



Worker Antenna Mount Access Current & Best Practices



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The Structure, Tower and Antenna Council (STAC) helps ensure communications antennas in Canada continue to be constructed with the highest regard to worker safety.

STAC is a non-profit Council of the Canadian Wireless Telecommunications Association, representing and providing a collaborative forum for Canadian wireless communications carriers, tower owners/operators, tower and rooftop equipment engineering service suppliers, and wireless communication facilities construction and maintenance contractors.

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Worker Antenna Mount Access

1. Intent

The intent of this document is to promote conversation on worker safety in regards to antenna mount structural adequacy to support workers and associated fall protection anchorage locations and strengths for workers to use.

2. Goal

The goal is to create conversation through pictures and current designs to ensure tower engineers are aware of the problems that exist for workers installing equipment on pinwheel mounts, and to then develop best practices or design changes to mitigate the hazards.

This document utilizes the general hierarchies for hazards as follows:

1. Identify the hazard
2. Engineer out the hazard
3. Time manage the hazard
4. Personal Protective Equipment

The end goal is to ensure all parties in the chain of development – from vendor to installer – understand the difficulties of installing the end product and through that understanding develop their own installation processes necessary for safe installation.

3. Field Workforce

For years, the tower industry has relied on the field work force to make the best decisions they could with little or no information to make those decisions.

4. Potential Issues

The following is a list of current potential problems to discuss, each of which should be considered in regards to each of the different types of mounts identified in Section 9 of this document:

1. Current CSA S37 standard does not address construction loads to install the structure
2. Current CSA S37 standard does not address construction loads to install appurtenances
3. Antenna mount design or the location of antennas does not consider worker access for maintenance or replacement

5. Questions

The following is a list of questions to be considered when looking at the pictures and drawings in Section 9:

1. When designing antennas mounts, what criteria defines horizontal separation and the distance out from the structure? Is the design efficient?
2. How is the mount going to be installed?
3. How are antennas and feeders going to be installed?
4. What is the access for maintenance work?
5. Where is fall protection equipment going to be attached during access?
6. Where are workers going to attach for work below the antennas for bottom feeds?
7. Where are workers going to attach their blocks to lift loads?
8. What special considerations require particular attention when working on antenna mounts at the very top of a structure?



6. Fall Protection Anchorage Requirements

Because all telecommunications work is federally regulated, enclosed here are federal anchorage requirement regulations along with the most recent applicable CSA Z259 standards. Please note that workers should always follow the appropriate governing body's anchorage requirements.

For easy reference, the provincial regulations are also covered in Section 10 of this document, as is the verbatim wording of federal regulations found under the Canada Occupational Health and Safety Regulations.

Please note that when discussing ultimate capacities, forces found in this document are assumed to incorporate all load factors. When discussing allowable capacities, the appropriate safety factors must be applied to the calculated capacities of the system. Finally, when the capacity is not specified as ultimate or allowable in this document, the reader can assume that the capacity is ultimate and that the forces include all load factors.

1. Federal Regulations¹

The anchorage of a fall arrest system shall be capable of withstanding a force of 17.8 kN. There are no federal regulations relating to anchorage requirements for restraint or positioning devices.

2. CSA Z259 Standards²

A fall arrest system shall be used in combination with a positioning lanyard. The anchorage of a fall arrest system shall be capable of withstanding a force of the greatest between 2x MAF or 16 kN.

An anchorage for fall restraint shall be capable of withstanding a force of 3.6 kN.

An anchorage for a positioning device shall be capable of withstanding a force of 3.6 kN.

In reference to CSA Z259.17 the anchorage for a fall arrest system shall be able to withstand two times the Maximum Arresting Force based on the chart below. The chart below is based on a system and components approved for use by the CSA 259 group of standards and limit the fall to no greater than 1.8 m (6 ft).

Worker's Mass*	Average Arresting Force	Maximum Arresting Force
45 kg (100 lb) < m < 115 kg (254 lb)	< 4 kN (900 lbf)	< 8 kN (1,800 lbf)
90 kg (200 lb) < m < 175 kg (386 lb)	< 6 kN (1,350 lbf)	< 8 kN (1,800 lbf)

**Note: Workers between 90 kg and 115 kg may fall into either Worker's Mass category depending on the equipment being used. A worker in the weight range would fall into the 45-115 kg class if using an E4 lanyard, but would fall into the 90-175 kg class if using an E6 lanyard, as defined by CSA Z259-11.*

¹ [Canada Occupational Health and Safety Regulations \(SOR/86-304\)](#)

² Z259.17-16 - Selection and use of active fall-protection equipment and systems



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3. Engineered System

An engineered system shall be designed in accordance with the CSA Z259 standards. The fall arrest system shall be designed to withstand a force of two times the maximum arresting force.

CSA Z259 establishes safety criteria for determining structural strength and behavior of components or anchorages of active fall-protection systems based on known strengths and behaviours – as determined through analytical testing or engineering methods.

7. Discussion Notes

In an effort to help encourage discussion and critical thinking, this document establishes discussion points and questions relating to each type of pinwheel mount identified in Section 9. Typically, these discussion points reflect the perspective of a worker who is not yet aware of the size, strength or stability of a tower member. Some assumptions included in these discussion points and questions may not be accurate when compared to the specific drawings or pictures included, but still represent important considerations.

8. Pictures and Drawings

The drawings and pictures seen in Section 9 of this document represent different types of pinwheel mount designs. These images are displayed to create conversation and discussion.

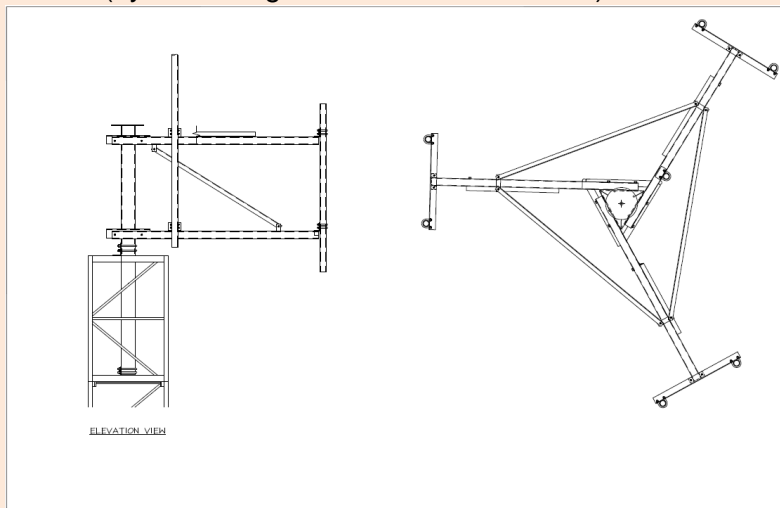


9.1 Rotatable Pinwheel

This drawing shows a T-Boom. The picture has a single antenna mount at the top of the structure. Other types of rotatable pinwheels also exist, though access practices remain the same for nearly all variants.

Important considerations and discussion points for this configuration include:

1. Is this mount strong enough to hold a worker and/or an antenna?
2. The only applicable fall protection anchor seems to be back to the mast/pinwheel pipe.
3. There will be a **major swing fall** with this setup if there is a fall.
4. The antennas are bottom fed; the worker will need to hang below from the lower horizontal member.
5. If the antenna needs to be replaced, the worker will need to place a block on the pipe or back to the structure and then carry the antenna out to the mount by hand.
6. Workers may feel forced to choose between reducing swing fall (by anchoring to end of mount) or reducing rescue access (by anchoring closer to or at the tower).



Steps a worker would typically take to access this mount currently include*:

1. Attach an energy absorbing lanyard to the *highest point* of the **main pipe** or near the **boom connection** to the main pipe.
2. Attach positioning device to the **top horizontal** mount member. *(If moving around an obstruction, workers should connect a second positioning device, though this practice is not always currently utilized.)*
3. Slide out to the antenna by putting feet on the **bottom horizontal** member.
4. If the horizontal distance is more than six feet, a fall protection anchorage extension will be necessary.



* see Appendix 1 for safe work practice.

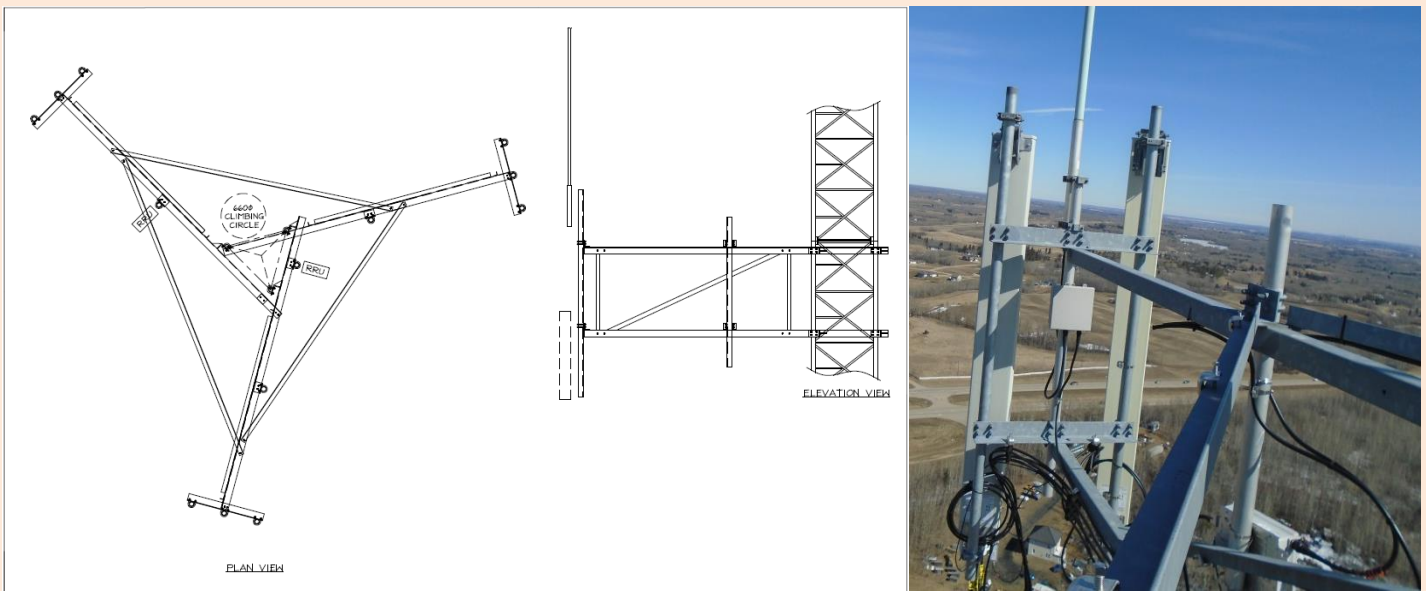


9.2 Fixed Pinwheel

This picture has a T-boom configuration where there are two antennas at the end of each boom. Though both the drawing and picture depict mounts with sway bracing, not all variants include sway bracing.

Important considerations and discussion points for this configuration include:

1. Based on the picture, it is uncertain if a fall protection anchorage could be placed halfway to the bracing point. If not, the anchorage must be back at the structure. For the field worker, this anchorage point becomes a guess.
2. The worker can anchor at the **midpoint** to reduce **swing fall**. Other systems like rope grabs can also be used to reduce swing fall if there is anchorage at higher points on the structure.
3. The antennas are bottom-fed, meaning a worker would need to hang below from the lower horizontal member.
4. If the antenna or radio needs to be replaced, a worker could place a block at the midpoint of the mount and move the antenna or radio out to the pipe by hand. Other techniques may also be used.



Steps a worker would typically take to access this mount include*:

1. Attach an energy absorbing lanyard to the structure.
2. Attach positioning device to the **top horizontal** mount member.
3. Place feet on the **lower horizontal** mount member.
4. Attach another anchorage at the midpoint and attach a second lanyard before removing the lanyard that is attached to the structure.
5. Move out to the antenna.
6. If the horizontal distance is more than six feet, a fall protection anchorage extension will be necessary.

* see Appendix 2 for safe work practice.





9.4 Platform

This picture has a platform at the top of the structure where the antennas are mounted. This is just one of many varying types of platform designs.

Important considerations and discussion points for this mount include:

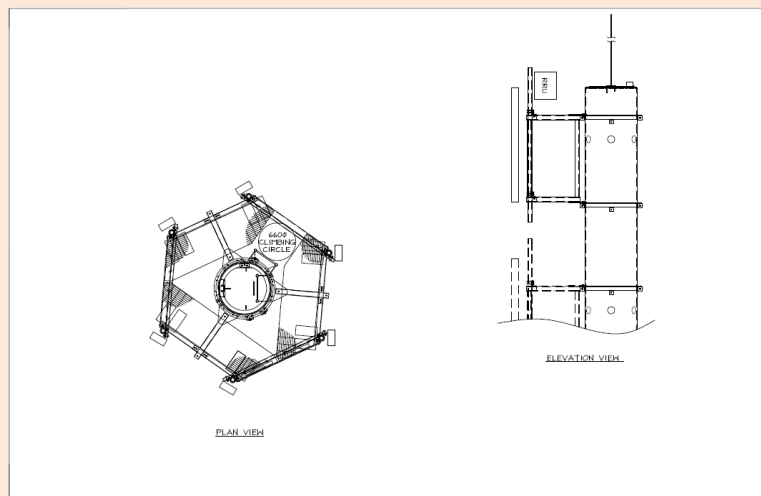
1. Due to the various voids in the grading, the side rails are likely designed for antennas only. Very few platforms work as a floor and/or handrail. Some platforms have self-containing flooring or rails.
2. It is not clear where a worker would attach a fall protection device.
3. Due to open voids in the platform, workers cannot use fall restraint and must use fall arrest
4. What would a worker attach a block to for lifting loads and what force could that location take?



Steps a worker would typically take to access this mount include*:

1. Attach a lanyard to the structure.
2. If the horizontal distance is more than six feet, a fall protection anchorage extension will be necessary.
3. Move out onto the platform.
4. To reduce an excessive fall distance, a lifeline or a self-retracting device may be used.

* see Appendix 4 for safe work practice.





10. Provincial and Federal Fall Protection Anchorage Requirements

Canada (Federal)³

(3) The anchor of a fall-protection system shall be capable of withstanding a force of 17.8 kN. (4) A fall-protection system that is used to arrest the fall of a person shall prevent that person (a) from being subjected to a peak fall arrest force greater than 8 kN; and (b) from falling freely for more than 1.2 m.

Alberta⁴

Anchor strength — permanent 152(1) An employer must ensure that a permanent anchor is capable of safely withstanding the impact forces applied to it and has a minimum breaking strength per attached worker of 16 kilonewtons or two times the maximum arresting force in any direction in which the load may be applied. 152(2) Subsection (1) does not apply to anchors installed before July 1, 2009. 152(3) Subsection (1) does not apply to the anchors of flexible horizontal lifeline systems that must meet the requirements of subsection 153(1).

152(4) The employer must ensure that an anchor rated at two times the maximum arresting force is designed, installed and used in accordance with (a) the manufacturer's specifications, or (b) specifications certified by a professional engineer. **Anchor strength — temporary** 152.1(1) An employer must ensure that a temporary anchor used in a travel restraint system (a) has a minimum breaking strength in any direction in which the load may be applied of at least 3.5 kilonewtons per worker attached, (b) is installed, used and removed according to the manufacturer's specifications or specifications certified by a professional engineer, (c) is permanently marked as being for travel restraint only, and (d) is removed from use on the earliest of (i) the date on which the work project for which it is intended is completed, or (ii) the time specified by the manufacturer or professional engineer. 152.1(2) An employer must ensure that a temporary anchor used in a personal fall arrest system (a) has a minimum breaking strength in any direction in which the load may be applied of at least 16 kilonewtons or two times the maximum arresting force per worker attached, (b) is installed, used and removed according to the manufacturer's specifications or specifications certified by a professional engineer, and, (c) is removed from use on the earliest of (i) the date on which the work project for which it is intended is completed, or (ii) the time specified by the manufacturer or professional engineer.

British Columbia⁵

(1) In a temporary fall restraint system, an anchor for a personal fall protection system must have an ultimate load capacity in any direction in which a load may be applied of at least (a) 3.5 kN (800 lbs), or (b) four times the weight of the worker to be connected to the system. (2) Each personal fall protection system that is connected to an anchor must be secured to an independent attachment point. (3) In a temporary fall arrest system, an anchor for a personal fall protection system must have an ultimate load capacity in any direction required to resist a fall of at least (a) 22 kN (5 000 lbs), or (b) two times the maximum arrest force. (4) A permanent anchor for a personal fall protection system must have an ultimate load capacity in any direction required to resist a fall of at least 22 kN (5 000 lbs).

³ [Canada Occupational Health and Safety Regulations \(SOR/86-304\)](#)

⁴ [Province of Alberta Occupational Health and Safety Code 2009](#)

⁵ [British Columbia 296/97 - Occupational Health and Safety Regulation](#)



Manitoba⁶

14.14(1) The owner of a building or structure must ensure that a permanent anchorage system used as the fixed support in a travel restraint system or fall arrest system for that building meets the following requirements: (a) the anchor has an ultimate capacity of at least 22.2 kN in any direction in which the load may be applied for each worker attached; (b) the anchorage system is certified by a professional engineer as having the required load capacity; (c) where the anchorage system is used in conjunction with a suspended work platform, the system is designed, constructed and used in accordance with CAN/CSA Standard-Z91-02, Health and Safety Code for Suspended Equipment Operations and CAN/CSA-Z271-98 (R2004), Safety Code for Suspended Elevating Platforms.

14.14(2) When a permanent anchorage system cannot be used at a workplace, an employer must ensure that the temporary fixed support in a travel restraint system or fall arrest system meets the following requirements: (a) when a fall arrest system without a shock absorber is used, a support used in a fall arrest system must be capable of supporting a static force of at least 8 kN without exceeding the allowable unit stress for each material used in the fabrication of the anchor point; (b) when a shock absorber is used in a fall arrest system, the support must be capable of supporting a static force of at least 6 kN without exceeding the allowable unit stress for each material used in the fabrication of the anchor point; (c) a support used in a travel restraint system must be capable of supporting a static force of at least 2 kN without exceeding the allowable unit stress for each material used in the fabrication of the anchor point.

New Brunswick⁷

49.2(1) An owner of a place of employment, an employer and a contractor shall each ensure that any fall-arresting system consists of the following: (a) a full body harness that is designed and rated by the manufacturer for the employee's body type and adjusted to fit the employee; (b) a self-retracting lanyard, an energy absorbing lanyard or a lanyard and energy absorber that is rated by the manufacturer for the employee; (c) unless it is a horizontal life line, an anchor point that is capable of withstanding a 22 kN force or, if used under the direction of a competent person, four times the maximum load that may be generated in the fall-arresting system. 49.2(2) An owner of a place of employment, an employer and a contractor shall each ensure that a fall-arresting system limits (a) free falls to the shortest distance possible, which distance cannot exceed 1.8 m or a shock level on the body of 8 kN, and (b) the total fall distance to an amount less than the distance from the work area to any safe level, water or obstruction below.

Newfoundland and Labrador⁸

142. (1) A fall arrest system that is provided in accordance with section 141 shall (a) be adequately secured to (i) an anchorage point, or (ii) a lifeline that is (A) securely fastened to anchor points, or (B) attached to a static line that is securely fastened to anchorage points and that is capable of withstanding either the maximum load likely to be imposed on the anchorage point or a load of 22.2 kilonewtons, whichever is the greater;

⁶ [Manitoba Regulation 217/2006 Workplace Safety and Health Regulation](#)

⁷ [New Brunswick Regulation 2010-159](#)

⁸ [Newfoundland and Labrador Regulation 5/12](#)



Nova Scotia⁹

21.15 An employer must ensure that all anchorages used as components of a fall-protection system are capable of withstanding the following forces in any direction in which the force may be applied: (a) 22 kN, for non-engineered anchorage; (b) 2 times the maximum arresting force anticipated, for an engineered anchorage.

Ontario¹⁰

26.7 (1) A permanent anchor system shall be used as the fixed support in a fall arrest system, fall restricting system or travel restraint system if the following conditions are met: 1. The anchor system has been installed according to the Building Code. 2. It is safe and practical to use the anchor system as the fixed support. O. Reg. 145/00, s. 14. (2) If the conditions set out in subsection (1) are not met, a temporary fixed support shall be used that meets the following requirements: 1. Subject to paragraph 2, a support used in a fall arrest system shall be capable of supporting a static force of at least 8 kilonewtons without exceeding the allowable unit stress for each material used. 2. If a shock absorber is also used in the fall arrest system, the support shall be capable of supporting a static force of at least 6 kilonewtons without exceeding the allowable unit stress for each material used. 3. Subject to paragraph 4, a support used in a fall restricting system must be capable of supporting a static force of at least 6 kilonewtons without exceeding the allowable unit stress for each material used. 4. Paragraph 3 does not apply to a support that is used in accordance with the manufacturer's written instructions and is adequate to protect a worker. 5. A support used in a travel restraint system shall be capable of supporting a static force of at least 2 kilonewtons without exceeding the allowable unit stress for each material used. O. Reg. 145/00, s. 14. (3) Despite the requirements listed in subsection (2), the support capacity of a temporary fixed support used in a fall protection system may be determined by dynamic testing in accordance with good engineering practice to ensure that the temporary fixed support has adequate capacity to arrest a worker's fall. O. Reg. 145/00, s. 14.

Prince Edward Island¹¹

3. (1) A fall arrest system that is provided, in accordance with subsection 2(1), to a worker at a work area as a means of fall protection shall (a) be adequately secured to (i) an anchor point, or (ii) a lifeline that is (A) securely fastened to an anchor point, or (B) attached to a static line that is securely fastened to an anchor point that is capable of withstanding either the maximum load likely to be imposed on the anchor point or a load of 17.8 kN, whichever is greater;

Quebec¹²

348. Anchorage point: The anchorage point for a safety harness lifeline shall be attached in one of the following ways: (1) be anchored to some point with a tensile strength at break of at least 18 kN; (2) be attached to a sliding sleeve in compliance with the CAN/CSA Z259.2-M1979 standard Fall-arresting Devices, Personal Lowering Devices and Life Lines; (3) be attached to a horizontal lifeline and anchorage point system, designed by an engineer, as demonstrated by a plan or certification available on the premises where such work is performed.

⁹ [Nova Scotia Regulations 52/2013, 143/2014 - Workplace Health and Safety Regulations](#)

¹⁰ [Ontario Regulation 213/91: Construction Projects](#)

¹¹ [Occupational Health and Safety Act – Fall Protection Regulations](#)

¹² [S-2.1 r. 13 – Regulation respecting occupational health and safety](#)



Saskatchewan¹³

Personal fall arrest systems 102(1) An employer or contractor shall ensure that a personal fall arrest system and connecting linkage required by these regulations are approved and maintained. (2) An employer or contractor shall ensure that a personal fall arrest system required by these regulations: (a) prevents a worker from falling more than 1.2 metres without a shock absorber; (b) where a shock absorber is used, prevents a worker from falling more than two metres or the limit specified in the manufacturer's specifications, whichever is less; (c) applies a peak fall-arrest force not greater than eight kilonewtons to a worker; and (d) is fastened to a lifeline or to a secure anchor point that has a breaking strength of at least 22.2 kilonewtons.

116.3(1) Where a worker uses a personal fall arrest system or a travel restraint system, an employer, contractor or owner shall ensure that an anchor point or anchor plate that meets the requirements of this section is used as part of that system. (2) An employer, contractor or owner shall ensure that a temporary anchor point used in a travel restraint system: (a) has an ultimate load capacity of at least 3.5 kilonewtons (800 pounds-force) per worker attached in any direction in which the load may be applied; (b) is installed and used according to the manufacturer's specifications; (c) is permanently marked as being for travel restraint only; and (d) is removed by the last worker from use on the earlier of: (i) the date the work project for which it is intended is completed; and (ii) the time specified by the manufacturer. (3) An employer, contractor or owner shall ensure that a permanent anchor point used in a travel restraint system associated with any new construction project on or after the date this section comes into force: (a) has an ultimate load capacity of at least 8.75 kilonewtons (2 000 pounds-force) per worker attached in any direction in which the load may be applied; (b) is installed and used according to the manufacturer's specifications; and (c) is permanently marked as being for travel restraint only. (4) In the case of a personal fall arrest system installed on or after one year after the date this section comes into force, an employer, contractor, owner or supplier shall ensure that anchor points to which the personal fall arrest system is attached have an ultimate load capacity of at least 22.2 kilonewtons (5000 pounds-force) per worker attached in any direction in which the load may be applied. (5) An employer, contractor, owner or supplier shall ensure that the following types of equipment that are components of fall protection systems, and their installation, conform to the manufacturer's specifications or are certified by a professional engineer: (a) permanent anchor points; (b) anchors with multiple attachment points; (c) permanent horizontal lifeline systems; (d) support structures for safety nets

¹³ [O-1.1 Reg 1 - The Occupational Health and Safety Regulations, 1996](#)



Appendix 1: Safe Work Practice – Rotatable Pinwheel

NAME	ROTATABLE Pinwheel
DATE DEVELOPED/ BY	July 7, 2016 Clay Parchewsky
POSSIBLE HAZARDS PRESENT	Fall Arrest into system, swing falls, falls into structure, fall clearance
REFERENCES	CSA Z259.16, CSA Z259.17, Equipment CSA Z259 standards
PERSONAL PROTECTIVE EQUIPMENT (PPE)	Proper clothing (short sleeves, pants), gloves, CSA approved foot protection, CSA approved head protection with chin strap
PERSONAL FALL ARREST SYSTEM EQUIPMENT	Anchorage slings/ straps, energy absorbing Y-lanyard, positioning device(s) , SRD's, rope lifeline and rope arrestor, full body harness
RESCUE RESPONSIBILITY	Rescue equipment, rescue plan, qualified rescue personnel
STEP BY STEP	<ol style="list-style-type: none"> 1. Select fall arrest anchorage to the rotatable mast pipe at the highest possible location <i>or</i> to the boom near the boom connection. <i>If the rotatable pinwheel members are adequate to arrest a fall when using a lanyard with energy absorption, those members can be used for anchorage connections.</i> 2. If hook side loading is a problem, use an anchorage sling. 3. Maintain 100% connection with a positioning device on the horizontal boom. This eliminates a fall into a fall arrest system where swing fall hazards exist. Place your feet on the bottom boom and move out to the antenna. <ul style="list-style-type: none"> • Recommended: Attach adjustable positioning device to boom and transition sideways out to the work location. Alter adjustable positioning device so you can grip the boom with your hands to pull yourself out to the work location while the positioning device follows. There is a higher potential of a fall into the fall arrest system if a positioning device is not used.* 4. Consider cable locations and other hardware on the boom. These are possible obstacles to overcome on a boom. The use of an additional positioning device or SRD should achieve 100% positioning in most cases. 5. When the crown block is attached to an antenna mount for lifting operations, load calculations should be completed to ensure the mount can carry the forces created by the lifting operations and it is recommended that workers stay off the mount during lifting. 6. Hoisting equipment and/ or antennas to the tower off of a block or pulley to height is an alternative. Workers can then transfer equipment and/ or antenna to the work location.
<p>* The information presented in this chart is intended for general use and may not apply to every circumstance. The safe job procedures and safe work practices created for your workplace should reflect your organization's processes, equipment and hazards as identified by a hazard analysis.</p>	



Appendix 2: Safe Work Practice – Fixed Pinwheel

NAME	Fixed Pinwheel (Top or Mid level)
DATE DEVELOPED/ BY	August 11, 2016 Clay Parchewsky
POSSIBLE HAZARDS PRESENT	Fall Arrest into system, swing falls, falls into structure, fall clearance
REFERENCES	CSA Z259.16, CSA Z259.17, Equipment CSA Z259 standards
PERSONAL PROTECTIVE EQUIPMENT (PPE)	Proper clothing (short sleeves, pants), gloves, CSA approved foot protection, CSA approved head protection with chin strap
PERSONAL FALL ARREST SYSTEM EQUIPMENT	Anchorage slings/ straps, energy absorbing Y-lanyard, positioning device(s) , SRD's, rope lifeline and rope arrestor, full body harness
RESCUE RESPONSIBILITY	Rescue equipment, rescue plan, qualified rescue personnel
STEP BY STEP	<ol style="list-style-type: none"> 1. Select fall arrest anchorage to the tower structure leg or monopole structure at the highest possible location. 2. <i>If the pinwheel arms are adequate to arrest a fall when using a lanyard with energy absorption, members used for anchorage connections shall be at a connection point and closer to the tower.</i> 3. Connect with an anchorage sling and avoid connection gate/side load. 4. Maintain 100% connection with a positioning device on the horizontal boom. This eliminates a fall into a fall arrest system where swing fall hazards exist. Place your feet on the bottom boom and move out to the antenna. <ul style="list-style-type: none"> • Recommended: Attach adjustable positioning device to boom and transition sideways out to the work location. Alter adjustable positioning device so you can grip the boom with your hands to pull yourself out to the work location while the positioning device follows. There is a higher potential of a fall into the fall arrest system if a positioning device is not used.* 5. Consider cable locations and other hardware on the boom. These are possible obstacles to overcome on a boom. The use of an additional positioning device or SRD should achieve 100% positioning in most cases. 6. When the crown block is attached to an antenna mount for lifting operations, load calculations should be completed to ensure the mount can carry the forces created by the lifting operations and it is recommended that workers stay off the mount during lifting. 7. Hoisting equipment and/ or antennas to the tower off of a block or pulley to height is an alternative. Workers can then transfer equipment and/ or antenna to the work location.
<p>* The information presented in this chart is intended for general use and may not apply to every circumstance. The safe job procedures and safe work practices created for your workplace should reflect your organization's processes, equipment and hazards as identified by a hazard analysis.</p>	



Appendix 3: Safe Work Practice – Semi-Rotatable Pinwheel

NAME	Semi-Rotatable Pinwheel
DATE DEVELOPED/ BY	August 17, 2016 Clay Parchewsky
POSSIBLE HAZARDS PRESENT	Fall Arrest into system, swing falls, falls into structure, fall clearance
REFERENCES	CSA Z259.16, CSA Z259.17, Equipment CSA Z259 standards
PERSONAL PROTECTIVE EQUIPMENT (PPE)	Proper clothing (short sleeves, pants), gloves, CSA approved foot protection, CSA approved head protection with chin strap
PERSONAL FALL ARREST SYSTEM EQUIPMENT	Anchorage slings/ straps, energy absorbing Y-lanyard, positioning device(s) , SRD's, rope lifeline and rope arrestor, full body harness
RESCUE RESPONSIBILITY	Rescue equipment, rescue plan, qualified rescue personnel
STEP BY STEP	<ol style="list-style-type: none"> 1. Select fall arrest anchorage to the tower structure leg at the highest possible location. 2. Connect with an anchorage sling and avoid connection gate/side load. Lanyards may have to be lengthened with a sling to extend access to antenna locations. 3. Maintain 100% connection with a positioning device on the horizontal boom. This eliminates a fall into a fall arrest system where swing fall hazards exist. Place your feet on the bottom boom and move out to the antenna. <ul style="list-style-type: none"> • Recommended: Attach adjustable positioning device to boom and transition sideways out to the work location. Alter adjustable positioning device so you can grip the boom with your hands to pull yourself out to the work location while the positioning device follows. There is a higher potential of a fall into the fall arrest system if a positioning device is not used.* 4. Consider cable locations and other hardware on the boom. These are possible obstacles to overcome on a boom. The use of an additional positioning device or SRD should achieve 100% positioning in most cases. 5. When the crown block is attached to an antenna mount for lifting operations, load calculations should be completed to ensure the mount can carry the forces created by the lifting operations and it is recommended that workers stay off the mount during lifting. 6. Hoisting equipment and/ or antennas to the tower off of a block or pulley to height is an alternative. Workers can then transfer equipment and/ or antenna to the work location.
<p>* The information presented in this chart is intended for general use and may not apply to every circumstance. The safe job procedures and safe work practices created for your workplace should reflect your organization's processes, equipment and hazards as identified by a hazard analysis.</p>	



Appendix 4: Safe Work Practice – Platform

NAME	PLATFORM Pinwheel (metal standing grating with antenna(s), with or without guardrails)
DATE DEVELOPED/ BY	August 8, 2016 Clay Parchewsky
POSSIBLE HAZARDS PRESENT	Fall Arrest into system, swing falls, falls into structure, fall clearance
REFERENCES	CSA Z259.16, CSA Z259.17, Equipment CSA Z259 standards
PERSONAL PROTECTIVE EQUIPMENT (PPE)	Proper clothing (short sleeves, pants), gloves, CSA approved foot protection, CSA approved head protection with chin strap
PERSONAL FALL ARREST SYSTEM EQUIPMENT	Anchorage slings/ straps, energy absorbing Y-lanyard, positioning device(s) , SRD's, rope lifeline and rope arrestor, full body harness
RESCUE RESPONSIBILITY	Rescue equipment, rescue plan, qualified rescue personnel
STEP BY STEP	<ol style="list-style-type: none"> 1. Select fall arrest anchorage to the tower or mast pipe at the highest possible location. <ul style="list-style-type: none"> • If the antenna platform has guardrails installed, Fall Restraint methods could be considered to prevent a worker from going over the leading edge. Workers must first ensure that both the existing outside and existing inside systems conform to guard rail specifications before fall restraint can be used. 2. Connect with an anchorage sling and avoid hook side/gate load. 3. Close platform access floor doors/hatches if applicable. 4. Maintain 100% connection with a positioning device on the horizontal boom. This eliminates a fall into a fall arrest system where swing fall hazards exist. Place your feet on the bottom boom and move out to the antenna. <ul style="list-style-type: none"> • Recommended: Attach adjustable positioning device to boom and transition sideways out to the work location. Alter adjustable positioning device so you can grip the boom with your hands to pull yourself out to the work location while the positioning device follows. There is a higher potential of a fall into the fall arrest system if a positioning device is not used.* 5. Consider cable locations and other hardware on the boom. These are possible obstacles to overcome on a boom. The use of an additional positioning device or SRD should achieve 100% positioning in most cases. 6. When the crown block is attached to an antenna mount for lifting operations, load calculations should be completed to ensure the mount can carry the forces created by the lifting operations and it is recommended that workers stay off the mount during lifting. 7. Hoisting equipment and/ or antennas to the tower off of a block or pulley to height is an alternative. Workers can then transfer equipment and/ or antenna to the work location.
<p>* The information presented in this chart is intended for general use and may not apply to every circumstance. The safe job procedures and safe work practices created for your workplace should reflect your organization's processes, equipment and hazards as identified by a hazard analysis.</p>	



Appendix 5: Safe Work Practice – Single Mount

NAME	Single Mount (horizontal boom with a small antenna at the end)
DATE DEVELOPED/ BY	June 26, 2016 Clay Parchewsky
POSSIBLE HAZARDS PRESENT	Fall Arrest into system, swing falls, falls into structure, fall clearance
REFERENCES	CSA Z259.16, CSA Z259.17, Equipment CSA Z259 standards
PERSONAL PROTECTIVE EQUIPMENT (PPE)	Proper clothing (short sleeves, pants), gloves, CSA approved foot protection, CSA approved head protection with chin strap
PERSONAL FALL ARREST SYSTEM EQUIPMENT	Anchorage slings/ straps, energy absorbing Y-lanyard, positioning device(s) , SRD's, rope lifeline and rope arrestor, full body harness
RESCUE RESPONSIBILITY	Rescue equipment, rescue plan, qualified rescue personnel
STEP BY STEP	<ol style="list-style-type: none"> 1. Select anchorage to the tower leg only at the highest possible location. 2. Connect with an anchorage sling and avoid hook side load. 3. Maintain 100% connection with a positioning device on the horizontal boom. Accessing horizontally can be achieved in 2 ways. <ul style="list-style-type: none"> • Recommended: Hang under the boom and pull out to the work location. Alter adjustable positioning device so your hands can grip the boom to pull out to the work location. • Alternative: Straddle the mount to slide out to the work location on the boom arm. Alter adjustable positioning device so it is under the boom. There is a higher potential to fall into a positioning device in a roll over. * 4. Consider cable locations and other hardware on the boom. These are possible obstacles to overcome on a boom. The use of an additional positioning device or SRD should achieve 100% positioning in most cases. 5. When the crown block is attached to an antenna mount for lifting operations, load calculations should be completed to ensure the mount can carry the forces created by the lifting operations and it is recommended that workers stay off the mount during lifting. 6. Hoisting equipment and/ or antennas to the tower off of a block or pulley to height is an alternative. Workers can then transfer equipment and/or antenna to the work location.
<p>* The information presented in this chart is intended for general use and may not apply to every circumstance. The safe job procedures and safe work practices created for your workplace should reflect your organization's processes, equipment and hazards as identified by a hazard analysis.</p>	



Appendix 6: Current Work Practices – Common Additional Hazards

Note: Each of the situations outlined below describe difficult access scenarios and can significantly increase the risk of worker injury. These situations should be “engineered out” at every possible opportunity.

Due to access problems, single-supported mounts and antenna mounts supported by booms with wide gaps between them should be discouraged during the engineering design process.

Access Requirement	Additional Equipment Required	Additional Steps Required
Bypassing obstructions on a pinwheel	<ul style="list-style-type: none"> Additional positioning device 	<ol style="list-style-type: none"> 1. Attach second positioning device to safe anchorage point on the other side of the obstruction 2. Move around (bypass) the obstruction* <p><i>*May require detaching original positioning device to bypass the obstruction</i></p>
Hanging below a boom to access an installation using a portable ladder	<ul style="list-style-type: none"> Portable ladder Additional sling and shackle SRD, rope lifeline/rope arrestor* 	<ol style="list-style-type: none"> 1. Connect portable ladder to the boom, using sling and shackle and utilizing proper rigging techniques* 2. Descend the ladder to the appropriate height 3. Attach positioning device to safe anchorage point on the ladder at appropriate location <p><i>*Note: In some cases, workers will use an SRD or rope lifeline/rope arrestor for fall arrest when their lanyard is too short to reach the required location. In this situation, the worker would attach their additional device to the middle pipe and would then disconnect their fall arrest lanyard.</i></p>
	<ul style="list-style-type: none"> Additional slings 	<ol style="list-style-type: none"> 1. Use additional sling(s) to configure a choke/basket 2. Disconnect positioning device from boom and attach at a lower point by connecting to choke/basket
Hanging below a boom to access an installation using rope descent	<ul style="list-style-type: none"> Rope Descending device Additional slings and carabiner 	<ol style="list-style-type: none"> 1. Connect descending device to rope (if applicable) 2. Connect rope to the boom using sling(s) and carabiner(s) and utilizing proper rigging techniques 3. Descend the ladder to the appropriate height 4. Lock descending device upon reaching the appropriate location



<p>Accessing mounts/pipes above the booms</p>	<ul style="list-style-type: none"> • Additional positioning device • Additional slings and straps • Suggested: Temporary steps or temporary anchors 	<ol style="list-style-type: none"> 1. Attach fall protection lanyard to the nearest suitable anchor. (This may need to be moved depending on the distance you are travelling.) 2. Install climbing access such as a rope, a sling or temporary steps 3. Adjust positioning device by connecting it to the top of the vertical pipe holding the antenna. 4. Climb or pull yourself up to working position. 5. Adjust positioning device as needed
<p>Accessing a rotatable pinwheel without climbing facility access</p>	<ul style="list-style-type: none"> • Adjustable positioning device and a block • Additional slings and straps • Temporary steps • Ladder • Descent Control system 	<ol style="list-style-type: none"> 1. Climb to top of climbing facility access. 2. Move fall protection lanyard to highest suitable anchor point on the vertical mast. 3. Disconnect from the ladder or rigid rail system. 4. Repeat step 2 until you reach the desired height, if necessary. 5. Attach positioning device to horizontal boom. 6. Move out to the end of the boom or desired work position.



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Appendix 7: Force Conversion Chart

Note: The following chart provides metric and imperial conversions for all forces listed in this document by kilonewton.

Kilonewton (kN)	Kilogram-force (kgf)*	Pound- force (lbf)**
2	204	450
3.5	357	790
3.6	367	810
4	408	900
6	612	1,350
8	815	1,800
16	1632	3,600
17.8	1815	4,000
22	2243	4,950
22.2	2264	5,000

* Kilogram-force (kgf) conversions are rounded to the nearest whole number

** Pound-force (lbf) conversions are rounded to the nearest round number.