2020 GUIDE FOR
WIRE ROPE SAFETY CLIMBS ON ANTENNA SUPPORTING STRUCTURES

Safety Equipment Manufacturers Committee (SEMC)

NATE

THE COMMUNICATIONS INFRASTRUCTURE CONTRACTORS ASSOCIATION

ACKNOWLEDGEMENT

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1. Scope and Application

This manufacturer consensus document is intended to address use of a wire rope safety climb/system in the telecommunications industry. This consensus document is only intended to apply to structures that are governed by the ANSI/TIA-222 standard, as adopted by the International Building Code (IBC) and other jurisdictional building codes.

The objective is to provide detailed information applicable to the performance, installation, inspection, maintenance, and repair of wire rope safety climbs/systems for antenna supporting structures with ANSI/TIA-222 defined climbing facilities. This document also provides the structure owner, or the Engineer of Record (EOR), loading requirements necessary to analyze the wire rope safety climb connection as well as quantify the specific loading based number of users who may utilize the wire rope safety climb/system at any given time.

2. Definitions

2.1 Authorized Climber. An individual with the physical capabilities to climb, and who may or may not have previous climbing experience; has been trained in fall protection regulations, the equipment that applies to communication structures work and instruction for proper use and inspection of the equipment. Documented training must take place that shows the individual is capable of identifying hazards, inspecting equipment and has demonstrated the practical skills of an authorized climber. An authorized climber is to be supervised by a competent climber.

2.2 Appurtenance. Items attached to the structure such as antennas, antenna mounts, transmission lines, conduits, lighting equipment, climbing devices, platforms, signs, anti-climbing devices, etc.

2.3 Base Anchorage. Attachment hardware provided by the wire rope safety climb manufacturer to transition from the structure to the base assembly.

2.4 Base Assembly. A positive means of attachment of the wire rope to the base anchorage assembly by means of the wire rope tensioner.

2.5 Carabiner. A connector, conforming to ANSI/ASSE Z359.12, generally comprised of a trapezoidal or oval shaped body with a closed gate or similar arrangement that may be opened to attach another object and when released auto latches and auto locks to retain the object.

2.6 Connection Linkage. A connector or a combination of elements, which forms the link between the wire rope safety sleeve and the attachment element of the full body harness. This connection consists of the carabiner and may include additional components as specified by the manufacturer.

2.7 Connector. A component (such as a carabiner) or element (such as a D-ring sewn into a full body harness) that is used to couple parts of a system together.

2.8 Competent Climber. An individual physically able to climb; has actual tower climbing experience; is trained in the fall protection regulations including the equipment that applies to tower work; is capable of identifying existing and potential fall hazards; and has the employer's authority to take prompt corrective action to eliminate those hazards. A competent climber is responsible for the authorized climbers when working at heights.

2.9 Competent Person. One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees and who has authorization to take prompt corrective measures to eliminate or control exposure to the hazards.

2.10 Confined Safety Climb. Occurs when the safety climb wire rope is physically trapped behind an appurtenance, feed lines and/or structural modification, without adverse impact to the wire rope, and the competent climber must use alternate means of fall protection to navigate the obstacle.

2.11 Engineer of Record (EOR). A registered Professional Engineer who is responsible for all structural aspects of the design including the design of all the structure's systems and components. The EOR may also develop a scope of work and set TIA maintenance and condition requirements assessment intervals.

2.12 Factored Load. The product of the nominal load and a load factor.

2.13 Flexible Carrier. The 3/8" diameter wire rope spanning from base assembly to top assembly, which supports the wire rope safety sleeve.

2.14 Full Body Harness. A body support designed to contain the torso and distribute the fall arrest forces over at least the upper thighs, pelvis, chest and shoulders. The full body hardness must contain a sternal D-ring.

2.15 Load Factor. A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the loads and load effects, and for the probability that more than one extreme load will occur simultaneously.

2.16 May. Denotes a permissive or possible statement.

2.17 Nominal Loads. The magnitude of the specified static and dynamic safety climb/system loads.

2.18 Owner. The public body, authority, corporation, association, firm or person for who work is to be performed on an antenna supporting structure via a contract document.

2.19 Personal Protective Equipment (PPE). Any materials or devices worn to protect a worker from exposure to, or any physical contact with, any (a) harmful substances (b) forms of energy (c) fall hazards, or (d) other hazardous environments or events.

2.20 Procurement. The act of obtaining or buying goods and services. The process includes preparation and processing of a demand as well as the end receipt and approval of payment.

2.21 Shall. A mandatory practice.

2.22 Should. A recommendation, which is advised, but not required.

2.23 Top Anchorage. A secure connecting point or termination component of a safety climb, capable of supporting the static and dynamic forces applied during a fall arrest event.

2.24 Top Assembly. A positive means of attachment, or termination, of the wire rope to top anchorage assembly. Top assembly may be integral with top anchorage.

2.25 Wire Rope. A 3/8" (0.375") solid core galvanized or stainless steel cable as a flexible carrier.

2.26 Wire Rope Tensioner. A spring, eye bolt, or other device that connects the wire rope to the base assembly to accommodate the manufacturer's specified force.

2.27 Wire Rope Guides. A device that acts to guide or connect a flexible carrier to the climbing facility or structure at intermediate points along the flexible carrier.

2.28 Wire Rope Safety Climb. (Safety Climb) Consists of the top anchorage, top assembly, wire rope (flexible carrier), wire rope guides, base assembly and base anchorage; considered an appurtenance on the structure.

2.29 Wire Rope Safety Climb System. (Safety Climb System) Consists of a wire rope safety climb which is inspected, and put in service by a competent climber, and used in conjunction with the wire rope safety sleeve, connection linkage and full body harness.

2.30 Wire Rope Safety Sleeve. (Safety Sleeve) A mechanical device that connects to and travels along the wire rope safety climb, designed to lock automatically in the event of a fall, connecting the wire rope to connection linkage, and allowing a competent/authorized climber to ascend and descend the wire rope safety climb.

3. Wire Rope Safety Climb

3.1 Wire Rope Safety Climb – Dead Loads

This section defines the factored dead load to be determined by the safety climb manufacturer.

Factored Dead Load = [Weight of all safety climb components supported by the top anchorage to the structure + 3/8" diameter Wire Rope Weight] x 1.2 Load Factor.

The 1.2 load factor for dead load is based on the 1.2 load factor for dead loads specified for the supporting structure in ANSI/TIA-222.

Example Calculation for a 100 ft. safety climb:

Weight of components supported by top anchorage = 35 pounds (varies by manufacturer and/or installation requirements).

3/8” diameter wire rope weight at 0.25 lbs. /ft.

Factored Dead Load = [35 lbs. + (100 ft. x 0.25 lbs. /ft.)] x 1.2 = 72 lbs.

3.2 Wire Rope Safety Climb System – Live Loads

Live loads on the safety climb system are applied in addition to the dead loads defined above.

Factored Live Load = [fall arresting force from one climber + climber weight x (number of additional climbers using the system)] x 1.5.

The force from the arrest of a climber after a fall is defined by ANSI/ASSE Z359.16 to be equal to a maximum value of 1,800 lbs. and an average value of 1,350 lbs.

The weight of a climber is defined by OSHA 29 CFR 1926.502 for engineered fall protection safety systems to be equal to 310 lbs.

Only one climber is assumed to subject the safety climb system to an arresting force. The arresting force includes the weight of the climber; therefore, only an additional 310 lb. live load is considered for each additional climber.

The 1.5 load factor is adopted from ANSI/TIA-222-G which specified a 1.5 load factor be applied to nominal load to obtain factored loads. ANSI/TIA-222-H specifies factored loads for climbing facilities which include a load factor; therefore, a load factor to be applied to nominal loads is not specified.

Example Calculations:

a) Factored Live Load for one climber = [1,800 + 310 x 0] x 1.5 = 2700 lbs.
b) Factored Live Load for two climbers = [1,800 + 310 x 1] x 1.5 = 3165 lbs.
c) Factored Live Load for three climbers = [1,800 + 310 x 2] x 1.5 = 3630 lbs.

3.3 Top Anchorage Loads

Anchorage loads shall be equal to the combined factored dead and live loads.

For the examples above, total factored dead and live loads:

a) For one climber = 72 + 2,700 = 2,772 lbs.
b) For two climbers = 72 + 3,165 = 3,237 lbs.
c) For three climbers = 72 + 3,630 = 3,702 lbs.

Top anchorage loads shall be provided by the safety climb manufacturer to the procurement entity for a safety climb. The factored loads are to be considered to act vertically.

Safety climbs installed with a taper beyond 15° from the vertical require site-specific loading considerations.

When the total factored dead and live loads exceed the 4,000 pound top anchorage capacity requirement of ANSI/TIA-222, the top anchorage load shall be provided to the EOR for a site-specific top anchorage design (refer to ANSI/TIA-222-H, Annex A, Section A. 12.0).

4. Wire Rope Safety Climb as an Appurtenance Inspection Guidelines

This section is to define the maintenance and condition assessment requirements of a safety climb.

A safety climb is considered an appurtenance, however the scope of the ANSI/TIA-222 standard does not include maintenance and condition assessment requirements for safety climbs (refer to Section 14.1 and Annex J).

The safety climb maintenance and condition assessment requirements are defined by the safety climb manufacturer.

If deficiencies outside of the safety climb manufacturer maintenance and conditions assessment requirements are found in any safety climb component, the manufacturer of the safety climb or tower owner shall be consulted for corrective action.

Corrective actions involving the connection of the safety climb to the structure shall be established under the direction of an EOR.

4.1 Top Assembly/Anchorage and Wire Rope Termination

a) Ensure compliance with the manufacturer's installation requirements.
b) Top anchorage is installed in compliance with the requirements of the EOR and/or ANSI/TIA-222 for the conveyed loads.
c) Inspect the following components per manufacturer's instructions:
    1. Top assembly
    2. Top anchorage
    3. Energy absorber
    4. Inspect hardware/fastening system
d) Inspection may include but is not limited to the following:
    1. Signs of a fall arrest event
    2. Weld cracks
    3. Deformations
    4. Degradation
    5. Excessive corrosion/wear
    6. Ensure wire rope and top anchorage termination is secure per manufacturer's instructions including no excessive corrosion
    7. Protective cap (if applicable)
    8. Excess or insufficiency of protective coating

4.2 Wire Rope

a) Wire rope shall be installed per manufacturer's specifications.
b) Document the information from the existing identification tag.

c) Inspect wire rope to ensure it is clean and free of any contaminants that would impede the proper function of the safety sleeve, such as paint, animal debris, etc.
d) Measure diameter of wire rope to confirm 3/8".
e) Check for corrosion (i.e. red rust) on the wire rope. If corrosion is present, ensure there is no loss of material due.
f) Inspect wire rope for defects, including but not limited to, excessive wear, kinks, bird caging, fraying, broken wires, signs of electrical arcing such as burn marks, etc.
g) Ensure wire rope is not pinched, or does not contact any portion of climbing facilities, structure or other appurtenances.
h) If the safety climb is obstructed, ensure the obstruction is not causing damage to the safety climb wire rope.
i) Confined safety climb is acceptable if the wire rope is not being damaged. Alternative forms of fall protection may be required when safety climb wire rope is obstructed.
j) Check to ensure the wire rope is tensioned in compliance with the manufacturers' specifications.
k) Ensure the wire rope is properly terminated to the top assembly, in compliance with the manufacturers' specifications.

4.3 Wire Rope Guides

a) Wire rope guides shall be provided and installed per manufacturer's specifications.
b) Check the rubber grommets for degradation, wear, etc. if applicable.
c) Check wire rope guides for weld cracks, deformations, degradation, excessive corrosion/wear, etc.
d) Inspect hardware/fastening system required (i.e. U-bolts, clamp plates, brackets) for damage, excessive corrosion, and ensure all fasteners are present and secure.
e) Ensure guides are clean and free of any contaminants that would impede the proper function of the safety sleeve (i.e. paint, animal debris, etc.)
f) Ensure all wire rope guides firmly clasp the wire rope as to prevent it becoming damaged or causing damage.
g) Check to ensure the wire rope guides are mounted or oriented in correct position and aligned with the wire rope.
h) Check that the spacing of the wire rope guides are installed at a maximum spacing of 40 ft along the entire length of the wire rope, or spaced as required by the manufacturer, whichever is less.
i) Ensure spacing of wire rope guides vary to cancel the tendency of harmonic vibration of the wire rope during a wind event.
j) Ensure locking wire rope guides are properly installed and the locking mechanism is not damaged or causing damage to the wire rope.

4.4 Base/Bottom Anchorage Assembly

a) Installation shall be compliant with the manufacturer's installation requirements.
b) Wire rope termination method shall be installed in accordance with the manufacturer's specification (example: wire rope clips).

c) Inspect hardware (including spring tensioner/turnbuckle and fastening system) for damage, excessive corrosion, defects (cracks, defective welds, bends or wear), and ensure all fasteners are present and secure.
d) Ensure assembly is clean and free of any contaminants that would impede the proper function of the installation, such as paint, animal debris, etc.
e) Ensure minimum wire rope tension is in accordance with the manufacturer's specification. Inspection and documentation are required in JHA/JSA. Such tension adjustments are typically facilitated by hardware located at the base/bottom anchorage assembly.

4.5 Identification (ID) Tag Inspection

a) Ensure ID tag is present and all required information is fully legible.
b) Ensure ID tag in located where the user typically accesses the system (typically at the base of the structure) and is clearly visible to the user.

4.6 Minimum Requirements for ID Tag on new installations

a) Wire rope size, type, construction (i.e. 3/8" solid core wire rope galv. - 1 x 7, etc.) as per manufacturer's specification.
b) Applicable compliance standards based on country of use. (i.e. ANSI Z359.16, CSA Z259.2.5, etc.)
c) Minimum anchorage requirements and number of permissible users on the system. (i.e. 3 users, 310 lbs. per user)
d) Use warnings:
    1. Do not remove this ID tag.
    2. Read and understand all manufacturer's instructions before each use.
    3. Install system components per manufacturer's instructions.
    4. Inspect system for proper installation before each use.
    5. Use only compatible personal protective equipment.
    6. Never alter or modify any safety climb components.
    7. Never use a safety climb that has been altered from manufacturers design.
    8. Failure to follow warnings may lead to serious injury or death. (Should come with the warning sign)
e) Manufactured date(s) and install date
f) Manufacturer name and lot and/or serial number
g) Minimum tension for use

5. Wire Rope Safety Climb as PPE Inspection Guidelines

5.1 SCOPE AND APPLICATION

This section defines the inspection requirements of a safety climb when it is used as part of a complete fall protection plan in compliance with ANSI/ASSE A10.48. The safety climb must have a maintenance and condition inspection completed in compliance with this consensus document and the manufacturer's requirements. The PPE inspection is not intended to supersede the maintenance and condition assessment requirements and intervals of EOR and/or ANSI/TIA-222.

The safety climb shall be considered PPE when the climber elects to connect to it using a safety sleeve as part of an overall fall protection plan supervised by a competent person. The entire safety climb shall be inspected prior to each use.

While inspecting safety climbs, for use as PPE, refer to the manufacturer's instructions for specific inspection and maintenance guidelines along with the minimum PPE inspection criteria contained below. For safety climbs not meeting manufacturer's specifications, and deemed unsafe by the competent person on site, the tower owner/EOR or safety climb manufacturer shall be notified for corrective action.

For questions associated with the TIA antenna supporting structure, including climbing facilities and appurtenance connections, communication shall occur with the structure owner.

5.2 PPE Inspections Outline

a) The safety climb is considered PPE when utilized with a compatible 3/8" safety sleeve as part of a safety climb system.
b) The system must have an inspection at the point of access prior to each use by a competent person as outlined below.
c) If deficiencies are identified during the inspection by the competent person, equipment is to be tagged and removed from service.
d) PPE equipment inspections shall include, but not be limited to:

Inspection of safety sleeve in addition to manufacturers recommendations:

1. Inspect energy absorber/fall indicator (if present) for bends, cracks and deformities.
2. Inspect components for:
    a. wear or damage
    b. secure attachment hardware, if present
    c. deformation
3. Locking mechanism(s) shall operate smoothly and freely. Inspect for wear or damage. Check for proper engagement of the safety sleeve on the wire rope to ensure performance.
4. Verify the compatibility of the safety sleeve with the installed safety climb, including but not limited to wire rope size, type and manufacturer specified tension.
5. Inspect anti-inversion mechanism for proper function (if applicable).
6. Inspect all marking. Marking shall be secured to safety climb sleeve and clearly legible. Marking shall include:
    a. Capacity
    b. Correct orientation
    c. Indication of correct wire rope type (size, construction, shape)
    d. Restrictions of use
    e. Manufacturer
    f. Lot and/or serial number

5.2.1 Carabiner/connector

a) Utilize manufacturer specified/supplied carabiner for compatibility.

b) Ensure that the connector appropriately/freely aligns with the sternal D-ring/attachment on a full body harness.
c) Test gate to ensure that it closes and locks automatically.
d) The carabiner/connector with captive pin is a required attachment to the safety sleeve.
e) Connection distance shall be compliant with manufacturer's specification (OSHA requirement is no more than 9" between the carrier and harness attachment).

5.2.2 Full body harness with sternal (D-ring) attachment point

a) Inspect per manufacturer's instructions.
b) Ensure that carabiner/connector does not bind when connected.
c) Inspect hardware (buckles, d-rings, pads, loop keepers, etc.) for damage, deformation, burrs, cracks, corrosion, excessive wear, or missing parts. Hardware shall operate freely and smoothly.
d) Inspect webbing. Material must be free of frayed, cut or broken fibers. Check for tears, abrasion, knots, mold, burns or discoloration.
e) Inspect stitching. Check for pulled or cut stitches.
f) Inspect impact indicator (if present).
g) Check for excessive soiling or wear.
h) Inspect labels. All labels shall be present and legible.

5.2.3 Test fit of harness and function of PPE safety climb by ascending and descending the climb facility approximately 6 feet. All PPE shall function automatically hands free up and down without any manual manipulation. If the safety sleeve and carabiner/connector do not function as intended, adjustments shall be made until proper fit and function are achieved.

5.2.4 Documented visual inspection shall be completed prior to any type of physical testing procedure (i.e. static loading) on the system. The visual inspection shall cover at a minimum the following:

a) Wire rope shall be tensioned, compliant with the safety sleeve manufacturer's requirements.
b) Safety climb shall not be kinked or damaged (e.g. fraying, broken wires, or strands).
c) Check for corrosion (i.e. red rust) on the wire rope. If so, ensure there is no loss of material due to the corrosion.
d) Safety climb path obstructions shall not cause damage to the wire rope.
e) Safety climb shall be secured by wire rope guides, spaced and oriented at intervals defined by the manufacture.
f) Inspect the top assembly and top anchorage of the safety climb for proper installation and defects or damage.
g) Inspect bottom assembly and anchorage for proper installation and defects or damage.
h) Additional requirements defined by the manufacturer.

5.2.5 After visual inspection, a documented physical load test (i.e. static loading) or other means as defined by the manufacturer shall be applied to the safety climb to verify the top anchorage, top assembly and wire rope condition.

a) The safety climb shall be physically verified per manufacturer's guidelines, at a minimum, each work day or changed condition of the safety climb system.

b) The condition of the safety climb system shall be inspected by the first authorized climber to utilize the system.

Note: If inspections reveal a defective condition, consult competent person, tower owner/EOR and/or wire rope safety climb manufacturer for corrective action. If the defect cannot be resolved, the safety climb shall be tagged out by the competent person on site, and the tower owner/EOR or safety climb manufacturer shall be notified for corrective action.

6. Post Fall Arrest PPE Inspection

For a safety climb that is subjected to a fall and a rescue is required, the competent rescuer executing the rescue shall be required to assess the means available to efficiently and safely rescue the climber. If the best means is to use the existing wire rope safety climb that has been exposed to a fall, then the competent rescuer shall be required to, as a minimum:

a) Verify that the equipment utilized, including but not limited to the safety climb, meets the intended requirements for rescue as outlined by the manufacture(s)
b) Visually inspect the safety climb for changed conditions from the last written PPE inspection in compliance with section 5 of this document to assess the usability of the safety climb.
c) Communicate the plan to use the safety climb system with others involved with rescue procedures.
d) Once the rescue is complete, the wire rope safety climb is to be reported and tagged out until corrective action has been taken.
e) The competent rescuer shall ensure that use of the system will not create a greater hazard than other means.

APPENDIX A:

The SEMC provided test scenarios for the NATE Safety Sleeve Testing Event as outlined in the NATE Safety Sleeve Testing Final Report. This appendix is to provide a summary of the tests scenarios and user warnings as a result of those tests.

Tests scenarios and purpose

1. Function climb test while ascending/descending. To evaluate the travel and resistance of a safety sleeve on wire rope.
2. Dynamic drop test using a full body harness with sternal D-ring attachment. To evaluate a real world fall with human like characteristics.
3. Wire rope tension. To evaluate safety sleeve performance on variable tensions of wire rope conditions.
4. Side lateral dynamic drop test. To evaluate safety sleeve performance on variable tower geometries/climbing facilities.
5. Forward lateral dynamic drop test. To evaluate safety sleeve performance on variable tower geometries/climbing facilities.
6. Environmental conditions on wire rope. To evaluate safety sleeve performance in variable weather/environmental conditions including thin film ice, salt spray, corrosion and bird droppings.
7. Unattended safety sleeve on wire rope. To evaluate the performance of a safety sleeve when left unattended on an oscillating wire rope.
8. Safety climb system rescue/retrieval use. To evaluate the use of a safety climb system after a fall event.
9. Safety climb system with minor wire rope damage/defects. To evaluate the impact of wire rope use after minor defects have been found.
10. Climber in motion dynamic drop test – ascending and descending and with lateral oscillation. To evaluate a real world fall with climbing like characteristics.

Recommendations based on performance results.

User Warnings

1. Do not to leave unattended or non-secured safety sleeves attached to the safety climb.
2. Older safety sleeves should be either replaced with a newer model that is compatible with both 1x7 and 7x19 3/8” diameter wire rope or the user shall verify that the existing safety sleeve is compatible with the existing wire rope, meets and is utilized per manufacturer specifications.
3. All safety climbs must be properly tensioned and the top/bottom assembly attached per manufacturer instructions.
4. Manufacturer supplied carabiners with captive pins must be used in conjunction with the safety sleeve for proper function.
5. Users harness/body shall not come in contact with safety sleeve while ascending and descending on the safety climb system.
6. Always refer to manufacturer documentation of use and inspection.

The next goal of the SEMC will be to assist national consensus standard committee(s) with the development of testing procedures to further advance and define protocols for advanced uses, limits and warnings of wire rope safety climbs and systems on antenna supporting structures.

NATE Safety Sleeve Testing Final Report

For detailed information please reference the NATE Safety Sleeve Testing Final Report:

https://natehome.com/wp-content/uploads/2020/03/NATE-Safety-Sleeve-Testing-Report-White-Paper-FINAL-1.pdf