Fall Protection / Personal Fall Arrest Program

1. Purpose / Background

The Massachusetts Institute of Technology (MIT) is committed to the prevention of injuries on campus and at satellite locations. The purpose of this Fall Protection / Personal Fall Arrest Program is to (1) Outline fall protection procedures based on relevant safety standards and regulations, and (2) to ensure that each member of the MIT community who is exposed to elevated heights is trained and informed of the safety requirements that shall be implemented by this plan, prior to the start of work. This SOP covers all MIT employees (faculty, staff, and DLC), visitors to MIT, and all students conducting work in academia.

2. Scope

This Fall Protection / Personal Fall Arrest Program focuses on personal fall arrest systems used by MIT personnel regardless of location. It is designed to assist the employees in recognizing the fall hazards at MIT, and to establish procedures to be followed in order to prevent falls. Each employee and student conducting research that will expose them to fall hazards, will be trained in the proper procedures. Visitors at MIT shall only be allowed to access roof areas that are entirely encompassed by guardrails or are designated areas. Visitors must be accompanied by an MIT employee to the restricted areas (e.g. roof tops). This Fall Protection / Personal Fall Arrest Program is in accordance with OSHA regulations, ANSI standards, and industry best practice.

3. Prerequisites

Personnel may also need training in the following areas, if applicable:

- Mobile Elevated Work Platforms (MEWP)
- Ladder Safety
- Walking and Working Surfaces

4. Training

General

All affected MIT employees shall receive Fall Protection / Authorized Person Training prior to engaging in activities where the individual(s) are exposed to, or potentially exposed to a fall of 4 feet or more.

Training Records

Training shall be documented. Training records shall be kept as part of the EHS-MS training system. Names and dates of MIT personnel receiving training should be sent to

the DLC's EHS Coordinator, and emailed to environment@mit.edu or mailed to the EHS Office at N52-496.

The training will include:

- Identifying fall hazards in the work area;
- Correct procedures for establishing 100% fall protection for elevated work activities.
- Criteria for selecting anchorage points, and erecting, maintaining, disassembling, and inspecting systems and equipment utilized for fall protection;
- As applicable, the use and operation of permanent, temporary, and personal fall arrest systems;
- Any limitations of the systems or equipment being used for fall protection;
- Roles assigned to employees;
- The correct procedures necessary for handling and storage of equipment and materials.

Retraining

Retraining is needed anytime a worker demonstrates that they lack the knowledge necessary to use the fall protection / personal fall arrest equipment in accordance with this SOP, when changes in the workplace render previous training obsolete, or if there have been regulatory changes to fall protection standards.

5. Procedures

Fall Hazard Recognition

A fall hazard exists whenever there is an unguarded walking / working surface more than four (4) feet above the next level.

Fall Hazard Evaluation

When a fall hazard has been identified in an area where walking / work is to be performed, it must be evaluated by a competent person to determine the feasible means of protecting the personnel who will be performing the work. When evaluating a fall hazard, one must consider;

- Proximity to the unguarded edge where work will be performed
- How often personnel will be exposed to the fall hazard
- The number of people exposed to the fall hazard
- Duration personnel will be exposed to the fall hazard
- Fall distance
- Weather and wind conditions

Consideration should always be given to determine the appropriate form of fall protection / personal fall arrest, or whether ladders, mobile elevated work platforms, or scaffolding should be used. The intent of any evaluation is to reduce hazards to levels as low as reasonably achievable (ALARA).

Fall Protection Approach

The MIT Fall Protection / Personal Fall Arrest Program will utilize a three step approach for protecting people from falls (listed in order of preference);

1) Elimination,
2) Prevention, and
3) Control

Elimination of fall hazards is the first and best line of defense against falls from heights and is the Institute's recommended and preferred means of guarding. A careful assessment of the work and the workplace in the early stages of design / engineering, and during all phases of work planning is essential. Questions should be raised about fall protection by a competent and or qualified person regarding the worksite and the work itself. It is imperative that 100% fall protection design be considered for the safety of employees or students that must work at heights, which also includes their safety during access and egress from elevated work sites. Addressing fall protection in the early stages of a project means that safety can be designed into the work process, not added as an afterthought.

Prevention of falls is the second line of defense when fall hazards cannot be eliminated. This step of continuous fall protection also requires an assessment of the workplace and process. It involves making changes to the workplace (i.e. adding guardrails) to preclude the need to rely on the worker's behavior and personal protective equipment to prevent falls.

Controlling a fall is the last line of defense and incorporates the use of fall arrest equipment. This step should only be considered after determining that the fall hazard cannot be eliminated or the possibility of falling prevented. It includes using such equipment as full body harnesses, lanyards, shock absorbers, lifelines, and anchorage connectors. Fall protection necessitates a careful assessment of the workplace to select the most appropriate equipment and to install and use it properly.

Fall Protection Options

The following is an overview of fall protection options that shall be used in conjunction with training and fall protection plans where required. There are three options available for MIT employees and students regarding fall protection. Additional task specific options for fall protection can be found in Appendix F. Proper selection and implementation for any given situation is critical. The three options in order of preferred (1) to less preferred (2) are:

1. Guardrail Systems
2. Fall Restraint Systems
3. Personal Fall Arrest Systems

If the above options for fall protection are determined to be infeasible by the DLC or Supervisor, then the EHS office shall be contacted for technical assistance.

Guardrail Systems may be installed for temporary or permanent control. Guardrail systems must meet regulatory requirements. CFR1910 subpart D and I (which allowed the use of alternate fall protection), OSHA states that the employer shall provide a guardrail system as a primary fall protection system, unless deemed to be unfeasible.

Fall Restraint System uses a line that is attached between the employee and an anchorage point to prevent the employee from walking or falling off an elevated surface. It does not support an employee at an elevated surface, but rather, prevents the employee from leaving the elevated surface or work position. Only a full body harness should be worn, however, the restraint line can be attached to any of the D-rings on the harness.

Fall Restraint Requirements

A fall restraint system is composed of the following – ABC acronym.

a. **A**nchorage
    i. Shall have the capacity of two times the intended load
b. **B**ody Harness (no body belts)
c. **C**onnective means (lanyard or rope)

Personal Fall Arrest Systems (PFAS) Personal fall arrest protective equipment shall be used to minimize fall hazards where engineering controls do not eliminate the hazard, or in conjunction with engineering controls.

Personal Fall Arrest System Requirements

Fall Protection equipment is divided into 4 categories;

- Fall arrest
- Positioning (Appendix F)
- Suspension (Appendix F)
- Retrieval (Appendix F)

Fall Arrest - An individual personal fall arrest system can consist of many different components such as a full body harness, anchor point, lanyard, lifeline, and deceleration/grabbing device. It is important to understand the use and application of each component and how it works with other components (consult owner's manual). All fall protection equipment shall meet or exceed the appropriate Occupational Safety and Health Administration (OSHA) and American National Standards Institute (ANSI) standards. MIT employees shall use only commercially manufactured equipment that is specifically designed for fall protection and certified by ANSI. All fall protection equipment must have the appropriate labels indicating manufacturer and approvals for specific use. Requirements for a personal fall arrest system include but are not limited to the following:

Body Harness - Only full body harnesses designed for fall protection shall be used. The use of a body belt is prohibited at MIT.

Connecting Device – Shock-absorbing lanyards and lifelines.

- Lanyards and lifelines shall have a minimum breaking strength of 5000 pounds.
- Ropes and straps (webbing) used in lanyards, lifelines, and strength components in body harnesses shall be made from synthetic fibers.
- Connecting assemblies shall have a minimum tensile strength of 5000 pounds.
- Self-retracting lifelines shall have a tensile strength of at least 3000 pounds, and limit freefall to 2 feet or less.
- Personal fall arrest systems shall limit the maximum arresting forces to 1800 pounds with a full body harness.
- The maximum free fall distance is six feet for all systems.
- The maximum deceleration distance is 3.5 feet.
- Lifelines shall be protected against cutting and abrasions.
- Horizontal lifelines shall be designed, installed and used under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of two. On suspended scaffolds or similar work platforms with horizontal lifelines which may become vertical lifelines, the devices used to connect to a horizontal lifeline shall be capable of locking in both directions on the lifeline; and
- Each employee shall be attached to a separate lifeline when vertical lifelines are used.

Anchorage - Anchorage point and anchorage connector.

- Anchorages used for personal fall arrest systems shall be independent of any anchorage being used to support or suspend platforms and be capable of supporting at least 5000 pounds per employee attached, or shall be designed, installed (temporarily or permanently), and used as part of a complete fall arrest system.
- A qualified person shall determine all anchor points, both temporary and permanent. Permanent anchor points shall be properly marked.
- Personal fall arrest systems shall not be attached to guardrail systems.
- Prior to use, a competent person must conduct a visual inspection of all tie offs and anchorages, and document these inspections in a fall protection plan (see Appendix A).
- Engineered anchor points must be inspected by a qualified person at 5 year intervals or prior to use after every 5 years.
- Anchorages used for rope descent systems: Before any rope descent system is used, the building owner must identify, test, certify, and maintain each anchorage so it is capable of supporting at least 5,000 pounds in any direction, for each employee attached. The information must be based on an annual inspection by a competent person and certification of each anchorage by a qualified person, as necessary, at least every 10 years.

Clearance Calculation and Minimizing Fall Forces

The objective of a personal fall arrest system is to not only prevent impact with the lower level, but to minimize the fall forces imposed upon the body in the event of a fall. Refer to Appendix A for calculating fall clearances.

Rescue

When employees are using a personal fall arrest system, OSHA requires the employer to provide for the prompt rescue of employees in the event of a fall or must assure that employees are able to rescue themselves. In many fall-related accidents, the fallen employee will sustain more serious injuries the longer he/she remains suspended. Rescue and retrieval planning shall take place before the work activity starts to ensure that the proper equipment and procedures will be in place to rescue employees if needed. Equipment that can be used to rescue a fallen employee includes (but is not limited to);

- Ladders
- Scaffolds
- Mobile Lifts

If the local fire department is going to be used as the primary rescue, then they shall be consulted prior to the start of work.

Overhead Work / Restricted Zones

If work is being done in a location overhead where others may be working or walking below, access to that lower area must be restricted if any items could be dropped or fall from the higher work level. This can be accomplished through the use of barricade / caution tape, signs, and rigid barriers. Signs and barricades must be removed, when the work is completed.

When barricades/barriers are unfeasible, tools and materials being used over an occupied area must be secured (tethered) to the structure or person if they might be dropped to the lower level. Toe boards and/or nets must be provided on working platforms and scaffolds.

Inspection and Maintenance

The following inspection criteria will be utilized to ensure that all equipment is in good working condition. Additional information can be found in Appendix C:

Full Body Harnesses

1) Inspect before each use.
    - Closely examine all of the nylon webbing to ensure there are no burn marks or worn areas which could weaken the material.
    - Verify there are no torn, frayed or broken fibers, pulled stitches, or frayed edges anywhere on the harness.
    - Examine the D-ring for excessive wear, pits, deterioration, deformation, or cracks.
    - Verify that buckles are not deformed or cracked and operate correctly.
    - Check to see that each grommet (if present) is secure and not deformed from abuse or a fall.
    - The harness should never have additional punched holes.
    - All rivets should be tight and not deformed.
    - Check tongue/straps for excessive wear from repeated buckling.

2) A competent person will complete an annual inspection of all harnesses and documentation will be maintained.
3) All harnesses that are involved in a fall will be immediately taken out of service.

Lanyards/Shock Absorbing Lanyards

1) Inspect before each use.
    - Check lanyard material for cuts, burns, abrasions, kinks, knots, broken stitches, and excessive wear.
    - Inspect the snap hooks for distortions in the hook, locks, and eye.
    - Check carabiner for excessive wear, distortion, and lock operation.
    - Ensure that all locking mechanisms seat and lock properly.
    - Once locked, locking mechanism should prevent hook from opening.
    - Visually inspect shock absorber for any signs of damage, paying close attention to where the shock absorber attaches to the lanyard.
    - Verify that points where the lanyard attaches to the snap-hooks are free of defects.
2) A competent person will complete an annual inspection of all lanyards, and documentation will be maintained
3) All lanyards that are involved in a fall will be immediately taken out of service.

Snap-Hooks

1) Inspect before each use.
    - Inspect snap-hook for any hook and eye distortions.
    - Verify there are no cracks or pitted surfaces.
    - The keeper latch should not be bent, distorted, or obstructed.
    - Verify that the keeper latch seats into the nose without binding.
    - Verify that the keeper spring securely closes the keeper latch.
    - Test the locking mechanism to verify that the keeper latch locks properly.
2) A competent person will complete an annual inspection of all snap-hooks and documentation will be maintained.
3) All snap-hooks involved in a fall will be immediately taken out of service.

Self-Retracting Lanyards (SRL)/Lifelines

1) Inspect before each use.
    - Visually inspect the lanyard / lifeline to ensure there is no physical damage to the body.
    - Make sure all nuts and rivets are tight.
    - Make sure the entire length of the nylon strap/wire rope is free from any cuts, burns, abrasions, kinks, knots, broken stitches/strands, excessive wear and that it retracts freely.
    - Test the unit by pulling sharply on the lanyard/lifeline to verify that the locking mechanism is operating correctly.
    - If the manufacturer requires, make certain the retractable lanyard is returned to the manufacturer for scheduled annual inspections.
    - Check manufacturer's manual to determine if the indicators of a fall have been activated on the device.

2) A competent person will conduct and document an annual inspection of all self-retracting lanyards/lifelines.
3) Service per manufacturer's specifications.
4) All Self-Retracting Lanyards involved in a fall will be immediately taken out of service, and reported to EHS.

Tie-Off Adapters/Anchorages

1) Inspect for integrity and attachment to solid surface.
2) A competent person will complete an annual inspection of all tie-offs and anchorages and documentation will be maintained.
3) All tie-offs and anchorages must be taken out of service and re-inspected by a qualified person after being exposed to a fall.

Horizontal Lifelines

1) Inspect before each use for structural integrity of line and anchors.
2) A competent person will complete an annual inspection.

Storage

Follow the manufacturer's instruction for storage. This includes but is not limited to;

- Never store the personal fall arrest equipment in the bottom of a toolbox, on the ground, or outdoors exposed to the elements (i.e., sun, rain, snow, etc.).
- Hang equipment in a cool, dry location in a manner that retains its shape.
- Always follow manufacturer's recommendations for storage, maintenance, and inspections.
- Clean with a mild, nonabrasive soap and hang to dry.
- Never force dry or use strong detergents in cleaning.
- Never store equipment near excessive heat, chemicals, moisture, or sunlight.
- Never store in an area with exposures to fumes or corrosive elements.
- Avoid dirt or other types of build-up on equipment.
- Never use this equipment for any purpose other than personal fall arrest.

6. Roles & Responsibilities

The Fall Protection / Personal Fall Arrest program will not be effective unless all MIT employees understand and take an active role in meeting the responsibilities required of them.

Competent Person

Is 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 the authorization to take prompt corrective measures to eliminate existing hazards. A competent person for fall protection / personal fall arrest at MIT, is anybody assigning or supervising work at elevated heights (above 4 feet). The following are the responsibilities of the competent person under the provisions of the MIT Fall Protection / Personal Fall Arrest Program.

- Have a complete understanding of the applicable safety standards and / or any other data provided.
- Be capable of identifying existing and predictable hazards in the surroundings or working conditions and have the authorization to take prompt corrective measures to eliminate them.
- Initiate and maintain a progressive disciplinary program that includes consequences up to termination of employment for those who choose not to utilize fall protection, when required and trained to do so.
- Conduct annual inspections of equipment.
- Stop projects when unsafe conditions or situations are discovered.

Departments Labs and Centers

The following are the responsibilities of the DLC under the provisions of the MIT Fall Protection / Personal Fall Arrest Program.

- Maintain manufacturer's instructions and manuals that are included with fall protection systems. Have a copies readily available to those employees who may need to reference these materials.
- Maintain an inventory of fall protection equipment utilized within their department and ensure that their employees' fall protection Personal Protective Equipment (PPE) is inspected and documented at least annually. Documentation of inspections shall be maintained for a minimum of 3 years.
- Ensure new, existing, and affected employees receive fall protection training as outlined in the training section of this SOP.
- Identify all tasks performed by their employees that are in need of systems and equipment for protecting against falls of four (4) feet or more.
- Provide necessary funding for purchase and installation of systems and equipment utilized for fall protection.
- Provide equipment necessary to meet OSHA standards, and job requirements.
- Shall not design, alter, construct, or create areas for MIT personnel to occupy that exposes them to fall hazards.
- Notify the EHS Office for technical support and the need for training.
- Evaluate the effectiveness of this program, as it applies to their employees, to provide EHS with conclusions, challenges, and recommendations.
- Implement corrective actions recommended by the EHS Office after an incident investigation involving a fall or near fall.
- Support disciplinary actions in the event that proper procedures were not followed.
- Certification of engineered anchor points at 5 year intervals, or prior to use if greater than 5 years. Certification is to be conducted by a qualified person.

Supervisors

The following are the responsibilities of the supervisor under the provisions of the MIT Fall Protection / Personal Fall Arrest Program.

- Ensure that fall protection is installed, donned, and used in accordance with manufacturer's recommendations (refer to owner's manual).

- Ensure personal fall arrest systems are maintained according to the manufacturer's recommendations.
- Does not knowingly assign work that exposes individuals to a fall of four (4) or more feet unless fall protection is available and will be utilized.
- Ensure that a rescue plan has been developed in accordance with this SOP.
- Is trained as a competent person.
- Ensure that employees shall not be involved in outdoor work that involves the use of fall protection during periods of high winds (wind advisory), lightning storms, snow storms, or other potentially hazardous weather conditions. Hazards are assessed by the supervisor / competent person.
- When required, will complete a Fall Protection Planning Worksheet (Appendix A) and maintain it for 3 years.
- Review documents submitted by competent persons to ensure they are completed properly and that all safety needs are addressed.
- Review and approve all alternate fall protection plans.

MIT Employees

The following are the responsibilities of the MIT employees under the provisions of the MIT Fall Protection / Personal Fall Arrest Program.

- Attentively attend training, understand, and follow the Fall Protection / Personal Fall Arrest Program.
- Notify supervisor when questions arise surrounding safe procedures: i.e. the need for fall protection equipment, PPE, and difficulties complying with requirements. (Please call the EHS Office if there is uncertainty regarding fall protection between the employee and supervisor.)
- Do not remove or damage systems or equipment utilized for fall protection.
- Do not use damaged systems or equipment utilized for fall protection and report any damaged systems or equipment to your supervisor.
- Do not perform work when exposed to a potential fall of four (4) feet or more, unless using an appropriate fall protection system.
- Do not use, set-up, or install equipment or systems utilized for fall protection until you have received the proper training as outlined in this SOP.
- Report all incidents and near misses.

MIT Department of Facilities (DOF)

The following are the responsibilities of the MIT DOF under the provisions of the MIT Fall Protection / Personal Fall Arrest Program.

- Maintain an inventory of fall protection equipment utilized within the department and ensure that their employees' fall protection Personal Protective Equipment (PPE) is inspected and documented at least annually. Documentation of inspections shall be maintained for a minimum of 3 years.
- Ensure new, existing, and affected employees receive fall protection training as outlined in the training section of this SOP.
- Ensure that newly installed fall protection systems are engineered, installed and tested in accordance with ANSI Z359.18 standards.

- Develop roof access plans in accordance with this SOP and regulatory guidelines. Refer to 29CFR1910.28(b) and Appendix E for establishing Controlled Access Zones.
- Maintain a list of engineered anchor points used for rope descent systems. These anchor points must be identified, tested, certified, and maintained to be capable of supporting at least 5,000 pounds (268 kg), in any direction. The information must be based on an annual inspection by a qualified person and certification of each anchorage by a qualified person, as necessary, and at least every 10 years.

MIT EHS Office

The following are the responsibilities of the MIT EHS Office under the provisions of the MIT Fall Protection / Personal Fall Arrest Program.

- Develop and maintain a written Fall Protection / Personal Fall Arrest Program.
- Train all affected employees in the associated hazards and general safe work practices.
- Assist DLC's with the development of fall protection plans
- Provide technical assistance to institute personnel.
- Evaluate the overall effectiveness of the program on a periodic basis.
- Investigate incidents involving falls or near falls and give recommended corrective actions to prevent future falls or near falls from occurring.
- Promote the elimination of fall hazards at MIT, and when there is a fall hazard, promote the use of elimination / prevention as discussed in the fall protection approach section.
- Monitor the submission of required records and reports.
- Keep records for manufacturer required documented inspections of personal fall protection equipment.
- Review design documents for construction activities and assist with identifying engineering controls for locations posing fall hazards

Contractors

Contractors must comply with all local, state, and federal safety requirements, and assure that all of their employees performing work on MIT properties have been trained in fall protection. Contractors must also comply with the requirements outlined in the MIT's Contractor Safety Program. Contractors shall use their own personal fall arrest equipment. MIT will only provide fall arrest equipment to trained members in the MIT community. Contractors are responsible for assessing anchor points utilized for working on campus structures.

Variances from this Procedure

Any variances from this Fall Protection / Personal Fall Arrest Program must be submitted in writing to the MIT EHS Office and must be approved by the MIT EHS Office and the supervisor of the particular job, prior to the start of work.

7. Monitoring Requirements

Departments Labs and Centers

Collect and maintain the following documents:

- A list of individuals who have been trained.
- Maintain Supervisor inspection checklists for three years and provide them to the MIT EHS Office upon request.
- A list of fall protection equipment and PPE used within the department. Non DOF DLC's may notify central EHS annually to assist with inspecting fall protection equipment / PPE.

Supervisors

- Monitor work sites for compliance with all fall protection procedures and regulations.
- Inspect employees' fall protection gear annually, document the inspection, and save all paper work for three years.

Competent Person

- Monitor worksites for compliance with all fall protection procedures and regulations.
- Stop projects when unsafe conditions or situations are discovered.
- Complete annual inspections of fall protection gear.

MIT EHS Office

- Provide additional training, as may be necessary, to ensure compliance with the Fall Protection Program.
- Perform random assessments of field activities related to fall protection, and provide feedback to the respective departments.
- Assist DLC's with annual inspection requirements for fall protection equipment and related PPE

Review of Program

The Fall Protection / Personal Fall Arrest Program will be reviewed at least once a year by the MIT EHS Office OCSP Program. This review will encompass changes in regulations, safety hazards as related to fall protection, changing demands of the program for the campus, and changes in technology.

8. Record Management

The DLC EHS Coordinator or supervisor shall ensure that training records are kept current in the EHS-MS training database as outlined in the training section.

Additionally, maintenance, inspections, and all documents received shall be maintained and recorded by the EHS Coordinator or supervisor.

9. References

9.1. Standards

- 29 CFR 1910 Subpart D – Walking and Working Surfaces

- 29 CFR 1910 Subpart F – Powered Platforms, Man lifts, and Vehicle Mounted Work Platforms
- 29 CFR 1926 Subpart L – Scaffolds
- 29 CFR 1926 Subpart M – Fall Protection
- 29 CFR 1926 Subpart X – Stairs and Ladders
- ANSI Z359 – Fall Protection Code
- ANSI A10.32 – Fall Protection for Construction and Demolitions
- ANSI / ASSE A1264.1 – Safety Requirements for Workplace Walking/Working Surfaces and Their Access; Workplace Floor, Wall and Roof Openings; Stairs and Guardrails Systems

9.2. Other SOP/ SOGs

To view the SOPs/SOGs go to https://ehs.mit.edu/sops/ and search for the SOP/SOG listed. MIT Certificates are required to view SOPs/SOGs.

- EHS-0146: Mobil Elevated Work Platforms (MEWP)
- EHS-0091: Walking / Working Surfaces
- EHS-0033: Portable Ladder Safety

9.3. Supplementary Documents

- Appendix A: Fall Protection Planning Work Plan (includes clearance calculation for minimizing fall forces)
- Appendix B: Donning a Full Body Harness
- Appendix C: Personal Fall Arrest Equipment Inspection Instructions
- Appendix D: Example Supervisor Equipment Inspection Sheet
- Appendix E: Fall Protection Options for Specialty Tasks
- Appendix F: Alternative Personal Fall Arrest System Requirements
- Appendix G: Self-retracting Lifeline / Lanyard Manufacturers Inspections

10. Definitions

Anchorage means a secure point of attachment for lifelines, lanyards, or deceleration devices.

ANSI (American National Standards Institute): A private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States. The organization also coordinates U.S. standards with international standards so that American products can be used worldwide.

Body belt (safety belt) means a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device.

Body harness means straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and

shoulders with means for attaching it to other components of a personal fall arrest system.

Buckle means any device for holding the body belt or body harness closed around the employee's body.

Connector means a device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together. It may be an independent component of the system, such as a carabiner, or it may be an integral component of part of the system (such as a buckle or d-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

Controlled access zone (CAZ) means an area in which certain work (e.g., overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems and access to the zone is controlled.

Dangerous equipment means equipment (such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to employees who fall onto or into such equipment.

Deceleration device means any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards, etc., which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.

Deceleration distance means the additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.

Engineered anchor point is an anchor point that has been designed and installed to provide personal fall protection.

Equivalent means alternative designs, materials, or methods to protect against a hazard which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

Failure means load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

Free fall means the act of falling before a personal fall arrest system begins to apply force to arrest the fall.

Free fall distance means the vertical displacement of the fall arrest attachment point on the employee's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

Guardrail system means a barrier erected to prevent employees from falling to lower levels.

Hole means a gap or void 2 inches (5.1 cm) or more in its least dimension, in a floor, roof, or other walking/working surface.

Infeasible means that it is impossible to perform the construction work using a conventional fall protection system (i.e., guardrail system, safety net system, or personal fall arrest system) or that it is technologically impossible to use any one of these systems to provide fall protection.

Lanyard means a flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading edge means the edge of a floor, roof, or formwork for a floor or other walking/working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed, or constructed. A leading edge is considered to be an "unprotected side and edge" during periods when it is not actively and continuously under construction.

Lifeline means a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Low-slope roof means a roof having a slope less than or equal to 4in 12in (vertical to horizontal).

Lower levels are those areas or surfaces to which an employee can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, pits, tanks, materials, water, equipment, structures, or portions thereof.

Mechanical equipment means all motor or human propelled wheeled equipment used for roofing work, except wheelbarrows and mop carts.

Non-Certified Anchor point is an anchorage that is selected by a competent person after a visual inspection of the location. In order for a competent person to designate a point as a non-certified anchorage point, they must visually inspect the location and

decide whether or not that area is capable of supporting 5,000 pounds (roughly the weight of a full size pickup truck)

Opening means a gap or void 30 inches (76 cm) or more high and 18 inches (48 cm) or more wide in a wall or partition through which employees can fall to a lower level.

Overhand bricklaying and related work means the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. Related work includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

Personal fall arrest system means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these. As of January 1, 1998, the use of a body belt for fall arrest is prohibited.

Positioning device system means a body belt or body harness system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

Rope grab means a deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/level locking, or both.

Roof means the exterior surface on the top of a building. This does not include floors or formwork which, because a building has not been completed, temporarily becomes the top surface of a building.

Roofing work means the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck.

Safety-monitoring system means a safety system in which a competent person is responsible for recognizing and warning employees of fall hazards.

Self-retracting lifeline/lanyard means a deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

Snap-hook means a connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snap-hooks are generally one of two types: **1926.500(b)(1)** The locking type with a self-closing, self-locking keeper which remains closed and locked until unlocked and

pressed open for connection or disconnection; or

Steep roof means a roof having a slope greater than 4in 12in (vertical to horizontal).

Toe board means a low protective barrier that will prevent the fall of materials and equipment to lower levels and provide protection from falls for personnel.

Unprotected sides and edges refers to any side or edge (except at entrances to points of access) of a walking/working surface, e.g., floor, roof, ramp, or runway where there is no wall or guardrail system at least 39 inches (1.0 m) high.

Walking/working surface means any surface, whether horizontal or vertical on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

Warning line system means a barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of a guardrail, body belt, or safety net system to protect employees in the area.

Work area refers to that portion of a walking/working surface where job duties are being performed.

Appendix A: Example Fall Protection Work Plan

Department / Lab or Center	Site Location
Job Task	
Job Location/Description	

Plan prepared by	Date

- **Workers must review and sign this fall protection work plan prior to starting work. Workers must understand this plan and be trained in fall protection and the systems and equipment that will be used.**
- **This Fall Protection Work Plan must be submitted and approved by EHS.**

1. Identify potential fall hazards (check all that apply)			
☐	Mobile elevating work platforms	☐	Stairways
☐	Excavations/trenches	☐	Roof steep slope (greater than 4:12)
☐	Floor openings	☐	Roof low slope (4:12 or less)
☐	Wall openings	☐	Swing fall
☐	Skylight openings	☐	Hazardous process/equipment
☐	Roof openings	☐	Debris/objects falling to lower level
☐	Elevator shaft	☐	Sharp edges
☐	Ladders (fixed or portable)	☐	Reinforcing steel installation
☐	Scaffold	☐	Other:
2. Describe the fall hazard(s) details			
3. Identify fall protection systems to be used			
☐	Guardrail system	☐	Aerial lift
☐	Covers (holes and openings)	☐	Horizontal lifeline
☐	Appropriate anchors for systems used	☐	Vertical lifeline and rope grab
☐	Personal fall arrest system	☐	Warning line
☐	Personal fall restraint system	☐	Safety monitor
☐	Positioning device system	☐	Safety watch
☐	Scaffold with guardrail	☐	Other:
☐	Scissor lift	☐	Other:
4. Describe procedures for assembly, maintenance, inspection, disassembly of fall protection system to be used.			

5. Describe procedures for handling, storage, securing tools and materials

6. Identify methods of overhead protection for workers who may be in, or pass through the area below worksite

☐	Barricading	☐	Toeboards/screens on scaffolds
☐	Hard hats required	☐	Toeboards/covers on floor openings
☐	Catch net	☐	Screens on guardrails
☐	Warning signs	☐	Secure large tools
☐	Tool belts	☐	Other:
☐	Tool lanyards	☐	Other:

7. Identify method for prompt, safe removal of injured workers / CALL 617-253-1500 IF FALL OCCURS

☐	Written agreement with:	☐	Self-rescue
☐	Site first aid	☐	Other employees
☐	Elevator/stairs	☐	Other:

8. Identify method used to determine adequacy of anchorage points

☐	Evaluation by professional engineer	☐	Existing engineering/design documents
☐	Manufacturer's data	☐	Other:

9. Describe and identify anchor points to be utilized as part of this fall protection plan. Attach photos as needed

10. Select system components

☐	Full body harness	☐	Choker
☐	Vertical lifeline	☐	Carabiner
☐	Horizontal lifeline	☐	Rope grab
☐	Lanyard	☐	Personal shock absorber
☐	Boatswains chair	☐	Beam clamp
☐	Connecting devices (identify)	☐	Anchorage points (identify)

☐	Other:	☐	Other:

11. Distance from anchor to ground, lower level or obstruction (see page 4 chart)

12. Calculated minimum fall clearance (see page 4 chart)

13. Personal Protective Equipment Inspection Checklist

☐	Identification tags
☐	Horizontal lifeline tension is correct
☐	Integrity of stitching in shock absorber
☐	Integrity of stitching in harness/lanyard
☐	Manufacturers assembly/disassembly instructions
☐	Locking capability of retractable lanyards assured
☐	Locking capability of carabiners assured
☐	Locking capability of snap hooks assured
☐	Knots and other connection methods do not weaken lifeline
☐	Lifelines installed and protected from cuts or abrasions
☐	Rope (wear, fraying, damage, mildew)
☐	Lanyards (wear, fraying, damage, mildew)
☐	D-rings have adequate strength, are not cracked or deformed
☐	Guardrails are sound and of adequate strength
☐	Devices that are used to connect to horizontal lifelines lock in both directions
☐	Anchorage points provide adequate strength and are capable of meeting requirements
☐	Hole covers are secured, marked and capable of withstanding anticipated weight loads
☐	Warning line meets strength and other requirements
☐	Safety Monitor is Authorized Person, can see workers, is close enough to communicate, has no other duties
☐	Safety Watch is Authorized Person, can see worker, is close enough to communicate, has no other duties
☐	Other
☐	Other

14. Employee(s) trained to work under this plan

Name (print)	Signature	Date

Name/title of Competent Person who provided training under this plan

15. Work plan approval(s)

Name of lead worker or supervisor	Signature	Date
Name of Competent Person (If engineered system: Name of Qualified Person)		

Fall clearance is the minimum vertical distance needed between the anchor point and a lower level (this can be the ground or lower obstruction) with a safety factor to prevent the worker from hitting the lower level in a fall.

What is the distance from the anchor point to the ground or lower level where a worker would fall?

If a worker falls, when wearing a fall protection system, what is the minimum fall clearance from the anchor point to the worker's feet including a 3 ft. safety factor? (Calculate as shown below)

The calculated minimum fall clearance of a specific fall protection system may **never** be equal or greater than the distance between the anchor point and the lower level.

Description	Distance (ft.)
Lanyard length or free fall distance for self-retracting lifeline	
Maximum allowable deceleration distance	**3 ½ ft.**
Worker's height	
Other component if applies	
Safety factor	**3**
Minimum fall clearance (sum of above)	

Appendix B: Donning a Full Body Harness

Miller Fall Guide
Images above from: https://www.windpowerengineering.com/safety-properly-adjusting-your-harness-can-make-all-the-difference/

Step 3 Note: Be sure not to allow straps to twist or roll in any area of the harness; untwist the shoulder straps before continuing.

Step 4 Note: Be sure that the straps fit correctly. The leg straps have a horizontal strap attaching them together that create a seat for the user. Be aware of this feature and make sure that it properly fitting the user. Do not allow straps to twist.

Appendix C: Personal Fall Arrest Equipment Inspection Instructions

The following procedural information is from: https://www.ishn.com/articles/99736-how-to-inspect-and-maintain-personal-fall-arrest-systems

Harness Inspection

To inspect your harness, perform the following procedures.

1) Webbing
Grasp the webbing with your hands 6 inches (152mm) to 8 inches (203mm) apart. Bend the webbing in an inverted "U" as shown. The surface tension resulting makes damaged fibers or cuts easier to detect. Follow this procedure the entire length of the webbing, inspecting both sides of each strap. Look for frayed edges, broken fibers, pulled stitches, cuts, burns and chemical damage.

2) D-Rings/Back Pads
Check D-rings for distortion, cracks, breaks, and rough or sharp edges. The D-ring should pivot freely. D-ring back pads should also be inspected for damage.

3) Attachment of Buckles
Inspect for any unusual wear, frayed or cut fibers, or broken stitching of the buckle or D-ring attachments.

4) Tongue/Grommets
The tongue receives heavy wear from repeated buckling and unbuckling. Inspect for loose, distorted or broken grommets. Webbing should not have additional punched holes.

5) Tongue Buckles
Buckle tongues should be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. Roller should turn freely on frame. Check for distortion or sharp edges.

6) Friction and Mating Buckles
Inspect the buckle for distortion. The outer bars and center bars must be straight. Pay special attention to corners and attachment points at the center bar.

7) Quick-Connect Buckles
Inspect the buckle for distortion. The outer bars and center bars must be straight. Make sure dual-tab release mechanism is free of debris and engages properly.

Lanyard Inspection

When inspecting lanyards, begin at one end and work to the opposite end, slowly rotating the lanyard so that the entire circumference is checked. Additionally, follow the procedures below.

1) Hardware
A) **Snaps**: Inspect closely for hook and eye distortions, cracks, corrosion, or pitted surfaces. The keeper (latch) should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to firmly close the keeper. Keeper locks must prevent the keeper from opening when the keeper closes.

B) Thimbles: The thimble must be firmly seated in the eye of the splice, and the splice should have no loose or cut strands. The edges of the thimble must be free of sharp edges, distortion, or cracks.

2) Wire Rope Lanyard
While rotating the wire rope lanyard, watch for cuts, frayed areas, or unusual wearing patterns on the wire. Broken strands will separate from the body of the lanyard.

3) Web Lanyard
While bending webbing over a pipe or mandrel, observe each side of the webbed lanyard. This will reveal any cuts or breaks. Swelling, discoloration, cracks and charring are obvious signs of chemical or heat damage. Observe closely for any breaks in stitching.

4) Rope Lanyard
Rotate the rope lanyard while inspecting from end-to-end for any fuzzy, worn, broken or cut fibers. Weakened areas from extreme loads will appear as a noticeable change in original diameter. The rope diameter should be uniform throughout, following a short break-in period.

5) Shock Absorber Pack
The outer portion of the pack should be examined for burn holes and tears. Stitching on areas where the pack is sewn to D-rings, belts or lanyards should be examined for loose strands, rips and deterioration.

6) Shock-Absorbing Lanyard
Shock-absorbing lanyards should be examined as a web lanyard (described in item 3 above). However, also look for the warning flag or signs of deployment. If the flag has been activated, remove this shock-absorbing lanyard from service.

Self-Retracting Lifeline Inspection

1) Check Housing
Before every use, inspect the unit's housing for loose fasteners and bent, cracked, distorted, worn, malfunctioning or damaged parts.

2) Lifeline
Test the lifeline retraction and tension by pulling out several feet of the lifeline and allow it to retract back into the unit. Always maintain a light tension on the lifeline as it retracts.

The lifeline should pull out freely and retract all the way back into the unit. Do not use the unit if the lifeline does not retract. The lifeline must be checked regularly for signs of damage. Inspect for cuts, burns, corrosion, kinks, frays or worn areas. Inspect any sewing (web lifelines) for loose, broken or damaged stitching.

3) Braking Mechanism
The braking mechanism must be tested by grasping the lifeline above the impact indicator and applying a sharp steady pull downward which will engage the brakes. There should be no slippage of the lifeline while the brakes are engaged, once tension is released, the brakes will disengage and the unit will return to the retractable mode. Do not use the unit if the brakes do not engage.

Check the hardware as directed in 1A under Lanyard Inspection. The snap hook load indicator is located in the swivel of the snap hook. The swivel eye will elongate and expose a red area when subjected to fall arresting forces. Do not use the unit if the load impact indicator has been activated.

Appendix D: Example Supervisor Equipment Inspection Sheet

Fall Protection Equipment Inspection List

Note: Guidance on Equipment Inspections of Fall Arrest Equipment can be found in Appendix C of this SOP. Supervisors may use alternative recordkeeping format (e.g., Excel spreadsheet) to document this inspection process but must contain the information provided here.

Description		Manufacturer
Model #	Serial #	Date of Inspection
FAIL ☐ Remove from Service		**PASS** ☐ Return to Service
Competent Person (Print)		
Competent Person (Signature)		

Description		Manufacturer
Model #	Serial #	Date of Inspection
FAIL ☐ Remove from Service		**PASS** ☐ Return to Service
Competent Person (Print)		
Competent Person (Signature)		

Description		Manufacturer
Model #	Serial #	Date of Inspection
FAIL ☐ Remove from Service		**PASS** ☐ Return to Service
Competent Person (Print)		
Competent Person (Signature)		

Appendix E: Fall Protection Options for Specialty Tasks

Safety nets are required whenever workplaces are 25 feet or more above the ground or water surface and where the use of ladders, scaffolds, catch platforms, temporary floors, safety lines, or personal fall arrest systems are impractical.

Controlled Access Zones (CAZ) are used for certain work activities including:

- Rooftop access where leading-edge hazards exist
- Erecting precast concrete members
- Overhand bricklaying.

For these activities, access to the hazardous area is controlled and control lines are placed dependent upon the type of work being performed. Additional information regarding CAZ setup for rooftop applications is outlined here.

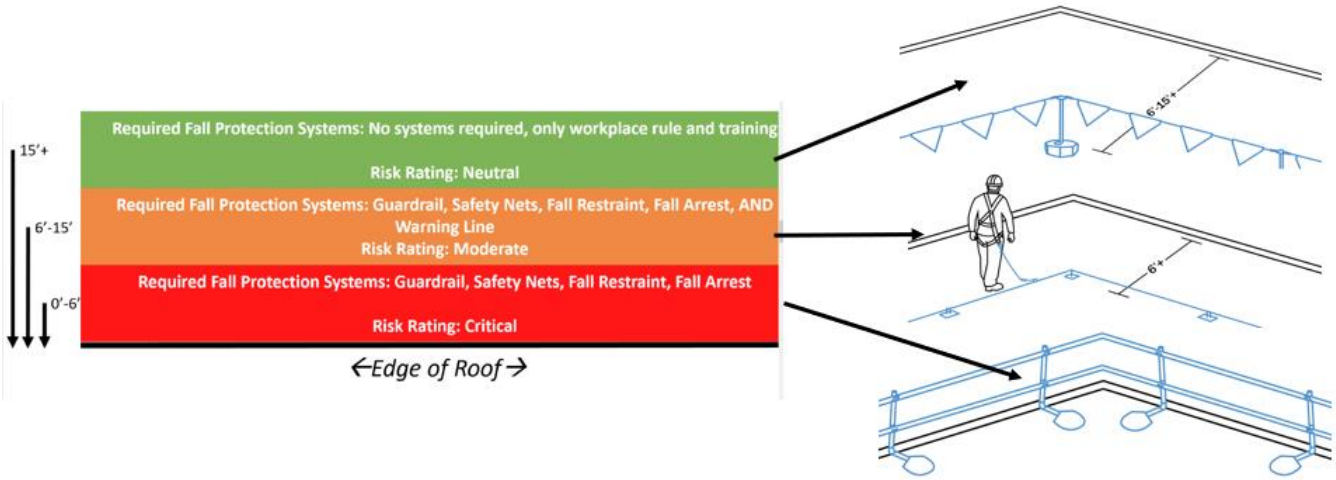
- When work area is less than 6 feet from the roof edge: Ensure that each employee is protected from falling by using fall protection systems such as guardrails, safety net system, fall restraint or fall arrest systems. See Diagram 1 below and *Critical* risk rating.

- Between 6 feet and 15 feet from the roof edge: Ensure that each employee is protected from falling by using fall protection systems such as guardrails, safety net system, fall restraint or fall arrest systems. A secured designated area instead of rooftop fall protection systems is acceptable when the work is infrequent and temporary. A warning line is required at 6 feet to serve as a warning that a worker is nearing an unprotected edge. See Diagram 1 below and *Moderate* risk rating.

- More than 15 feet from the roof edge: Ensure that each employee is protected from falling by using fall protection systems such as guardrails, safety net, fall restraint, covers or fall arrest systems. Employers are not required to provide fall protection when the work is infrequent and temporary. See the Diagram 1 below and *Neutral* risk rating.

- Under no circumstances shall persons go within 15 feet of the roof edge without a fall protection in place.

Diagram 1: Adapted from Kee Safety Inc. webinars **(**www.keesafety.com**)**



Warning lines are typically used for roofers doing roof work to warn personnel that they are approaching an unprotected roof side or edge. It designates an area in which the roofing work may take place without the use of other safeguarding means. The rope, wire, or chain used to establish the safe area must have a tensile strength of at least 500 pounds and shall not be less than 34 inches high (at the lowest point), nor more than 39 inches high from the walking/working surface. The warning line shall be flagged every six (6) feet in length with high visibility material. Stanchions or supports must be capable of resisting, without tip-over, a force of at least 16 pounds.

Safety monitors are used as a last resort, when other means of protection are not feasible. A competent person shall serve as the monitor and is responsible for recognizing and warning personnel of unsafe conditions or actions which may result in a fall. The monitor must be on the same walking/working surface as the workers and within visual sighting of the persons being monitored. The monitor must be close enough to communicate orally with the workers, and shall have no other responsibilities, which could distract him/her from the assigned monitoring function.

Appendix F: Alternative Personal Fall Arrest System Requirements

Appendix F includes information regarding Positioning Systems, Suspension Systems, and Retrieval Systems.

Positioning - A positioning device is not a substitute for a personal fall arrest system, and is limited to use as a system rigged to allow an employee to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

Where any positioning device is used, it shall comply with the following:

- Only a full-body harness shall be worn as part of a positioning device system. Body belts are not permitted.
- Positioning devices shall be rigged such that a free fall cannot be more than 2 feet; and
- Positioning devices shall be secured to an anchorage point capable of supporting at least twice the potential impact load of an employee's fall or 3,000lbs, whichever is greater.

Suspension - Personal suspension systems are used for window washing and painting and are designed to lower and support a worker to perform tasks. The components of a suspension system are:

- Full-Body Harness.
- Lifeline.
- Work line.
- Anchorage; and
- Positioning device (i.e. boatswains' chair).

A boatswain's chair system is considered a single-point adjustable suspended scaffold. Since the suspension system components are not designed to arrest a free fall, a back-up fall arrest system shall be used in conjunction with the personal suspension system that would activate only if the worker were to experience a free fall.

Retrieval - Personal retrieval systems are used for confined space entry and on-entry rescue. Refer to the MIT Permit Required Confined Space Program for information on confined spaces entry. Personal retrieval systems consist of the following:

- Full body harness;
- Retractable lifeline/rescue unit; and Tripod.

Appendix G: Self-Retracting Lifeline / Lanyard Manufacturer Inspections

Per ANSI Z359.14

Type of Use	Application Examples	Condition of Use	Inspection Frequency by Competent Person	Factory Authorized Inspection
Infrequent to Light	Rescue and confined space, factory maintenance	Good storage conditions, indoor or infrequent outdoor use, room temperature, Clean environments	Annually	At least every 2-5 years, but not longer than intervals required by the manufacturer
Moderate to Heavy Use	Transportation, residential, construction, utilities, warehouse	Fair storage conditions, indoor and extended outdoor use, all temperatures, clean or dusty environments	Semi-annually to annually	At least every 1-2 years, but not longer than intervals required by the manufacturer
Severe to Continuous	Commercial construction, oil and gas, mining	Harsh storage conditions, prolonged or continuous outdoor use, all temperatures, dirty environments	Quarterly to semi-annually	At least annually, but not longer than intervals required by the manufacturer