

# Fixed Ladder Extent of Condition and Inspection

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**BROOKHAVEN**  
NATIONAL LABORATORY

*a passion for discovery*

Rev 1

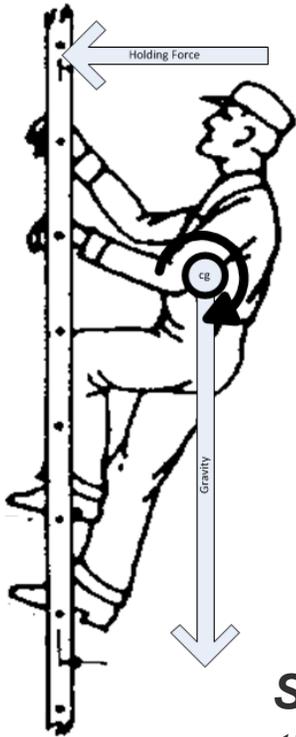


# Extent of Condition

- All fixed ladders at BNL will be evaluated utilizing the an OSHA-based checklist.
  - Compliance is the baseline
- Inspections will be coordinated by Ed Murphy, F&O Chief Engineer
  - Ladder evaluation data captured tracking and corrective actions
- Staff performing evaluations will be specifically trained on the use of the checklist
  - Evaluators will be required to be Ladder Safety trained and OMC cleared for the work being performed
  - Evaluators will include Facility Complex Engineers (FCE's), Facility Project Managers (FPM's), Environment, Safety, and Health (ESH) support staff, and Research Operations Coordination and Oversight (ROCO) technical staff.
- Evaluations will determine whether:
  - Ladder is OSHA compliant and remains in service
  - Ladder has manageable deficiencies.
    - The risk can be mitigated to an acceptable level by use of Work Planning and other administrative controls
  - Ladder has significant deficiencies

# Fixed Ladders

- Working at Height is always hazardous
  - There is no OFF switch for gravity
- Ladders are an engineered solution to allow work at height
  - Ladders need to be in good condition, compliant with industry standards and climbed with 3-point of contact to be used safely
- Because fixed ladders are typically installed at 90° the climber is always subject to a “moment arm” which acts as a force causing the climber's body to rotate away from the ladder.
  - Anything that can cause the climber's feet from slipping off rung will cause a fall.
    - Only a powerful grip with the remaining hand will allow the climber to remain stable enough to restore stability.
    - Handrails and ladder rail extensions need to allow adequate grasp.



***Ships Ladders and Alternating Tread Stairs are not covered under the Fixed Ladder Standard***

# Human Performance Factors

- Fully compliant ladders allows climbers to remain in a “Skill-Based Activity”.
  - High success rate.
- As a ladder has more non-compliances, the climber needs to perform unanticipated problem solving actions.
  - Activities become “Knowledge-Based”.
  - Probability of errors increase by **ORDERS** of magnitude.

# Overall Ladder Design

## ■ **Out of Service (OOS) Condition**

- All fasteners secure, general condition good, no broken welds, missing bolts or other damage.

## ■ **Evaluate for Potential Use using Administrative Controls**

- Fasteners are an integral part of fixed ladder design.
- All splices and connections have smooth transition with original members and with no sharp or extensive projections.
- Dissimilar metals are protected from electrolytic action where such metals are joined.
- Side rails allow adequate gripping surface.
- Sharp edges, splinters, or burrs.
- Metal ladders and appurtenances are painted or otherwise treated to resist corrosion and rusting.
- Wood ladders, when used under conditions where decay may occur, are treated with a nonirritating preservative, and the accumulation of water on wood parts is minimized.
- If different materials are used, are they compatible?

## ■ **Ladder Guard**

- If provided or needed, does it pose a hazard?

# Rungs and Cleats

- Ladder minimum diameter 3/4 inch (metal rungs).
  - Individual metal rungs embedded in concrete (pits) minimum 1 inch diameter.
- The distance between rungs, cleats, and steps does not exceed 12 inches and is uniform throughout the length of the ladder.
  - First rung from the bottom can be up to 14 inches
- Minimum clear width of rungs or cleats is 16 inches.
- Rungs, cleats, and steps are free of splinters, sharp edges, burrs, or projections which may be a hazard.
- Are rungs designed so that the foot cannot slide off the end?
- Unistrut Ladders are not automatically OOS if fully compliant
  - Note that they need to be but into FOC for annual inspection

**Ladder Diameter requirement assumes a 16-inch rung width**

- **If significantly greater than 18-inches, Engineer evaluation may be required**

# Clearance Issues

- **Out of Service Condition**

- Minimum 7 inches clearance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder (note: see possible exemption)

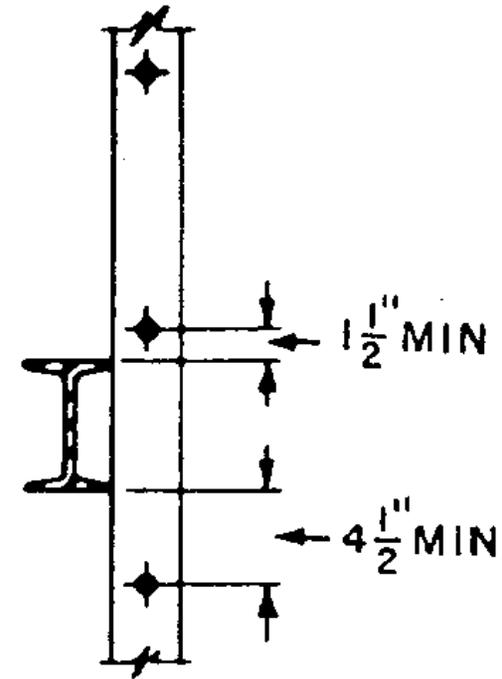
- **Evaluate for Potential Use using Administrative Controls**

- The perpendicular distance from the centerline of the rungs to the nearest permanent object on the climbing side of the ladder is 36 inches for a for a pitch of 76° & 30 inches for a pitch of 90°
- A clear width of at least 15 inches is provided each way from the centerline of the ladder in the climbing space.
  - Does not apply when cages or wells are required.
- Minimum 4 inches clearance from the centerline of the grab bar to the nearest permanent object in back of the grab bars.
- Grab bars do not protrude on the climbing side beyond the ladder rungs.
- Counterweighted hatch covers open a minimum of 60° degrees from the horizontal.
- The distance from the centerline of rungs or cleats to the edge of the hatch opening on the climbing side is at least 24 inches for offset wells or 30 inches for straight wells.
- No protruding potential hazards within 24 inches of the centerline of rungs or cleats.
- Deflector plates installed when protrusions within 30 inches of the centerline of the rungs or cleats.

# Clearance Exemption

**EXEMPTION = EXEMPTION  
NOT RULE**

- 1910.27(c)(4) -"Clearance in back of ladder." The distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches, except that when unavoidable obstructions are encountered, minimum clearances as shown shall be provided.
  - If obstruction was installed AFTER the ladder – NO UNAVOIDABLE
    - EXEMPTION is not applicable
- Examples of **Unavoidable conditions** could include:
  - Building Structure
  - Roof flashing



# Ladder Platforms and Rail Extensions

## ■ Out of Service Condition

- Landing platform step off distance shall be
  - Maximum = 12 inches
  - Minimum step-across distance = 2½ inches.
    - From the centerline of the rung of a ladder to the nearest edge of structure or equipment.
- Width of through ladder extensions 18 inches minimum and 30 inches maximum

**If < 24 inches → Yellow**

- Ladders having a pitch in excess of 90° with the horizontal are prohibited.
  - The preferred pitch of fixed ladders is considered to be in the range of 75° & 90° with the horizontal

# Ladder Platforms and Rail Extensions

- **Evaluate for Potential Use using Administrative Controls**

- Is ladderway floor opening or platform guarded by a standard railing with standard toeboard on all exposed sides?
- Is passage through the railing protected with a swinging gate or so offset that a person cannot walk directly into the opening?
  - **Chain installation allowed of legacy installation**
- For ladders over 20 feet, landing platforms provided (Note: Exception if cages are provided).
- On ladders with landing platforms, sections are offset.
- Landings provided at each offset ladder.
- Landing platforms provided every 30 feet when cage is present.
- **Is the top of a step or rung of a ladder shall be level with the top of the access/egress level or landing platform served by the ladder.**
- Landing platforms are equipped with standard railings and toeboards.
- Platforms minimum 24 inches in width and 30 inches in length.
- The side rails of through or side-step ladder extensions extend 3½ feet (42 inches) above parapets and landings.
- For side-step or offset fixed ladder sections, at landings, the side rails and rungs are carried to the next regular rung beyond or above the 3½ feet minimum (42 inches)
- Grab bars are spaced as a continuation of the rung spacing when they are located in the horizontal position.
- Vertical grab bars have the same spacing as the ladder side rails.
- Grab-bar diameters are the same as the round-rung diameters.
- For Intermediate Platforms: One rung of any section of ladder is located at the level of the landing laterally served by the ladder. Where access to the landing is through the ladder, the same rung spacing as used on the ladder must be used from the landing platform to the first rung below the landing.

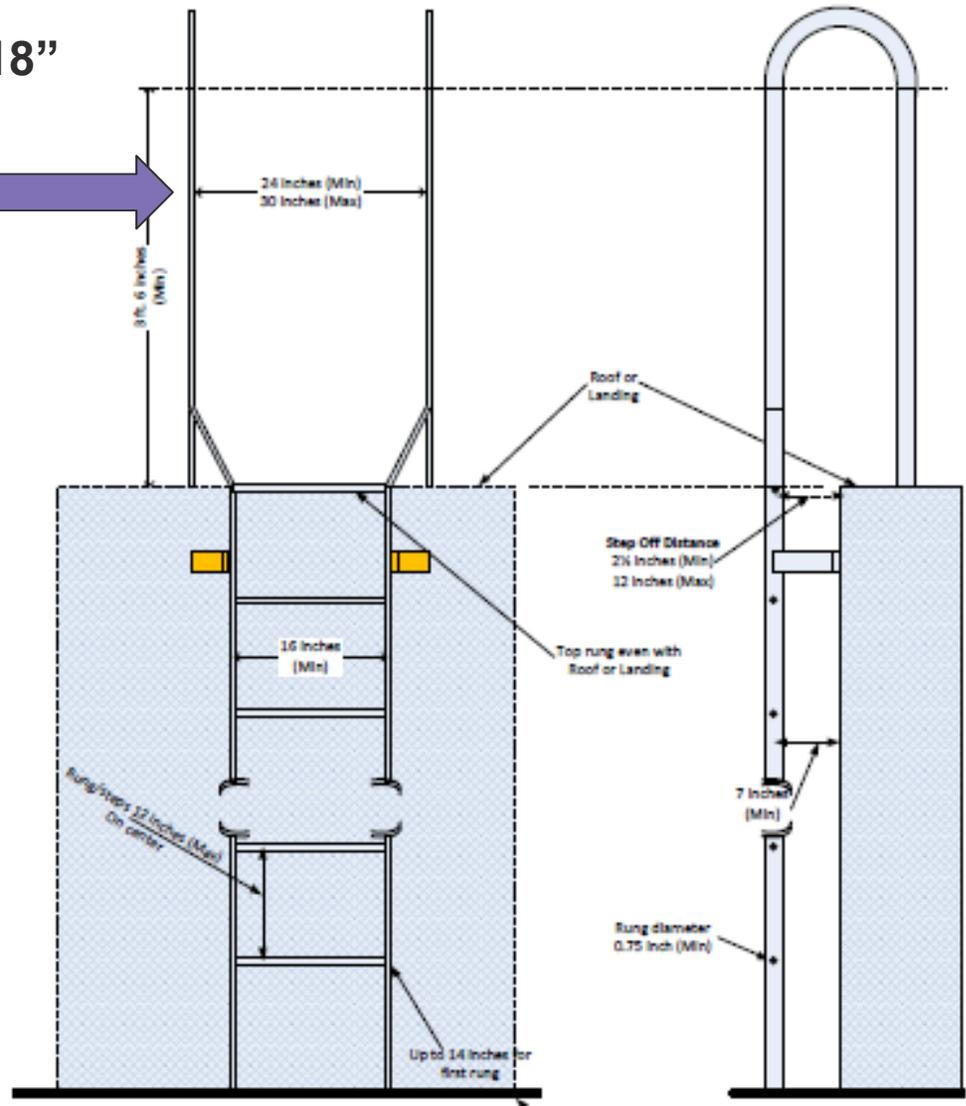
# Cages and Wells

## ■ Evaluate for Potential Use using Administrative Controls

- Cages or wells provided on ladders of more than 20 feet.
- Cages extend a minimum of 42 inches above the top of landing, unless other acceptable protection is provided.
- Cages extend down the ladder to a point not less than 7 feet nor more than 8 feet above the base of the ladder.
- Cage bottom flared at least 4 inches, or portion of cage opposite ladder extends to the base.
- Cage is minimum 27 inches in width.
- Cages extend between 27 and 28 inches from the centerline of the rungs of the ladder.
- The inside of the cage or well is clear of projections.
- Maximum spacing of vertical bars approximately 9½ inches, center to center (40 degrees).
- Ladder wells have a clear width of at least 15 inches measured each way from the centerline of the ladder.
- Smooth-walled wells are a minimum of 27 inches from the centerline of rungs to the well wall on the climbing side of the ladder. If other obstructions on the climbing side of the ladder exist, a minimum of 30 inches from the centerline of the rungs is required.

# ANSI A14.3 Requirement Summary

OSHA still has 18"



# Ladder Categorized

## Categorized overall ladder condition on Checklist

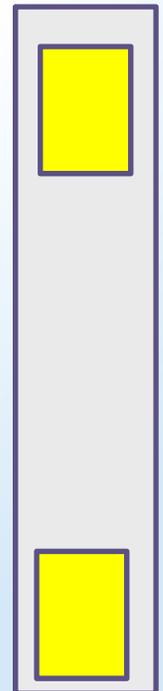
- **Ladders found without deficiencies**

- **Right Side Rail Painted Green at Access Points**



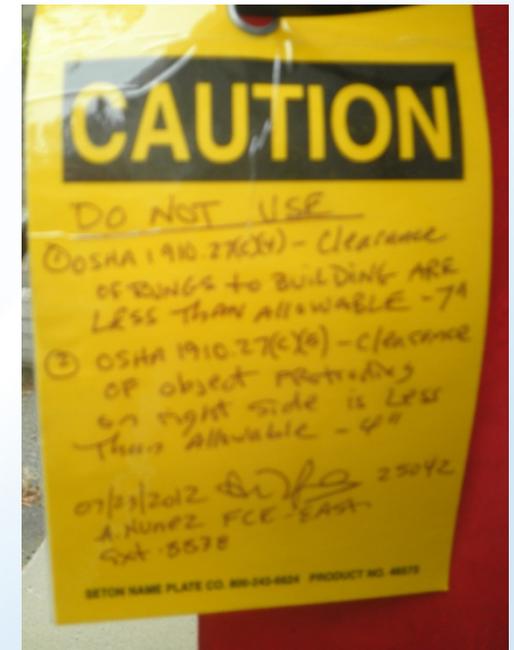
- **Ladders found with some deficiencies but can be used safely with administrative controls**

- **Right Side Rail Painted Yellow at Access Points**

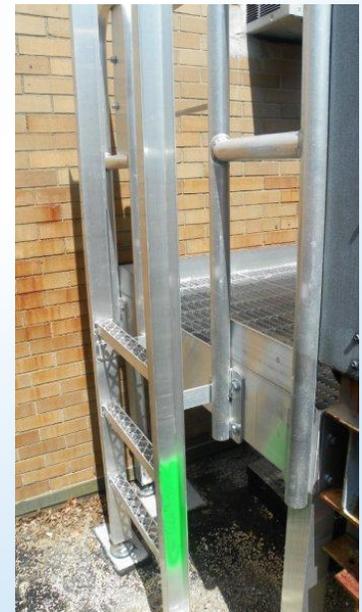


# Out of Service

- Ladders found with deficiencies and can not be used safely
  - Ladder taken out of Service with Posting and Red Paint



# Ladder Examples



# Inspection Requirements

**Minimum means minimum**

**Maximum means maximum**

- Work Permit and JSA required for Inspection
  - Standing Work Permit acceptable
  - PPE to include Safety shoes with heel
    - Do not use shoes without heels to climb ladders.
    - No sneakers or deckshoes
- Recommended Equipment
  - Tape Measure (3/4-inch wide)
    - Caliper if available
  - Camera
  - Level or Protractor
- 2<sup>nd</sup> Evaluator
  - Remember, Always Maintain 3-point of contact on the ladder
    - So someone will need to record observations.
  - Do not carry things in your hand (may need backpack)

***Training is being recorded in BTMS as TA-LADDER-INSPECT***

# Judgment Is Needed

- Even a fully compliant ladder may have concerns!
  - Number of ladder rail extensions are to standards but are not secured
  - Users have commented of their discomfort when using a ladder
    - Building 902 has “Yellow Tag” the concern as a control



**Remember: Continuous Improvement Continuum Provide feedback on the process**

# Safety Is the Goal

- If you are uncomfortable performing the evaluation, request assistance
  - F&O Chief Engineer
  - Safety Engineering Group
- Copy of Training and Checklist are posted on SHSD Fall Protection Program Area Web site

[http://www.bnl.gov/esh/shsd/Programs/Program\\_Area\\_Fall\\_Protection.asp](http://www.bnl.gov/esh/shsd/Programs/Program_Area_Fall_Protection.asp)