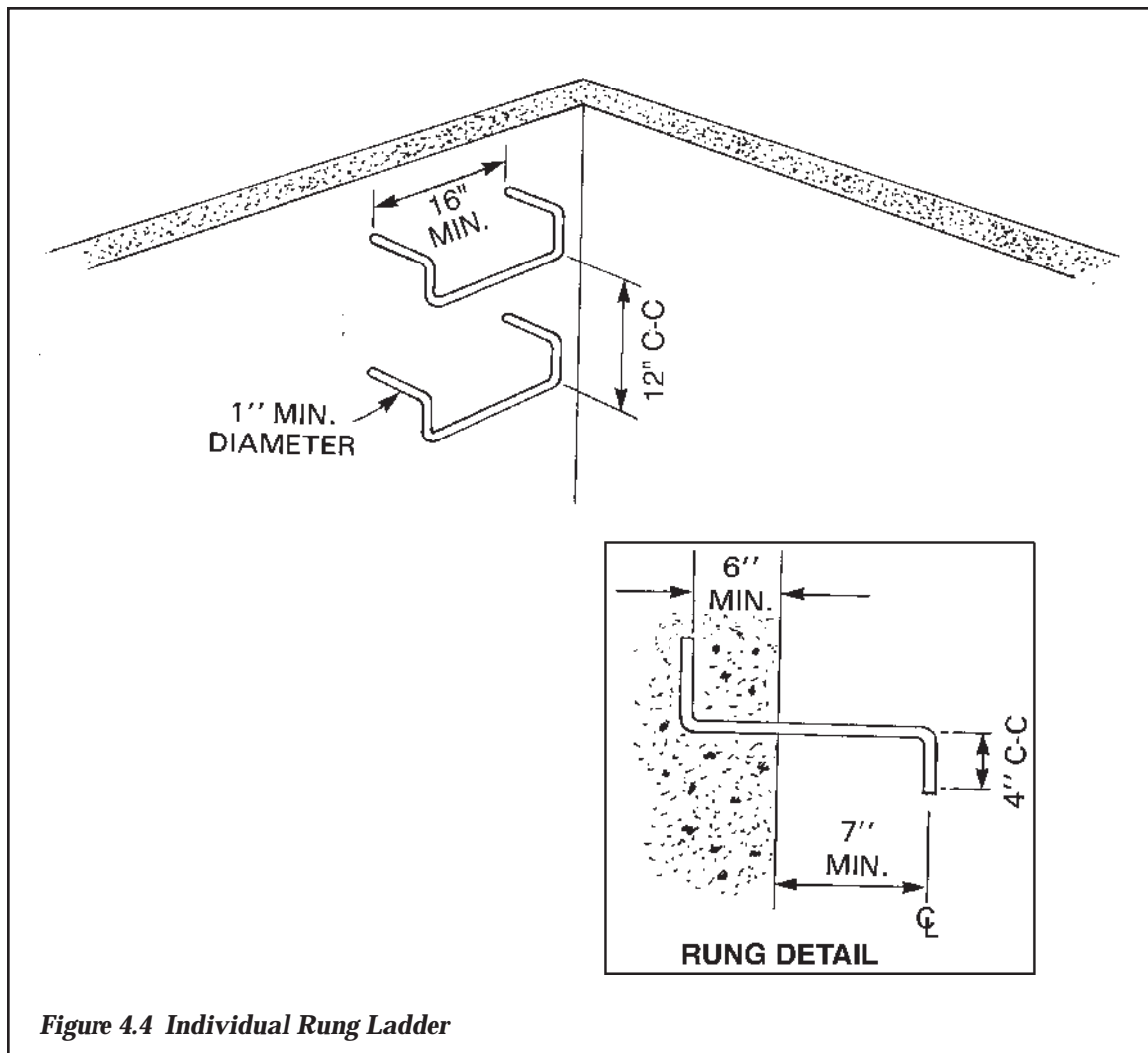


Figure 4.4 Individual Rung Ladder

C. SIDE ACCESS LADDER HEADS

Chevron Guidelines

1. The side access ladder head is preferred where structure or equipment is available for supporting ladder stringers directly.
2. Figure 4.5 shows the side access arrangement.

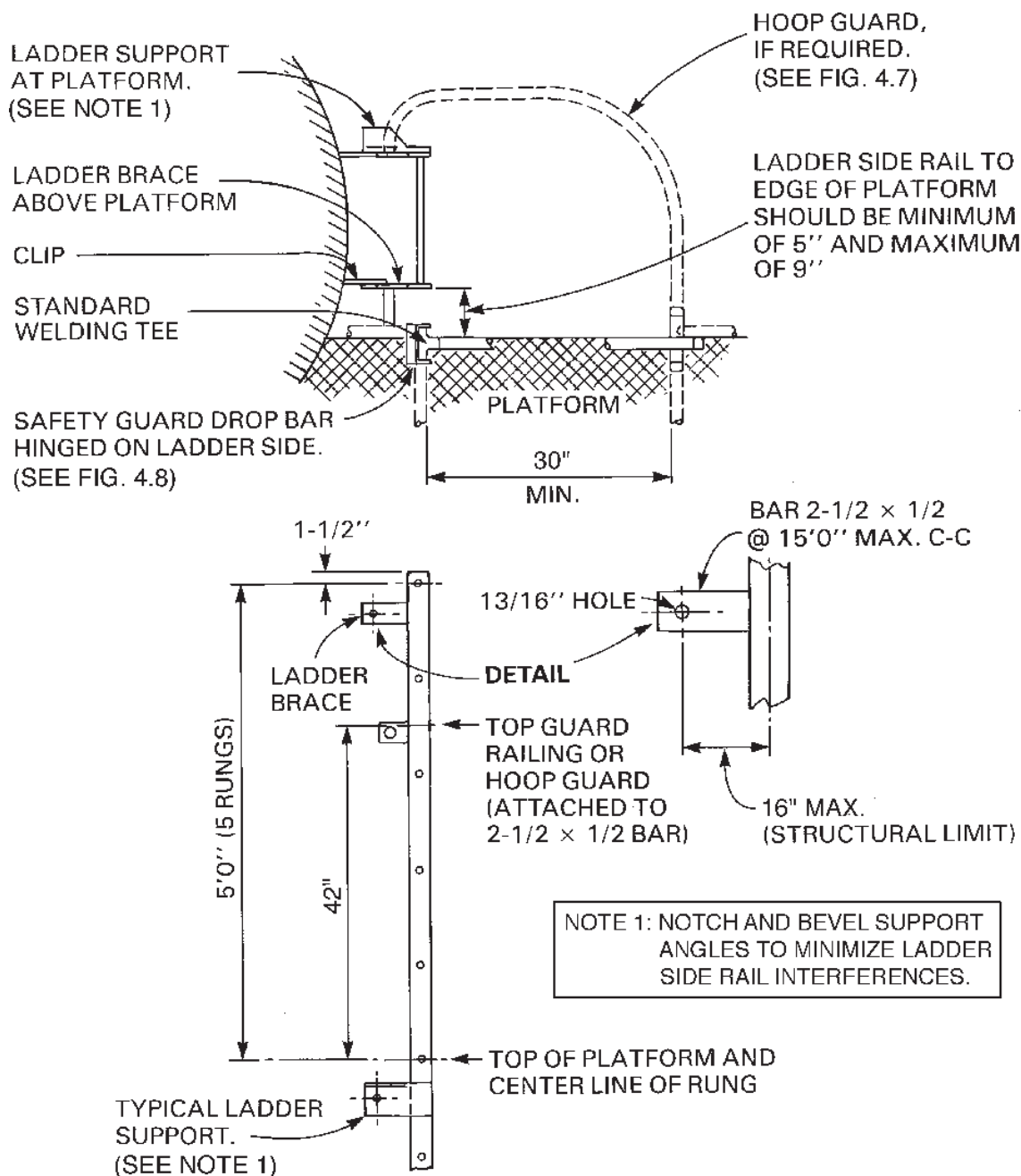


Figure 4.5 Side Access Ladder Head (Preferred Arrangement)

D. STEP THROUGH LADDER HEADS

Chevron Guidelines

1. *Figure 4.6* shows the step through arrangement.

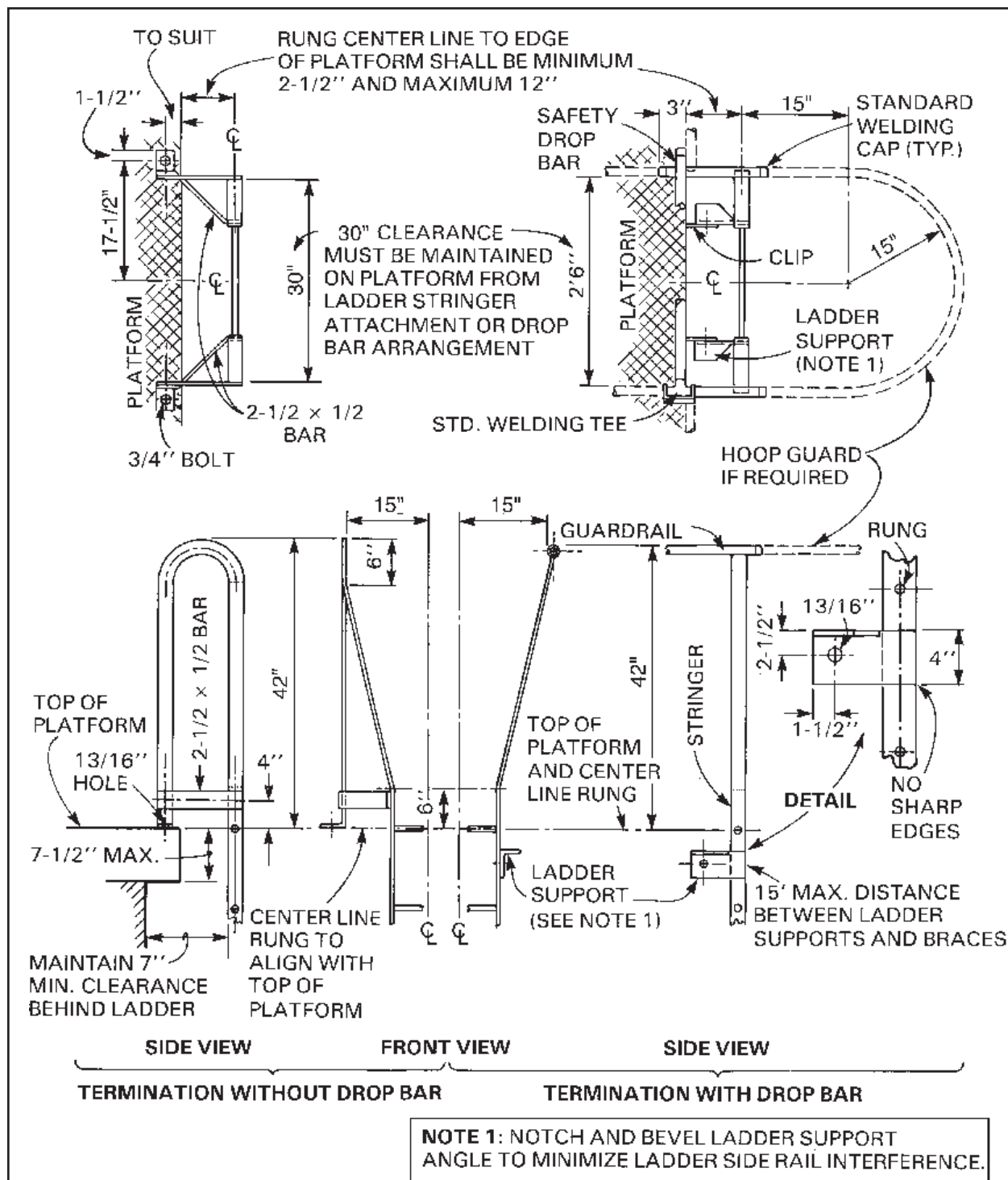


Figure 4.6 Step Through Ladder Head (Alternate)

4.4 FALL PROTECTION FEATURES

A. HOOP GUARDS AND DROP BARS

Chevron Guidelines

1. Hoop guards shown in *Figure 4.7* are required for all fixed ladders serving elevations 10 feet or more above the ground, existing platform or floor.
2. All fixed ladders serving elevations 30 inches or more above ground, platform, or floor level shall be equipped with drop bars attached as follows:
 - Side access ladders hinge at the ladder side.
 - Front access ladders hinge at the right when facing the ladder from the platform side.

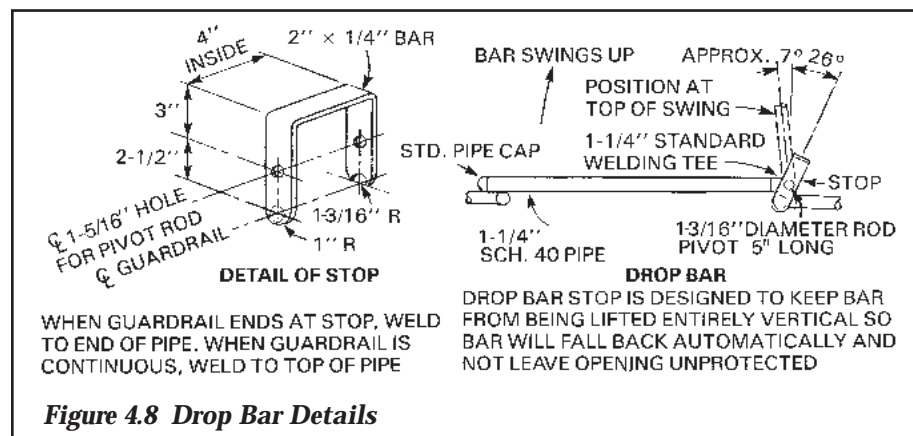
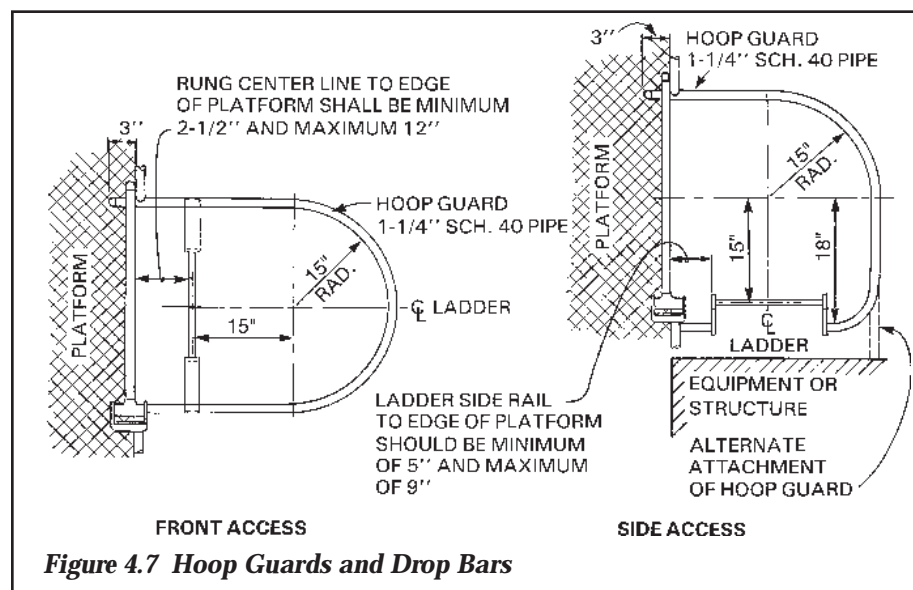
Drop bars shall not be placed beyond the outer edge of the platform.

3. *Figure 4.7* and *Figure 4.8* shows the typical arrangement for hoop guards and drop bars.

1. Every ladderway floor opening or platform shall be guarded by a standard railing with standard toeboard on all exposed sides (except at entrance to opening), with the passage through the railing either provided with a swinging gate or so offset that a person cannot walk directly into the opening.

⌘ Chevron Interpretation

Chevron adopted a drop bar prior to Fed. OSHA requirement. The drop bar provides equivalent protection.



Fed-OSHA 1910.27

1. Cages or wells shall be provided on ladders of more than 20 feet and a maximum unbroken length of 30 feet.

✚ OSHA Interpretation

The requirements of 1910.27 for cages, platforms or similar fall protection devices are not appropriate for fixed ladders on structures where the fixed ladders are used only as a means of access for firefighters and other emergency personnel, or escape for employees in fire and other emergency situations. In such cases, the employer must establish and implement adequate administrative controls such as barricades and signs to prevent non-emergency use of fixed ladders which are meant for fire fighter and emergency escape only. [Fed-OSHA Instruction Std 1-1.12, (6-20-83)]

2. Cages shall extend a minimum of 42 inches above the top of the landing, unless other acceptable protection is provided.
3. Cages shall extend down the ladder to a point not less than 7 feet nor more than 8 feet above the base of the ladder with a bottom flare of not less than 4 inches, or portion of the cage opposite the ladder shall be carried to the base of the ladder.
4. Cages shall not extend less than 27 inches nor more than 28 inches from the centerline of the rungs of the ladder. Cages shall not be less than 27 inches in width.

✚ Chevron Interpretation

Chevron adopted a 30 inch clearance prior to the OSHA Standard. The 30 inch clearance provides additional space for workers wearing self-contained breathing apparatus. The 30 inch clearance is consistent with ANSI A 14.3.

5. The inside of cages shall be clear of projections.
6. Vertical bars shall be located at a maximum spacing of 40° around the circumference of the cage. This will give a maximum spacing of 9- 1/2 inches center to center.

✚ Chevron Interpretation

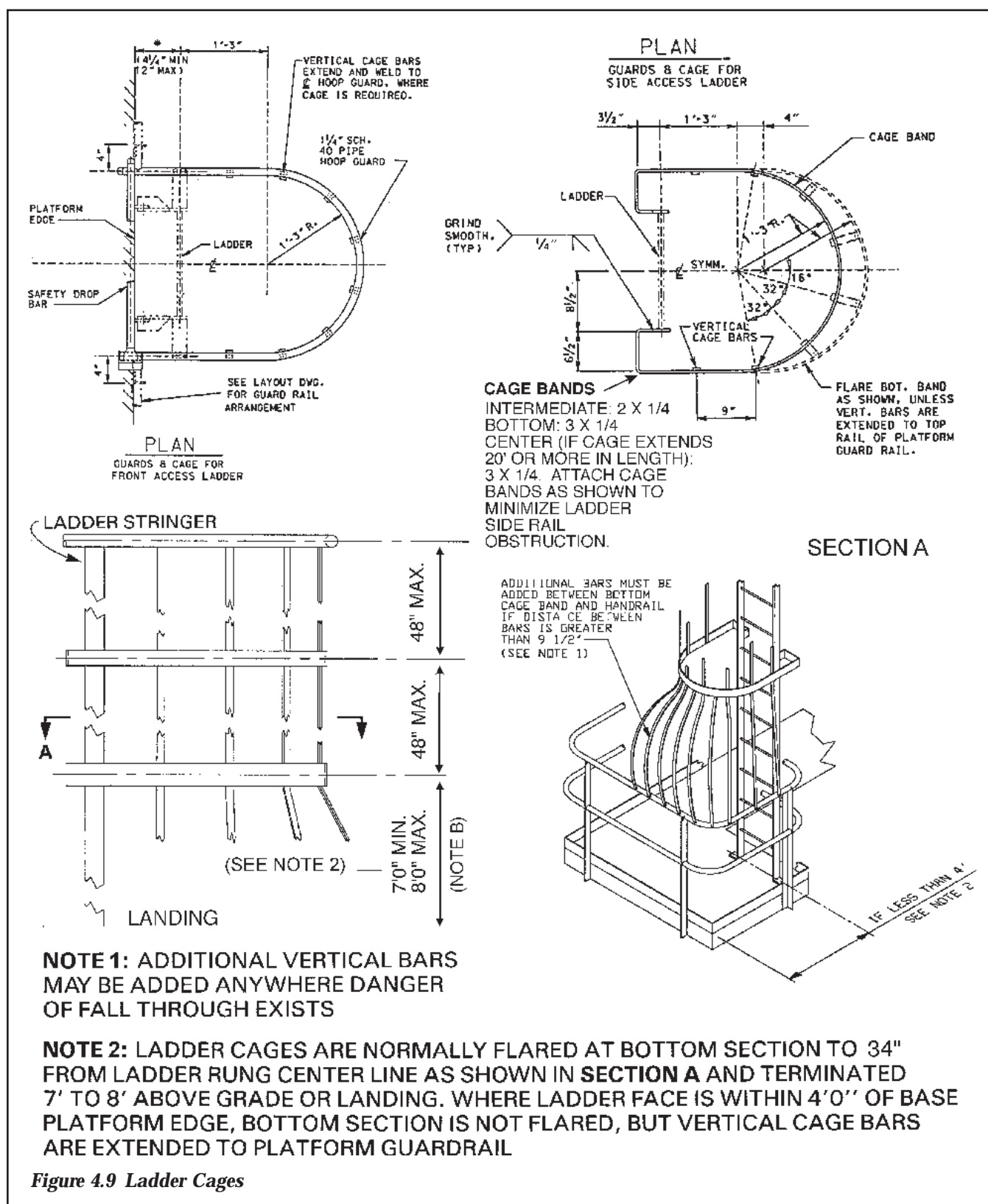
Due to Chevron's 30 inch cage clearance, bar spacing of 32° is required to achieve 9-1/2 inch maximum center to center spacing of vertical bars.

B. LADDER CAGES**Chevron Guidelines**

1. All fixed ladders **serving elevations 20 feet or more above grade** shall be equipped with ladder cages.*

Exceptions:

- ladders on mobile equipment where such devices interfere with mobility of equipment
 - ladders on smokestacks, water towers, transmission poles that are used by steeple jacks or riggers, etc., for occasional maintenance and where such persons are required to use safety belts or approved ladder climbing device
 - ladders less than 20 feet in length, originating from large platforms, such as 10 x 10 feet, located at elevations 20 feet or more above grade*
2. **Unless protected by location, a barrier or additional straps are required where the base of the ladder is less than 4 feet from the platform edge when the platform is greater than 20 feet above floor or grade level.***
 3. *Figure 4.9* shows typical ladder cage arrangement.

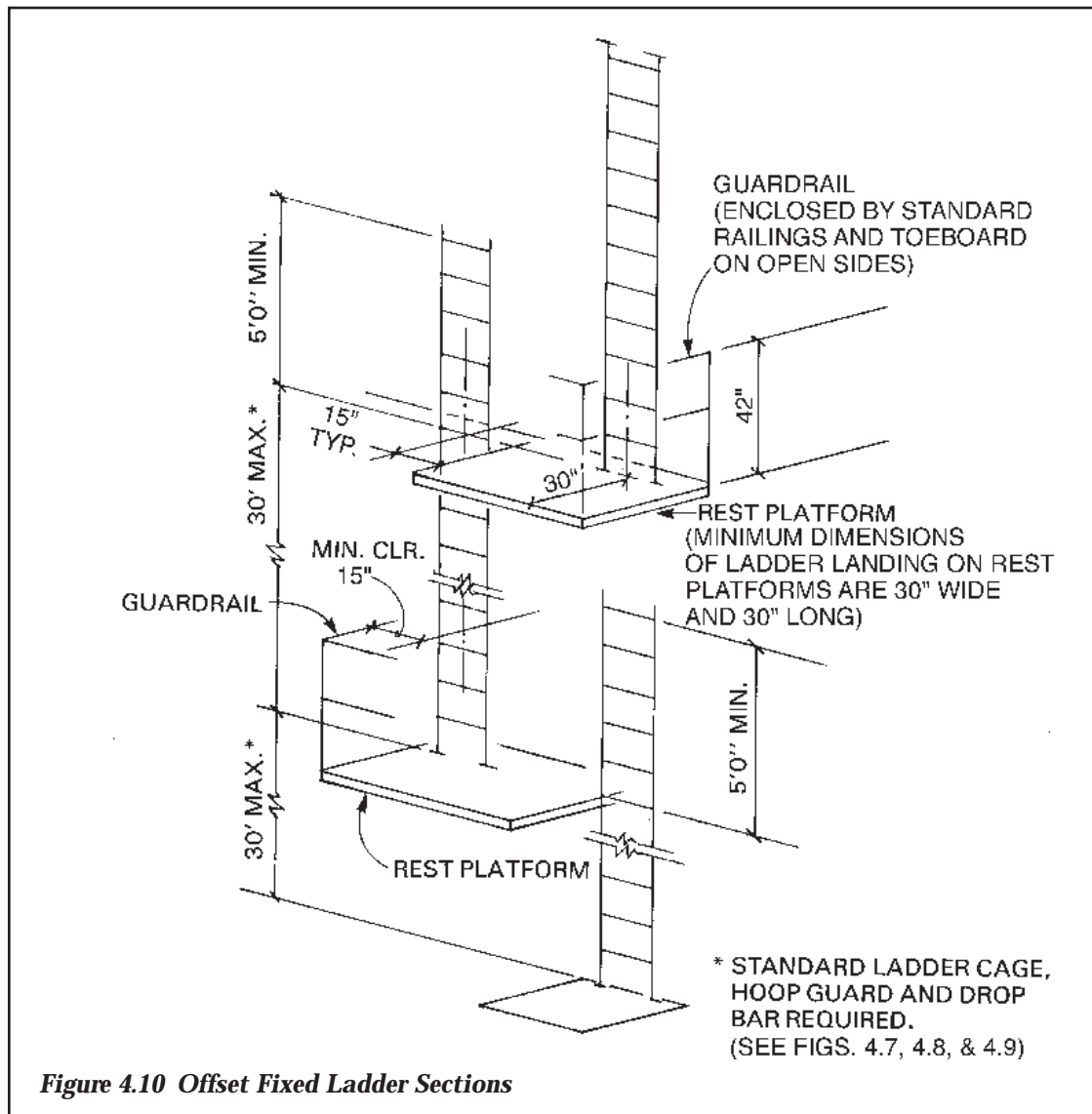


Fed-OSHA 1910.27
C. REST PLATFORMS FOR LADDERS

1. When ladders are used to ascend to heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof, except that, where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof. Each ladder section shall be offset from adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.
2. All landing platforms shall be equipped with standard railings and toeboards.
3. Landing platforms shall be not less than 24 inches in width and 30 inches in length.

Chevron Guidelines

1. Long ladders shall be built in offset sections with rest platforms every 30 feet maximum. Where possible platforms should be located so the ladder flights are equal or located so that the shortest flight is at the highest elevation.
2. The minimum dimensions of ladder landings on rest platforms are 30 inches wide and 30 inches long.
3. Rest platforms shall be enclosed by standard railing and toeboard on open sides.
4. *Figure 4.10* shows typical ladder rest platform arrangement.



4.5 WOODEN FIXED LADDERS

A. SPECIFIC REQUIREMENTS FOR WOODEN FIXED LADDERS

Suggested Fabrication Details

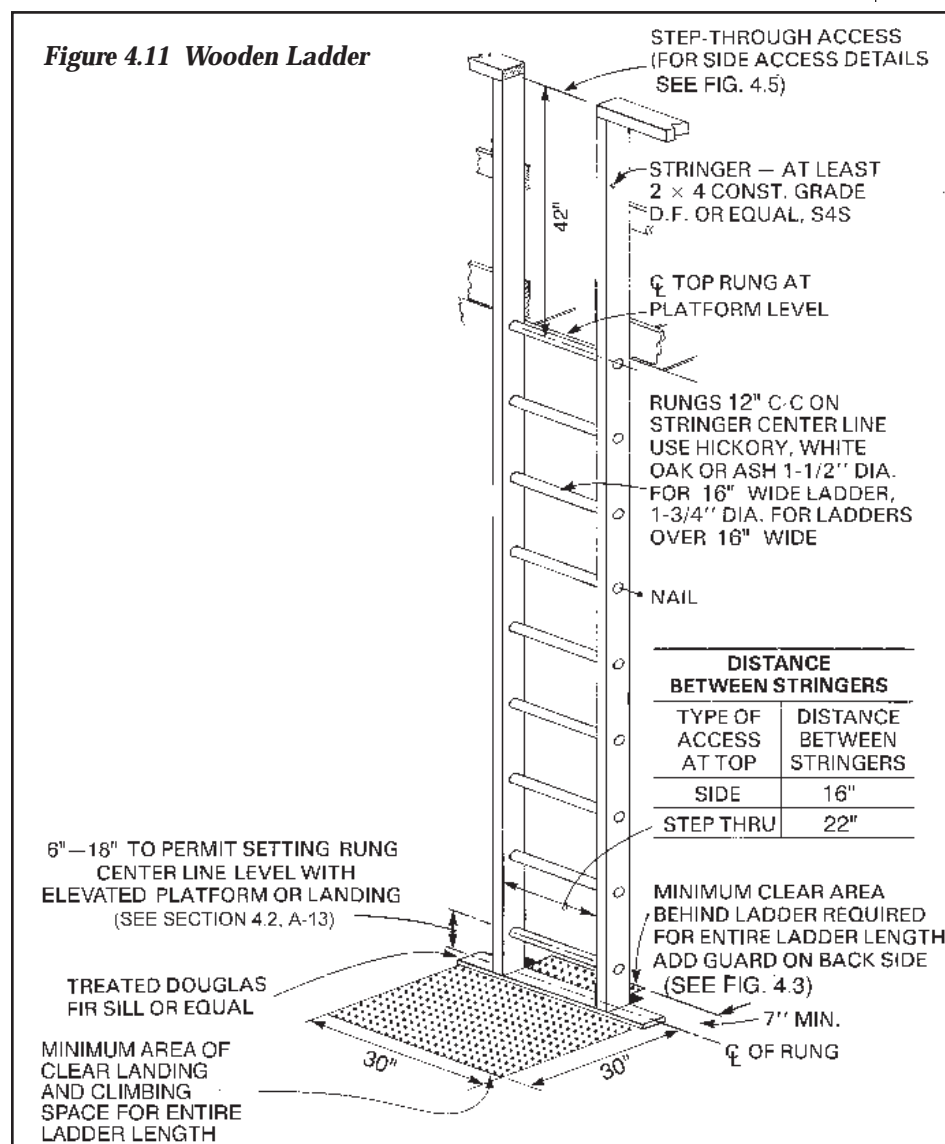
1. Galvanized nails or machine bolts with steel cut washers shall be used.
2. Drive nails into ends of rungs to insure snug fit in stringers.
3. Figure 4.11 shows typical wooden ladder arrangement.

1. All rungs shall have a minimum diameter of 1-1/8 inches.
2. When used under conditions where decay may occur:
 - wood ladders shall be treated with a non-irritating preservative, and
 - the detail shall be such as to prevent or minimize the accumulation of water on wood parts.

Note: The design stresses for wood components of ladders shall not exceed those specified in 1910.25. All wood parts shall meet the requirements of 1910.25 (b).

Note: See Section 4.2 for general OSHA requirements.

Figure 4.11 Wooden Ladder





4.6 NOTES AND REFERENCES

OTHER GUIDES

A 14.3-1992 ANSI Standard
“Ladders-Fixed- Safety Requirements”

ADDITIONAL REFERENCES

CRTC Engineering Standard Drawing GF-M88575
“Standard Ladder Cages and Guards”