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SECTION 11 81 29 - Facility Fall Protection

TIPS:

To view/hide non-printing Editor's Notes that provide guidance for editing:
Word 365 and recent versions: Select Home/Font and check/uncheck Hidden in the Effects group.
Word legacy versions: Select Tools/Options and check/uncheck Hidden Text in the Formatting Marks group.

**WHAT MANNER OF FALL PROTECTION SHOULD BE PROVIDED**? Step one is to determine, for the structure or area in question, whether fall protection will be provided via a "Travel Restraint System" or a "Fall Arrest System." The main difference between "travel restraint" and "fall arrest" is that travel restraint stops people from accessing or approaching a fall hazard through a tie off system, while fall arrest allows a fall to occur but arrests and minimizes injury in the event of a fall. Additionally, exterior Building Maintenance (EBM) anchorage systems are required when façade access such as window washing, caulking, or other maintenance activities are to be accomplished using suspended access via powered platform and/or RDS (Rope Descent System)

**WHO IS RESPONSIBLE FOR FALL PROTECTION**: Building owners, employers, workers, architects and engineers all have their respective duties and responsibilities.

✍ **Building Owners** are responsible for fall protection if they hire someone to work at height. This happens more often than you’d think. The frequency of cleaning, maintenance and repair work at height is often underestimated. As the owner of a building, you are responsible for the work that is done on your building. Therefore, building owners are advised to ensure that the appropriate safety measures are taken, and that workers observe the applicable regulations for the use of fall protection equipment.

 Per 29 CFR § 1910.27(b)(1)(i) - Before any rope descent system is used, the building owner must inform the employer, in writing that the building owner has identified, tested, certified, and maintained each anchorage so it is capable of supporting at least 5,000 pounds (2,268 kg), in any direction, for each employee attached. 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.

 Per 29 CFR § 1910.27(b)(1)(i) - The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE).

✍ **Employers** are responsible for the safety of their employees. They are also expected to make sure that all employees possess the skills and knowledge needed to use the equipment the correct way. This also applies to interns, temporary workers or third-party workers under the supervision of an employer. See 29 CFR § 1926.501 - Duty to have fall protection
 ✍ Qualified Person is responsible for supervising the design, selection, installation, use and inspection of certified anchorages and horizontal lifelines.
 ✍ Competent Person is responsible for the immediate supervision, implementation and monitoring of the fall protection program.

Authorized person means a person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the jobsite

✍ **Employees** - It is mandatory for employees to make use of fall protection equipment. They are also expected to assess their own safety in a particular situation. Among other things, this means they have to inspect the equipment before using it. If something is not in good condition, they must cease to use the equipment. When in doubt, they are required to report the situation to their supervisor, to rule out the possibility of work at height being executed in an unsafe manner.

✍ **Architects** should develop, in coordination with the Owner and structural and specialty fall protection engineers, a preliminary design layout that is in compliance with applicable Building Codes, OSHA Regulations, and industry standards for suspended facade access and fall protections systems that will best suit the building facade access and/or fall protection requirements and that are safe, functional and compliant. One of the most important aspects of personal fall protection systems is fully planning the system "before" it is put into use. Probably the most overlooked component is planning for suitable anchorage points. Such planning should ideally be done before the structure or building is constructed so that anchorage points can be incorporated during construction for use later for window cleaning or other building maintenance. If properly planned, these anchorage points may be used "during" construction, as well as afterwards.

✍ **Structural** **Engineer of Record**: Building structural engineer should design roof and wall structures to accommodate added loads imposed by facility fall protection equipment that is integrated into the building structure. Specialty fall protection engineers are best equipped to perform final design of facility fall protection equipment in a design/build capacity. Depending on the scope of the project and the qualifications of the engineer, this party may act as the Fall Protection Engineer (see below).

✍ **Fall Protection Engineer**: Qualified by OSHA and ANSI z359.6 to supervise the design, selection, installation, use and inspection of fall protection systems.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section includes the following fall protection equipment:

Edit the following to reflect items required for Project.

**[Roof]** **[Wall]** **[Roof- and wall]**-mounted safety and tie-back anchorage.

**[Horizontal]** **[Vertical]**[Horizontal and vertical] cable lifeline systems.

**[Horizontal]** **[Overhead]** **[Horizontal and overhead]** rail systems.

Sloped roof rail systems.

Overhead rail systems.

Ladder safety systems.

Davit systems including roof-mounted **[sockets and bases]** **[sockets]** **[bases]** to secure davit arms.

Outrigger beams.

Rigging sleeves.

Warning line systems.

Permanent guardrails may be specified in this Section or in Division 05 Section "METAL RAILINGS."

**[Movable]** **[Permanent]** guardrails.

Roof hatch guardrails.

Safety signage.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Coordinate related work required to make a complete installation. Delete sections that do not apply to Project; add other sections as required. Be sure that structural design includes live and dead loads and safety factors for this equipment. Also consider suspension point locations, architectural obstructions, maintenance access to roof areas, hot and cold water supply for window washing, power supply, and method of hoisting and installation of equipment.

If including Section Numbers with or instead of Titles, below is MasterFormat Section Number 03 30 00.

Div. 03 Section "CAST-IN-PLACE CONCRETE" for embedment of anchorage devices in concrete structure.

If including Section Numbers with or instead of Titles, below are MasterFormat Section Numbers 03 41 00 and 03 45 00.

Div. 03 Section "PRECAST CONCRETE" for embedment of anchorage devices in pre-cast concrete members.

If including Section Numbers with or instead of Titles, below is MasterFormat Section Number 05 12 00.

Div. 05 Section "STRUCTURAL STEEL FRAMING" for steel structural members to which anchorage devices are to be attached.

If including Section Numbers with or instead of Titles, below is MasterFormat Section Number 05 50 00.

Division 05 Section "METAL FABRICATIONS" for permanent walkway platforms.

If including Section Numbers with or instead of Titles, below is MasterFormat Section Number 05 52 00.

Division 05 Section "METAL RAILINGS" for permanent guardrails.

If including Section Numbers with or instead of Titles, include appropriate numbers and titles below.

Div. 07 Roofing Sections for coordination of flashing of roof-mounted anchorage and supports.

If including Section Numbers with or instead of Titles, below is MasterFormat Section Number 07 62 00.

Div. 07 Section "SHEET METAL FLASHING AND TRIM" for coordination of flashing of roof-mounted anchorage and supports.

* + - 1. REFERENCES
				1. Abbreviations and Acronyms:

CLFAS: Climbing ladder fall arrest system.

HLL: Horizontal lifeline.

ISA: Intermittent stabilization anchorage.

PFPE: Personal fall protection equipment.

RDS: Rope descent system.

SAE: Suspended access equipment.

SRL: Self retracting lifeline.

SWPS: Suspended work platform system.

* + - * 1. Definitions: Definitions in OSHA 29 CFR 1910 and 1926 including their subparts apply to this Section.

Below are some definitions in OSHA 29 CFR 1910 and 1926 that are pertinent to this Section but need not be repeated herein.

Anchorage means a secure point of attachment for lifelines, lanyards or deceleration devices devices, and which is independent of the means of supporting or suspending the employee. - APPENDIX C TO § 1910.66

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. - APPENDIX C TO § 1910.66

Personal fall protection system means a system (including all components) an employer uses to provide protection from falling or to safely arrest an employee's fall if one occurs. Examples of personal fall protection systems include personal fall arrest systems, positioning systems, and travel restraint systems.

Positioning system (work-positioning system) means a system of equipment and connectors that, when used with a body harness or body belt, allows an employee to be supported on an elevated vertical surface, such as a wall or window sill, and work with both hands free. Positioning systems also are called "positioning system devices" and "work-positioning equipment."

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. - § 1926.500

Guardrail system means a barrier erected to prevent employees from falling to lower levels. - § 1926.500

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 protection system to the anchorage. - APPENDIX C TO § 1910.66

Travel restraint (tether) line means a rope or wire rope used to transfer forces from a body support to an anchorage or anchorage connector in a travel restraint system.

Travel restraint system means a combination of an anchorage, anchorage connector, lanyard (or other means of connection), and body support that an employer uses to eliminate the possibility of an employee going over the edge of a walking-working surface.

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 guardrail, body belt, or safety net systems to protect employees in the area.

Safety factor means the ratio of the design load and the ultimate strength of the material.

Note: Travel restraint systems allow users to approach fall hazards without falling over a dropoff. If a travel restraint system is used, there is no need to provide for prompt rescue under §1926.502(d)(20), since there would not be an arrested fall. ANSI Z359.2 prohibits travel restraint systems on sloped roofs with slope over 4:12.

**[Travel Restraint System]**: A system, consisting of a combination of an anchorage, anchorage connector, lanyard (or other means of connection), and body support that an employer uses to eliminate the possibility of an employee going over the edge of a walking-working surface. A Travel Restraint System is arranged so that a worker is allowed to approach fall hazards yet is prevented from falling over a dropoff.

Note: When use of a travel restraint system is not feasible, a fall arrest system must be used and engineered so if a user falls, the system will promptly arrest or stop the fall. A fall arrest system further requires provision for prompt rescue under §1926.502(d)(20).

**[Fall Arrest System]**: A system used to arrest an employee in a fall from a working level. A fall arrest system exposes a worker to a fall, but arrests or stops the fall within specified parameters.

Anchorage, as used in this Section, means a secure point of attachment for lifelines, lanyards, or deceleration devices, which is independent of the means of supporting or suspending an employee or worker.

Anchor, as used in this Section, means a fastener or fastening device used to secure an anchorage or other component of the fall protection system to the structure.

Competent Person:

As defined in 29 CFR 1910.140(b) as "a person who is capable of identifying existing and predictable hazards in any personal fall protection system or any component of it, as well as in their application and uses with related equipment, and who has authorization to take prompt, corrective action to eliminate the identified hazards."

Qualified Person:

As defined in 29 CFR 1910.140(b) as "a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience has successfully demonstrated the ability to solve or resolve problems relating to the subject matter, the work, or the project."

* + - * 1. Reference Standards: Perform Work per standards specified and as follows unless modified by requirements in the Contract Documents.

Include the following Paragraph only when cost of acquiring specified standards is justified. Retain first option for paid or free subscription access. Retain second option when a physical copy on site is required.

American National Standards Institute (ANSI)/The American Society of Safety Professionals (ASSP):

ANSI/ASSP Z359.16 "Safety Requirements for Climbing Ladder Fall Arrest Systems."

ANSI/ASSP Z359.6 - Specifications and Design Requirements for Active Fall Protection Systems."

In 1988, the ANSI Z359 Fall Protection Committee was chartered to develop the first consensus standard. In 1992, ANSI Z359.1 - Safety Requirements for Personal Fall Arrest Systems, Systems and Components was published. It was developed to provide standard safety requirements for personal fall arrest systems, subsystems, and components. The purpose of these ANSI safety standards was to provide guidance in regards to the design of fall protection systems and the variety of equipment used in the industry. The standard was revised in 2007 in conjunction with American Society of Safety Engineers (ASSE). ANSI and ASSP have continued to work together with other industry leaders and government agencies to keep the standard of fall protection updated. The standard is constantly evolving and has added separate sections to address different parts of the Fall Protection Code. The following are a list of the current sections::
ANSI/ASSP Z359.0-2012 - Definitions and Nomenclature Used for Fall Protection and Fall Arrest
ANSI/ASSP Z359.1-2016 - The Fall Protection Code - Digital Only
ANSI/ASSP Z359.2-2017 - Minimum Requirements for a Comprehensive Managed Fall Protection Program
ANSI/ASSP Z359.3-2017 - Safety Requirements for Lanyards and Positioning Lanyards
ANSI/ASSP Z359.4-2013 - Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystems and Components
ANSI/ASSP Z359.6-2016 - Specifications and Design Requirements for Active Fall Protection Systems
ANSI/ASSP Z359.7-2011 - Safety Requirements for Assisted Rescue and Self Rescue Systems, Subsystems, and Components
ANSI/ASSP Z359.11-2014 - Safety Requirements for Full Body Harnesses
ANSI/ASSP Z359.12-2009 - Connecting Components for Personal Fall Arrest Systems
ANSI/ASSP Z359.13-2013 - Personal Energy Absorbers and Energy Absorbing Lanyards
ANSI/ASSP Z359.14-2014 - Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems
ANSI/ASSP Z359.15-2014 - Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems
ANSI/ASSP Z359.16-2016 - Safety Requirements for Climbing Ladder Fall Arrest Systems
ANSI/ASSP Z359.18-2017 - Safety Requirements for Anchorage Connectors for Active Fall Protection Systems

Occupational Safety and Health Administration (OSHA):

OSHA 29 CFR 1910, "Occupational Safety and Health Standards."

OSHA 29 CFR 1910, Subpart D "Walking and Working Surfaces."

Below covers powered platform installations permanently dedicated to interior or exterior building maintenance such as window cleaning, caulking, metal polishing and reglazing. Building owners have a duty to inform the employer before each use in writing that the installation meets the requirements.

**[OSHA 29 CFR 1910, Subpart F "Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms."]**

OSHA 29 CFR 1926, "Safety and Health Regulations for Construction."

OSHA 29 CFR 1926, Subpart M "Fall Protection."

Delete the following paragraph and subparagraphs below if NOT in California.

**[State of California Regulations: Code of Regulations, Appendix C to Article 6 (Personal Fall Arrest System).]**

Retain below for Sustainable Design projects.

U.S. Green Building Council (USGBC) - Leadership in Energy and Environmental Design (LEED) ([http://www.usgbc.org/](http://usgbc.org/)):

USGBC-LEED **[v4]** for **[Building Design and Construction (BD+C)]** **[Interior Design and Construction (ID+C)]** **[Building Operations and Maintenance (O+M)]** **[Neighborhood Development (ND)]** **[Building Design and Construction: Homes and Midrise (BD+C)]** Reference Guide.

* + - 1. ADMINISTRATIVE REQUIREMENTS

Insert agenda items below not listed in Div. 01 Section "Project Meetings."

* + - * 1. Coordination:

Coordinate layout and installation of work of this Section with interfacing and adjoining work and other Sections affecting or affected by work of this Section for proper sequencing of each installation.

Furnish setting drawings, diagrams, templates and installation instructions to other Sections.

Furnish inserts and anchoring devices which need to be preset and built into structure to appropriate trade. Supply on timely basis to avoid delay in Work.

Instruct other trades of proper location and position.

* + - 1. action SUBMITTALS
				1. Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

Include rated capacities; operating weights; furnished specialties; and accessories.

* + - * 1. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of fall protection equipment, as well as procedures and diagrams.

Show complete layout and configuration of fall protection equipment including all components and accessories.

Clearly indicate design and fabrication details and installation details.

Include plans, elevations, sections, details, and attachments to other Work

Include installation and rigging instructions and all necessary Restrictive and Non-Restrictive Working Usage Notes and General Safety Notes.

For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Retain "data" below unless project engineers specifically request "calculations."

* + - * 1. Delegated-Design Submittal: Include design **[data]** for fall protection equipment for which design is assigned to Contractor.

Indicate working and ultimate loads for each item of fall protection equipment.

Indicate design loads imposed on **building structure** at points of support.

ICC 2015 IBC 107.3.4.1 reads:

"Deferral of any submittal items shall have the prior approval of the building official. The registered design professional in responsible charge shall list the deferred submittals on the construction documents for review by the building official."

DEFERRED SUBMITTAL (def): Those portions of the design that are not submitted at the time of the application and that are to be submitted to the building official within a specified period.

Deferred Submittals shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until the deferred submittal documents have been approved by the building official.

* + - 1. INFORMATIONAL SUBMITTALS
				1. Manufacturers’ instructions for each product.

Field quality control test and inspection reports.Retain below for Sustainable Design projects.

* + - * 1. Sustainable Design **[LEED]** Submittals:

**[<insert requirements or reference to Division 01 Sections as required>]**

Only retain last option below if Contractor or manufacturer selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.

* + - * 1. Qualification Statements for**[ manufacturer,]** **[ installer,]** **[ welders,]** **[ design professional,]** **[**

Include manufacturer's approval for installer.

Include list of past Projects and contacts evidencing compliance with specified qualifications.

* + - 1. Closeout Submittals
				1. Operation and Maintenance Data: For fall protection systems, subsystems, and equipment to include in operation and maintenance manuals.

Requirements for personal fall protection including complete instructions for users and building maintenance personnel for the safe and proper use, operation, and maintenance of the equipment specified.

Provisions for pre-operational, operation, and maintenance inspections. Include a Log Book outlining mandatory annual inspection requirements that are in accordance with ANSI and OSHA Regulations and Industry Standards.

Plan view drawing of the building’s roof, including the building name and address.

Show facility fall protection equipment layout and details of the roof maintenance, **[exterior building maintenance, ]**and fall protection systems.

Identify anchorage points for personal fall arrest systems.

Identify load ratings of each item of fall protection equipment including special use conditions.

The following paragraph applies only to California. Delete if not required.

**[An Operating Procedures Outline System (OPOS) for all procedures not covered by the California Labor Code orders. Indicate date the OPOS was prepared on isometric or plan view drawing.]**

Retain below if required by authorities having jurisdiction.

* + - * 1. **[Regulatory agency approvals for use of fall protection equipment.]**
			1. QUALITY ASSURANCE
				1. Qualifications:

Manufacturer Qualifications: Minimum **[10]** years experience

Company: One specializing in the design, fabrication and installation of fall protection equipment specified in this Section and whose products have a record of successful in-service performance.

Verify manufacturer insurance requirements with Owner.

Manufacturer shall maintain specific liability insurance (products and completed operations) in the amount of **[$2,000,000.00]** to protect against product/system failure.

Installer Qualifications: Minimum **[5]** years experience

Company: A firm or individual certified, licensed, or otherwise qualified or employed by fall protection equipment manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

Project Experience: Minimum **[5]** years experience on at least **[5]** projects of similar nature in past **[5]** years.

Staff: Employ a competent foreman who is a Competent Person as defined in 29 CFR § 1926.32(m) and who is a certified installer to supervise Work of this Section. Foreman shall be present whenever Work is in progress.

Welder Qualifications: Welders must be qualified to applicable AWS Standards for each type of weld required.

Retain "Testing Agency Qualifications" Paragraph below if Contractor or manufacturer selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article.

Design Professional Qualifications:

Professional engineer **[employed by the fall protection equipment manufacturer and]** experienced in design and engineering of fall protection equipment, its application and safety requirements, **[licensed]** **[ or ]** **[registered]** in jurisdiction in which Project is located, and who assumes responsibility for the following:

Preparation of comprehensive engineering analysis data.

Preparation of engineering calculations.

Preparation of shop drawings and other submittals.

Below may include lab or field testing for compliance.

Testing program development.

Review and corroborate comments from Architect and other reviewers on delegated-design submittals and address required changes in their design.

* + - * 1. Certifications:

1910.27(b)(1)(i) now requires that before “employers use a rope descent system, the building owner must inform the employer in writing that the building owner has identified, tested, certified, and maintained each anchorage so it is capable of supporting 5,000 pounds (2268 kg) in any direction, for each worker attached”.

Building owners had until fall of 2017 to ensure all of your anchorage is capable of supporting 5,000 pounds (2268 kg) in any direction for each attached worker. The only way to definitively make this determination is to pull test each anchorage.

Inspection certificates**[ and use permits]** for fall protection equipment.

Normally retain first option below if manufacturer or supplier will perform preconstruction testing. Retain second option if Owner will perform testing.

* + - 1. DELIVERY, STORAGE, AND HANDLING

Retain this article only if providing detailed requirements that apply to Work of this Section and that supplement general provisions in Section 016000 "Product Requirements."

* + - * 1. Delivery Requirements: Deliver materials in manufacturer’s undamaged packaging, complete with installation instructions.
			1. WARRANTY
				1. Manufacturer's Standard Warranty: Manufacturer will warrant the products specified below, to operate properly, if the fall protection system is inspected annually by the manufacturer or a certified representative.

Warranty Periods from date of Substantial Completion:

Edit below to retain only those components intended for installation on this Project.

Rooftop Rigid Anchors: 10 years.

Rooftop Force Management Anchors (Aluminum): 10 years.

Rooftop Horizontal Lifelines: 10 years.

Rooftop Davit Assemblies: 10 years.

Rooftop Outrigger Beams: 10 years.

Rooftop Rigging Sleeves: 10 years.

1. PRODUCTS
	* + 1. MANUFACTURERS

Retain "Manufacturers" Paragraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

* + - * 1. Manufacturers: Subject to compliance with requirements, **[provide products as furnished by the following]**

On June 23, 2015, 3M www.3m.com announced a deal to acquire Capital Safety for $1.8 billion. The Capital Safety brands—including DBI-SALA® and Protecta®—products, and people are now a part of 3M Fall Protection.

Diversified Fall Protection Toll Free Tel: 866-387-9965; Email: estimating@peak-fp.com

Substitutions **[will]** **[will not]** be considered. Comply with provisions of Div. 01 Section "SUBSTITUTION PROCEDURES."

* + - * 1. Project Source Limitations: Obtain each variety of fall protection equipment, whether specified in this Section or in other Sections, through one source from a single manufacturer who is capable of showing prior successful production of units similar to those required for entire Project
			1. DESCRIPTION

Suspended Access Fall Arrest Systems, are designed to provide two independent tie-off points required to support a suspended worker - one for the boatswain's chair or other worker support device and the other as the workers safety line. Suspended access fall arrest systems are typically used by window cleaners and other maintenance trades that need to access exterior building façades. Suspended access systems include anchorage points and may include davits, rigging sleeves, monorails, and outrigger beams.

Rooftop Access: Travel restraint and fall arrest systems allow workers to traverse rooftops or similar elevated areas while maintaining 100 percent tie-off to an OSHA and ANSI compliant system. Rooftop access systems are typically needed by trades who perform routine maintenance of roof-based equipment such as HVAC equipment, communication equipment, security cameras, gutters, solar panels, skylights, and lighting, or use by trades performing window cleaning or façade maintenance, allowing them to be safely tied to an anchorage point while rigging, prior to performing their descents.

* + - * 1. Fall protection systems consist of the following permanently installed equipment with required attachment devices and accessories:

Retain anchorages and systems used below. Delete items not planned for use.

Anchorages secured to building structure for securing worker safety lines**[, suspended scaffolds,][ and rope descent systems].**

Consider anchorage at mezzanines or similar removable railing/gate openings for hoist area material handling.

**[Intermittent stabilization anchorage secured to building facade** for powered platform stabilization.

**[Horizontal lifelines]** for attachment of personal fall arrest systems.

**[Vertical lifelines]** for attachment of personal fall arrest systems.

**[Rigid** **trolley rails]** for attachment of personal fall arrest systems.

**[Overhead monorails]** for attachment of **[rope descent systems]** **[and powered platforms]**.

**[Davit assembly]** for support of **[rope descent systems,]** **[powered platforms,]** **[single worker cages,]** **[or]** **[boatswain's chairs]**.

**[Outrigger beams]** for support of **[rope descent systems,]** **[powered platforms,]** **[single worker cages,]** **[or]** **[boatswain's chairs]**.

**[Rigging sleeves]** intended to directly or indirectly support or change the force direction of loads.

Fall protection guards may also include barriers across truck dock edges, dock doorways, roof hatches, ladder/stair access points, mezzanines, and other raised platforms.

Protection is required per 1910.28(b)(3)(i) at holes including skylights, stairway floor holes, ladderway floor holes, hatchway and chute-floor holes, and other holes on roofs

**[Ballasted** guard rails

**[Skylight screens.]**

**[Permanent powered platforms.]**

**[Warning lines]** to warn workers they are approaching an unprotected side or edge, and which designate areas in which work may take place without using other means of fall protection.

* + - * 1. Product Options: Drawings **[may]** indicate suggested locations**[, profiles, and dimensional requirements]** of fall protection equipment and are based on the specific system indicated. Final locations shall be determined according to fall protection equipment manufacturer's design requirements.

If modifications are proposed, submit, with Shop Drawings, comprehensive explanatory data to Architect for review.

Retain applicable standards below.

* + - * 1. Regulatory Requirements: Provide fall protection equipment, supports, and anchorage designed and constructed to suit building configuration and in accordance with the Contract Documents and applicable regulations and codes.

Comply with the following ANSI/ASSP regulations:

**[ANSI/ASSP Z359.16 "Safety Requirements for Climbing Ladder Fall Arrest Systems."]**

ANSI/ASSP Z359.18 "Safety Requirements for Anchorage Connectors for Active Fall Protection Systems "Part of The Fall Protection Code."

ANSI/IWCA I-14.1 Window Cleaning Safety Standard requires fall protection whenever a worker must travel within 6 feet of a vertical drop. Fall protection may be in the form of a code-compliant guardrail or parapet. When such code-compliant perimeter guarding does not exist and cannot be installed, a horizontal Travel Restraint cable system may be the best option for providing fall protection.

ANSI/IWCA I-14.1 "Window Cleaning Safety Standard."

Coordinate the code citations below with State and local requirements. The first set is U.S. OSHA regulations for all States except New York and California, which have more stringent regulations.

Comply with the following OSHA regulations:

OSHA 29 CFR 1910, Subpart D "Walking and Working Surfaces."

Below covers powered platform installations permanently dedicated to interior or exterior building maintenance such as window cleaning, caulking, metal polishing and reglazing. Building owners have a duty to inform the employer before each use in writing that the installation meets the requirements.

**[OSHA 29 CFR 1910, Subpart F "Powered Platforms, Manlifts, and Vehicle-Mounted Work Platforms."]**

OSHA 29 CFR 1926, Subpart M "Fall Protection."

Delete the following paragraph and subparagraphs below if NOT in California.

**[Comply with State of California regulations: Code of Regulations, Appendix C to Article 6 (Personal Fall Arrest System).]**

* + - 1. performance / design criteria
				1. Delegated Design: Professional design services are specifically required of Contractor. Engage a qualified design professional to design facility fall protection equipment, using performance requirements and design criteria specified herein.

Design Criteria:

Fall protection systems and equipment shall comply with current applicable federal, OSHA, ANSI, and state regulations and standards.

Design anchorage components, using proper engineering principles, to provide adequate attachment to building; ensure compatibility with industry standard equipment.

Retain below for suspended access work.

For suspended access work, locate anchorages to suit suspension equipment that will be used on the structure with respect to items such as reach, rigging, spacing, roof **[and other elevated ]**edge conditions, and similar items. Locate anchorages so lines don't exceed 15 degrees from perpendicular to the building edge that is serviced.

Design fall protection system to accommodate structural movement, movement within system, movement between system and support components, dynamic loading and release of loads, and deflection of structural support, without detriment to durability or performance, without damage to support structure.

Design fall protection system and provide clearances that will allow for installation tolerances, and expansion and contraction of adjacent building materials.

Structural Performance Criteria: Provide facility fall protection equipment and systems, including anchorages, complying with specific performance and design criteria indicated, capable of withstanding, without failure, the effects of gravity loads and in-use loads and stresses under conditions indicated or reasonably anticipated. Include necessary modifications to meet required criteria.

Contract Documents may indicate certain performance requirements, features, and primary components required, but do not cover details of design and construction, and do not purport to identify nor solve problems of thermal or structural movement, anchorage, or moisture disposal. Requirements shown by details are intended to establish basic locations and dimension of fall protection systems.

If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

Compliance with requirements of authorities having jurisdiction is the responsibility of Contractor.

* + - 1. RIGID ANCHORAGE

1910.21(b) Definitions. Anchorage means a secure point of attachment for equipment such as lifelines, lanyards, deceleration devices, and rope descent systems.

Per 29 CFR § 1926.502(d)(15) - Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (2268 kg) per employee attached, or shall be designed, installed, and used as follows:
1926.502(d)(15)(i) - as part of a complete personal fall arrest system which maintains a safety factor of at least two; and
1926.502(d)(15)(ii) - under the supervision of a qualified person.

* + - * 1. Design Criteria: Design anchorages used for attachment of personal fall arrest equipment to resist the following maximum static load in any direction without detachment or fracture occurring.

Safety Factor: 2:1

ANSI Anchorage Types:
• Type A: An anchorage connector (other than a Type D or T anchorage connector) designed for an active fall protection system.
• Type T: An anchorage connector designed to support a suspended component/tie-back line or for an active fall protection system.
• Type D: An anchorage connector designed to allow deformation or movement when arresting a fall with the purpose of absorbing fall energy and reducing the strength requirements of the anchorage to which it is attached. Deformation may be permanent or temporary. In some cases, these anchorage connectors may not be suitable for work positioning, rescue, rope access, and suspended component/tie-back because of their low serviceability load rating. Also, travel restraint may be acceptable based on the serviceability rating and deformation limits of the individual product.

Per 29 CFR § 1926.502(d)(15), Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds (2268 kg) per employee attached

For static strength testing, both Type A and Type T anchorage must withstand a minimum 5,000 pounds (2268 kg) load. Type D anchorage must withstand a static load between 2,700 pounds (1224 kg) and 5,000 pounds (2268 kg), and their deformation must be measured so that it may be accounted for in fall clearance calculations.
Note: Above assumes a combined person and tool weight of less than 310 lbs (140 kg) - additional restraint is required for heavier weights.

For dynamic strength testing, both Type A and Type T anchorage must not allow a 282 pounds (127 kg) test weight to impact the ground when dropped with a 3 ft (0.91 m) free fall, while Type D anchorage must do the same but with a 6 ft (1.83 m) free fall.

Delete one of the two options in the following subparagraph. The first is OSHA's requirement; the second applies to California only.

Type A and Type T Anchorages: **[5,000 pounds (2268 kg)]** **[5,400 pounds (2249 kg)]**.

**[Positioning Type Anchorages: 3,000 pounds (1361 kg).]**

* + - * 1. Roof-Mounted Rigid Anchorage: Stanchion post type with closed "loop" opening factory-welded to top of stanchion post for attachment of lifelines and other fall protection equipment. Factory-weld base plates of thickness and with means of securement to comply with design criteria.

Select loop size desired from the following two subparagraphs. 2 inch option applies to California projects.

Loop: 3/4 inch (19 mm) inside diameter forged, galvanized steel with **[1-1/2 inch (38 mm)]** **[2 inch (50.8 mm)]** opening loop.

Stanchion Post: Galvanized steel **pipe**, with wall thickness to comply with design criteria.

For steel roof decks, retain one of the following three options.

Base: **[Open ended post for direct-welded attachment to structural member]** **[Galvanized steel base plate factory-welded to bottom of stanchion post for field-welding to building structural member]** **[Galvanized steel base plate factory-welded to bottom of stanchion post for bolting around (wrapping) building structural member]**.

For concrete roof decks, retain one of the following three options. Rooftop Anchor, Inc. suggests Hilti 304 or 316 SS HAS-R stainless steel rods set with HT-HY 200Epoxy Adhesive - verify with Structural Engineer in Responsible Charge.

Base: Galvanized steel base plate factory welded to bottom of stanchion post **[with cast-in-place anchors for embedding in concrete deck]** **[for epoxy anchor attachment to concrete deck]** **[for through-bolting to concrete deck]**.

For wood roof decks, retain one of the following two options.

Base: Galvanized steel base plate factory welded to bottom of stanchion post for **[screw-fastening to wood framing]** **[bolting through wood deck]**.

Rooftop Anchor, Inc. steel and concrete deck products are available in 12, 15, 18, 21, 24 inch (305, 380, 456, 533, 609 mm)heights and custom heights. Wood deck anchorage products are available in 12, 15, 18 inch (305, 380, 456 mm) heights.

Minimum Post Height Above Roof Surface: Sufficient to allow **[8 inch (203 mm)]** **[12 inch (304 mm)]** high roof flashing and seal around stanchion. Depth of roofing materials is to be provided by General Contractor in coordination with roofing contractor’s tapered insulation shop drawings.

Steel Finish: **[Thermal diffusion galvanized]** **[Hot-dip galvanized]**.

Stainless Steel Finish: As fabricated.

* + - * 1. Wall-Mounted Anchorage: **[Galvanized steel]** **[Stainless steel]** base plate with closed "loop" opening factory-welded to

Select loop size desired from the following two subparagraphs. 2 inch option applies to California projects.

Loop: 3/4 inch (19 mm) inside diameter forged, galvanized steel with **[1-1/2 inch (38 mm)]** **[2 inch (50.8 mm)]** opening loop.

For steel column, beam, or other attachment points, retain one of the following three options.

Steel Mounting Type: **[For direct-welded attachment to structural member]** **[For bolting around (wrapping) building structural columns]** **[For bolt-through attachment to steel members]** **[Two-piece, pipe-wrap type, bolted attachment to round structural members]**.

For concrete column, beam, wall or other attachment points, retain one of the following three options.

Concrete Mounting Type: **[With cast-in-place anchors for embedding in concrete]** **[For bolt-through attachment as indicated]** **[For post-installed anchor attachment to concrete]**.

Other Wall Mounting Type: **[For bolt-through attachment as indicated]**.

Steel Finish: **[Thermal diffusion galvanized]** **[Hot-dip galvanized]**.

Stainless Steel Finish: As fabricated.

* + - 1. FORCE MANAGEMENT ANCHORAGE [WITH HORIZONTAL LIFELINES]
				1. Design Criteria: Design anchorages used for attachment of personal fall arrest equipment to resist the following maximum static load in any direction without detachment or fracture occurring.

Type D Anchorages: 2,700 pounds (1225 kg) to 5,000 pounds (2268 kg).

Anchorage below reduces the overturning moment on the structure by over half compared with a typical rigid anchorage. Their only limitation is they cannot be used for suspended access and must be replaced after a fall incident.

* + - * 1. Roof-Mounted Fall Arrest Anchorage: Energy-absorbing, deforming force management type (tip-over) anchorage designed to break open, deploying a unique and patented SpiraTechTM Force Management Technology absorbing system, which reduces the forces generated on the roof structure. Provide with swiveling anchorage point for **[direct-welded attachment to structural member]** **[bolt-through attachment to [concrete] [wood] deck]** **[epoxy anchor attachment to concrete deck]**.

Basis of Design Product: RoofSafeTM Anchorage as Distributed by Diversified Fall Protection

Base Mounting Plates: As appropriate for roofing type.

Fasteners: Manufacturer's recommended units designed to **[penetrate roof insulation and fasten to underlying [metal] [concrete] deck]** **[clamp onto standing seams of metal roof]**.

* + - * 1. Horizontal Cable Lifeline System: Hands-free fixed cable type for **[rooftop]** **[wall]** installation. Design system for **[travel restraint]** **[fall arrest]** purposes and install to allow users to walk uninterrupted the entire length of the system and provide secure anchorage to arrest a fall. System shall allow attachment at any point along the cable and enable freedom of movement along the cable as it passes by components.

Basis of Design System: RoofSafe Cable System by 3M as Distributed by Diversified Fall Protection.

Cable: ASTM A492 316 stainless steel wire rope, 7 x 7 type; 5/16 inch (7.94 mm) diameter

Fixed End Anchorage: Permanently swaged 316 stainless steel terminations.

Tension Absorber End Anchorage: 316 stainless steel tensioner with 180 pounds (82 kg) visual tension indicator.

Intermediate Brackets: 5/16 inch (8 mm) 316 stainless steel, electropolished.

Corner and Curve Transitions: 316 stainless steel, electropolished.

Horizontal Lifeline Energy Absorber: Installed inline at cable terminations as designated by Qualified Fall Protection Engineer. 316 stainless steel.

Attachment Traveler Device: 316 stainless steel casting, electropolished and serial numbered; with carabiner designed for attachment to cable at any point and to slide along cable.

Select traveler above or below. Above device must be removed and reinstalled to allow user to cross to other side of cable and still function. Below device allows user to cross cable without removing the traveler but does require a manual button-push to rotate the loop..

Select one or more of the following three roof anchorage types. Coordinate with Drawings and system design.

Roof-Mounted Force Management Anchorage: Energy-absorbing force management type as specified above. Equip each anchorage with loop and pin for cable attachment.

Retain below if required.

* + - 1. HORIZONTAL LIFELINES

1910.66(d) 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.

1910.140(c)(11)(ii) Is part of a complete personal fall arrest system that maintains a safety factor of at least two.

Designer/Specifier must decide if lifeline system is for "travel restraint" (to eliminate a fall possibility) or "fall arrest" (which allows a fall but arrests the fall to minimize injury). See discussion in TIP at beginning of this Section.

* + - * 1. Design Criteria: Design as part of a complete **[travel restraint]** **[fall arrest]** system as follows:

Safety Factor: 2:1

The horizontal lifeline shall be designed for a minimum of two (enter 1-3 as required) users, each using an energy absorbing lanyard which limits the force applied to the horizontal lifeline to 1,350 lbs (or as designated by the Qualified Fall Protection Engineer, not to exceed 1,800 lbs).Design trolleys to ensure no occurrence of structural or mechanical deterioration during designed life of system that could affect security and operation considering permanent exposure to elements.

* + - * 1. Horizontal Cable Lifeline System: Hands-free fixed cable type for **[rooftop]** **[wall]** installation. Design system for **[travel restraint]** **[fall arrest]** purposes and install to allow users to walk uninterrupted the entire length of the system and provide secure anchorage to arrest a fall. System shall allow attachment at any point along the cable and enable freedom of movement along the cable as it passes by components.

Basis of Design System: Horizontal Lifeline System by Diversified Fall Protection.

Cable: ASTM A492 316 stainless steel wire rope, 7 x 7 type; 5/16 inch (7.94 mm) diameter

Fixed End Anchorage: Permanently swaged 316 stainless steel terminations.

Tension Absorber End Anchorage: 316 stainless steel tensioner with 180 pounds (82 kg) visual tension indicator.

Intermediate Brackets: 5/16 inch (8 mm) 316 stainless steel, electropolished.

Corner and Curve Transitions: 316 stainless steel, electropolished.

Horizontal Lifeline Energy Absorber: Installed inline at cable terminations as designated by Qualified Fall Protection Engineer. 316 stainless steel.

Attachment Traveler Device: 316 stainless steel casting, electropolished and serial numbered; with carabiner designed for attachment to cable at any point and to slide along cable.

Select traveler above or below. Above device must be removed and reinstalled to allow user to cross to other side of cable and still function. Below device allows user to cross cable without removing the traveler but does require a manual button-push to rotate the loop..

Select one or more of the following three roof anchorage types. Coordinate with Drawings and system design.

Roof-Mounted Rigid Anchorage: Stanchion anchorage as specified above designed to withstand the maximum calculated fall arrest forces.

Retain below if required.

Custom Fabricated Roof-Mounted Anchorage: Galvanized steel members as indicated on Drawings.

* + - 1. HORIZONTAL RAIL SYSTEMS

Designer/Specifier must decide if lifeline system is for "travel restraint" (to eliminate a fall possibility) or "fall arrest" (which allows a fall but arrests the fall to minimize injury). See discussion in TIP at beginning of this Section.

* + - * 1. Design Criteria: Design as part of a complete **[travel restraint]** **[fall arrest]** system as follows:

Insert one to three simultaneous users below as required to suit Project.

Design to allow for **[<insert maximum number of individuals>]** simultaneous users maximum.

Maximum allowable force per rail span: 2,700 lbs.

* + - * 1. Horizontal Rigid Rail System: Hands-free fixed rail type for **[rooftop]** **[wall]** installation. Design system for **[travel restraint]** **[fall arrest]** purposes and install to allow users to walk uninterrupted the entire length of the system. System consists of a fixed rail with attached travelers to which persons attach to enable freedom of movement along the length of the rail.

Basis of Design System: RoofTrax system by Diversified Fall Protection

Rail: Low profile, 1.25 by 1.25 inch (32 by 32 mm), aluminum extrusion in **[10-0” (3048 mm)]** **[or]** **[20'-0" (6096 mm)]** lengths.

Maximum allowable force on rail: 2,700 lbs

Select one of the options below.
Concealed 2.11 by 6.06 inches (53.5 by 154 mm) joint must be supported within 7.87 inches (200 mm) by fixing back to the structure.
Fixed 5.31 by 6.06 inches (135 by 154 mm) joint also serves as anchor and is not required to have additional supports.

Rail Joint: Low profile, aluminum extrusion to connect rail sections

Additional bends and forms are available to a radius of 7.87 inches (200 mm).

Corner and Curve Transitions: Factory fabricated units forming **[90 degree]** **[and]** **[45 degree]** corners **[as required]**.

End Stops: Manufacturer’s standard extruded aluminum stops to prevent rails from coming out of end anchorage bracket including rubber buffers. Stops secured to rail by **[screws]** **[or]** **[plunger pin]**.

Molded Ends: Manufacturer's standard molded ends to protect exposed edge of end rails.

Carriage Stops: Manufacturer's standard stops which prevent carriages from unintentionally coming off the end of the system;

Attachment Carriages: Manufacturer’s standard aluminum units with aluminum, nylon coated wheels. Equip with stainless steel shackle with carabiner hook which pivots for any angle connection.

Rail Fixing Components: **Aluminum** connections as follows:

End Anchors: Manufacturer's standard anchors which secure end of the rail to structure and control rail movement in the event of a fall.

Tapped versions of concealed intermediate anchors are alos available.

Intermediate Anchors: Manufacturer's standard anchors which secure rail to structure at intervals to suit work site and structure (10’-0” max span).

Connections: Mount to substrate with low profile Weathertite bases as furnished by Diversified Fall Protection

Retain below if required.

Retain below if required.

**[Custom Fabricated Supports: [Galvanized] steel members as indicated on Drawings.]**

Mill finish is standard. Powder coating and anodizing are available.

Finish for Aluminum Components: **[Anodized]** **[clear] [Powder coated] [to match metal roof]**.

* + - 1. OVERHEAD Suspended Access Monorail SYSTEMS

Monorails offer an alternative to rigging sleeves to provide safe access to hard-to-reach building areas. Monorails can provide continuous horizontal movement and may offer design solutions where the following features exist:
• Overhangs/Cornices
• Atriums
• Interior curtain walls

Monorails can be used to support one-man cages, or one-man rope descents. Monorails may be preferred where spaces do not allow for access through building features or where minimal penetrations are desired. Use of a monorail for suspended maintenance could reduce the number of times suspension and fall arrest ropes have to be pulled up and down the building face, reducing wear and the chance of hardware damaging windows or building facades.

Designer/Specifier: Provide safe access to clip onto the monorail via a window, hatch, platform, etc.

* + - * 1. Design Criteria: Design as part of a complete **[rope-descent]** **[powered platform]** system as follows:

Insert one to three simultaneous users below as required to suit Project.

Design to allow for **[<insert maximum number of individuals>]** simultaneous users maximum.

Design to allow for simultaneous connection of a primary support line a safety line in a maximum 10'-0" (3048 mm) span with a 4:1 safety factor against fracture or detachment.

Retain subparagraph below for Rope Descent System use.

Minimum Rated Working Load for Rope Descent System: **[1,000 pounds (454 kg)]** **[5,000 pounds (2,268 kg)]**.

Minimum Rated Working Load for Powered Platforms: **[1,000 pounds (454 kg)]** **[4,000 pounds (1,816 kg)]**.

* + - * 1. Overhead Horizontal Monorail System: Hands-free fixed rail type for overhead suspended mounting from structure. Design system for **[travel restraint]** **[fall arrest]** purposes and install to allow users to traverse uninterrupted the entire length of the system and provide secure anchorage to arrest a fall.

Basis of Design System: RTA Monorail System by Diversified Fall Protection

Rail: 4 by 6 inch (101 by 152 mm), aluminum extrusion.

Rail Support Brackets: Factory fabricated galvanized steel Tee to connect rail sections at joints.

Additional bends and forms are available to a radius of 7.87 inches (200 mm).

Corners: Factory fabricated units forming corners **as required**.

Trolley Stops: Manufacturer's standard stops which prevent carriages from unintentionally coming off the end of the system. Designed for periodic removal of carriages for inspection and replacement.

Attachment Trolleys: Manufacturer’s standard stainless steel units with four stainless steel, nylon coated wheels. Equip with connection point for carabiner attachment.

Minimum tensile strength: 5,000 lbf

Mill finish is standard. Powder coating and anodizing are available.

Finish for Aluminum Components: **[Clear Anodized]** **[Powder coated]** **[to match metal roof]**.

* + - 1. OVERHEAD HORIZONTAL TRACK SYSTEMS (\*\*\*\*NOTE, WE NEED TO DELETE THE YELLOW BOX BELOW, THIS SYSTEM IS FOR ARREST ONLY\*\*\*)

Designer/Specifier must decide if lifeline system is for "travel restraint" (to eliminate a fall possibility) or "fall arrest" (which allows a fall but arrests the fall to minimize injury). See discussion in TIP at beginning of this Section.

* + - * 1. Design Criteria: Design as part of a complete **[fall arrest]** system as follows:

Insert one or two simultaneous users below as required to suit Project.

Design to allow for **[one]** **[two]** simultaneous users maximum.

Design to allow for **[900 pound (408 kg)]** **[<insert as required up to 1800 pounds (816 kg)>]** maximum arresting force.

Mounting systems available include:
Ceiling mounted using the building structure for support.
Fold-away wall- or column-mounted systems that swing into position and fold to the side out of the way when not in use
Free standing permanently mounted systems with integral tube upright supports.
Portable gantry systems with uprights angle-braced on bases.
Engineered systems with single or multiple floor-mounted pole supports.
Mobile systems (Road Ranger™) capable of being moved and positioned with a truck, forklift, or other towing device.

Modify below as required to suit desired system.

* + - * 1. Overhead Horizontal Track System: Hands-free fixed track type for overhead **[suspended]** **[direct]** mounting from structure. Design system for **[travel restraint]** **[fall arrest]** purposes and install to allow users to traverse uninterrupted the entire length of the system and provide secure anchorage to arrest a fall.

Basis of Design System: Tether Track™ as distributed by Diversified Fall Protection

Retain single track option below for direct mounting to overhead structure. Retain trussed track for longer spans up to 50 feet. Retain dual-trussed track to enable workers to pass by one another on separate tracks mounted on the same truss.

Track: Cold-rolled steel tapered box shaped track in **[single]** **[trussed]** **[dual-trussed]** track configuration. Provide track in straight configuration**[ with curves as indicated]**.

The bridge system allows for two axes of motion giving the worker complete mobility along the x and y axes, while keeping the fall protection anchor point directly over the worker’s head, reducing the risk of swing fall injuries. Multiple bridges are the best solution for supporting multiple workers.

Standard maximum bridge length is 18'-0" but may be longer upon request.

**[Bridge]:** Extruded aluminum beam mounted on trolleys at each truss track to move with the worker.

Duracomp 4® wheels are made of a food grade material that outperforms steel wheels in endurance and destructive testing. Wheels are tapered to match the track flange’s 2° taper, which enhances wheel life and keeps the trolleys running smoothly.

Attachment Trolleys: Manufacturer’s standard steel units with three Duracomp 4® wheels. Equip with stainless steel pivoting shackle for carabiner attachment.

Track Fixing Components: **[Galvanized]** **[Prime-painted]** steel support brackets custom designed and shop-fabricated to suit points of attachment to building structure.Mill finish is standard. Powder coating and anodizing are available.

* + - 1. LADDER SAFETY SYSTEMS

If not specified in Div. 05 Section "Metal Fabrications" specify ladder safety system here.

Per OSHA 1910.28(b)(9)(i)(A) new ladders over 24 feet above a lower level built after 11/19/2018 must be equipped with a ladder safety system or personal fall arrest system.
✍ Ladder Safety Systems usually consists of a carrier; a safety sleeve, which is a moving component that travels on the carrier; a lanyard: connectors; and a body harness.
✍ Personal Fall Protection Systems usually consists of an anchorage, body support like a body harness, and connectors used as a means to connect the anchorage and the body support.

1910.29(i) - Ladder safety systems. The employer must ensure:
1910.29(i)(1) - Each ladder safety system allows the employee to climb up and down using both hands and does not require that the employee continuously hold, push, or pull any part of the system while climbing;
1910.29(i)(2) - The connection between the carrier or lifeline and the point of attachment to the body harness or belt does not exceed 9 inches (23 cm);
1910.29(i)(3) - Mountings for rigid carriers are attached at each end of the carrier, with intermediate mountings spaced, as necessary, along the entire length of the carrier so the system has the strength to stop employee falls;
1910.29(i)(4) - Mountings for flexible carriers are attached at each end of the carrier and cable guides for flexible carriers are installed at least 25 feet (7.6 m) apart but not more than 40 feet (12.2 m) apart along the entire length of the carrier;
1910.29(i)(5) - The design and installation of mountings and cable guides does not reduce the design strength of the ladder; and
1910.29(i)(6) - Ladder safety systems and their support systems are capable of withstanding, without failure, a drop test consisting of an 18-inch (41-cm) drop of a 500 pounds (227-kg) weight.

* + - * 1. Design Criteria: Design to withstand, without failure, a drop test consisting of an 18-inch (41 cm) drop of a 500 pound (227 kg) weight.
				2. Climbing Ladder Fall Arrest System (CLAFS): Comply with [29 CFR 1910.29](http://www.ecfr.gov), 29 CFR 1926.1053, Section 7 of [ALI A14.3](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=ANSI%20A14.3), [ANSI/ASSP Z359.15](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=ANSI%20Z359.15), and [ANSI/ASSP Z359.16](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=ANSI%20Z359.16); climbing ladder fall arrest system allowing workers to climb and descend ladder using both hands and which does not require workers to continuously, hold, push, or pull any part of system while climbing.

Products:

3MTM DBI-SALA® Lad-SafTM Flexible Cable Ladder Safety System [as](http://as) distributed by Diversified Fall Protection

Height options refer to 3M Lad-SafTM product.

Anchorage: Design for anchorage to fixed ladders **[up to height indicated]** **[up to 499 foot height]** **[over 500 feet in height]** with rungs 1-1/8 inch (28.5 mm) diameter or less meeting requirements of [29 CFR 1910.23](http://www.ecfr.gov).

Top Bracket Assembly: Designed to fasten to three rungs with U-bolts**[ with extension post above ladder top meeting requirements of** [**ANSI/ASSP Z359.16**](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=ANSI%20Z359.16)**]**; built-in energy absorber; **[hot-dip galvanized]** **[stainless steel]**.

Bottom Bracket Assembly: Designed to fasten to two rungs with U-bolts; include built-in tensioning device; **[hot-dip galvanized]** **[stainless steel]**.

Cable Guides: Non-metallic, automatic pass-through guides for mounting to ladder rungs at 25 foot maximum intervals; **[hot-dip galvanized]** **[stainless steel]**.

Cable Lifeline: **[Stainless steel]** wire strand,; 3/8 inch (9.52 mm) diameter or as required to sustain applied loads.

Carrier Sleeve: Manufacturer's standard automatic pass-through, detachable fall arrestor unit with attached carabiner designed to connect the worker to the system, automatically follow the user during the climb and lock onto the cable in the event of a fall, allowing the user to regain their footing. Design unit to prevent user from installing the carrier upside down and to require at least two deliberate manual actions by the user to remove from cable. Sleeves shall lock automatically in a fall and must include a second independent locking mechanism that can’t be disengaged or interfered with during a fall. During climbing and descent, sleeve movement shall be automatic, not requiring manual intervention.

* + - 1. DAVIT SYSTEMS

1910.66(d) Davit means a device, used singly or in pairs, for suspending a powered platform from work, storage, and rigging locations on the building being serviced. Unlike outriggers, a davit reacts its operating load into a single roof socket or carriage attachment.

The main function of a davit arm is support for suspended scaffold systems. They can be short or tall depending on the parapet wall conditions, or may even allow the scaffold to raise high enough to clear the wall and swing the unit onto the roof. Some have very large outreach to clear obstacles below such as balconies or cornices. Davit Arms are almost always designed to fit the particular buildings requirements and can be fabricated to fit most new construction and existing buildings.

Davits can be used alone or in pairs. Davits may be used singly when supporting one-man rope descents or a single-point suspension scaffold. Davits are used in pairs when they will be used to suspend a powered platform with hoists mounted at each end.

Davits can be ground-rigged or roof-rigged.
✍ Ground-rigged davits provide an anchorage point for suspending a platform situated on a lower level (e.g. sidewalk or street below). They only need to be tall enough for the boom to clear the parapet, making them easier to handle and erect than roof-rigged davits.
✍ Roof-rigged davits enable workers to initially rig and board a powered platform from the roof, which will then be launched outboard over the parapet and suspended along the building face. Consideration needs to be given to providing sufficient landing surface on the rooftop for the platform and a suitable load-bearing track for safely rolling it along the roof perimeter to each drop location. Horizontal clearance is required for the davits to rest on the deck during set-up and dismantling.

* + - * 1. Design Criteria: Design for the following:

Retain second option below for Rope Descent System use.

Minimum Rated Working Load: **[1,000 pounds (454 kg)]** **[1,250 pounds (2,268 kg)]**.

Ultimate Load: [4,000 pounds (1814 kg)] [5,000 pounds].

* + - * 1. Types: Ground-rigged davit systems.

Indicate dimensions based on project conditions. Maximum portable rooftop davit reach is 8’-6” (2590 mm). Discuss with manufacturer if greater reach is needed which may require fixed davits.

Davit Reach: **[As required based on design conditions, 8’-6” max]**

Davit Height: **[As required based on design conditions]**

* + - * 1. System Components: Portable Sockets: Designed to receive davit arm and for hinged attachment to davit base. Galvanized steel. Equipped with (2) Stainless Steel locking pins with fastening tethers and safety pins to prevent unintentional disengagement.

Retain one of the two paragraph below.

Davit Base: Fixed galvanized steel base section designed to transmit davit assembly loads to supporting building structure. **[Provide portable lifting bracket for easy securement to base.]**

Retain one or both paragraphs below depending on roof structure with either Base paragraph above.

For steel roof decks, retain one of the following three options.

Base Mounting: **[Open ended post for direct-welded attachment to structural member]** **[Galvanized steel base plate factory-welded to bottom of stanchion-type base for field-welding to building structural member]** **[Galvanized steel base plate factory-welded to bottom of stanchion-type base for bolting around (wrapping) building structural member]**.

For concrete roof decks, retain one of the following two options.

Base Mounting: Galvanized steel base plate factory welded to bottom of stanchion post **[with cast-in-place anchors for embedding in concrete deck]** **[for through-bolting to concrete deck]**.

Mast: Round aluminum tube capable of rotating 360 degrees in socket. Equip with carrying handles, connecting pins, and **[dual wheels]** on for wheeled transport across roof. Provide turning brackets with removable handles for rotating davit arm in socket.

Boom: Structural aluminum member sized to comply with design criteria, equipped with anchorage point at underside of overhanging end. Affix boom to mast in a **[semi-permanent]** manner.

Brace: **[Structural aluminum]** shapes with end brackets, angle-braced to mast with fastenings bolted to boom and mast.

Retain below for tall and heavy davit arms. Davit arm is pinned to the base and cranked to upright position with winch.

Davit Raising Winch: Manufacturer's standard manually operated hand winch with load brake for attachment between brackets on the mast and base used to raise davit arm from horizontal to vertical position.

Suspension Trolley: Captive trolley sliding along the boom flanges to allow optimum positioning of the work platform it suspends

**[Transporting Wheels]:** Non-pneumatic, resilient tired type securely attached to davit arm.

Tethers: Secure all pins and loose pieces using stainless steel cable complete with easily inserted connectors to avoid loss.

Steel Finish: **[Thermal diffusion galvanized]** **[Hot-dip galvanized]**.

Stainless Steel Finish: As fabricated.

Finish for Aluminum Components: [Mill Finish] **[Clear Anodized]**

* + - * 1. Affix permanent, non-fading, legible labels indicating maximum working load and ultimate load capacity of each davit arm and base.
			1. Outrigger Beams

1910.66(d) Outrigger means a device, used singly or in pairs, for suspending a working platform from work, storage, and rigging locations on the building being serviced. Unlike davits, an outrigger reacts its operating moment load as at least two opposing vertical components acting into two or more distinct roof points and/or attachments.

1910.66(f)(3)(ii)(A) Transportable outriggers may be used as a method of suspension for ground rigged working platforms where the point of suspension does not exceed 300 feet (91.5 m) above a safe surface. Tie-in guide system(s) shall be provided which meet the requirements of paragraph (e)(2) of this section.
1910.66(f)(3)(ii)(C) Each transportable outrigger shall be secured with a tie-down to a verified anchorage on the building during the entire period of its use. The anchorage shall be designed to have a stability factor of not less than four against overturning or upsetting of the outrigger.
1910.66(f)(3)(ii)(H) A transportable outrigger shall be tied-back to a verified anchorage on the building with a rope equivalent in strength to the suspension rope.

Outrigger Beams are routinely used to support rope descent systems, powered platforms, single worker cages or powered boatswain's chair access.

* + - * 1. Design Criteria: Design for the following:

Retain second option below for Rope Descent System use.

Minimum Rated Working Load: **[1,000 pounds (454 kg)]** **[1,250 pounds (**

Ultimate Load: [4,000 pounds (1814 kg)] [5,000 pounds]

* + - * 1. Outrigger Beam: **[Rear loop restraint (pinned)]** **[Suspension point]** **[Sliding collar]** **[Beam stand]** type designed for ease of use and transport and for installation in a manner to prevent beam from rolling.

Fabricate section lengths for connections with means of preventing pins from loosening and falling out.

Install lifting handles on top of beams near each end.

* + - * 1. Rolling Rear Loop Restraint (Pinned) Outrigger Beams: Structural aluminum M- or S-Shape beam, sized to comply with design criteria, with bolt-on anchorage point at underside of overhanging end and a restraint loop to tie-down (pin) to a stanchion-type rigid anchor at the fixed end. At the fulcrum support point, provide a braced four-wheel assembly on a post bolted to underside of beam. Provide a second transporting single-wheel on a post bolted to underside of beam near the fixed end. Weight of wheel assembly on roof shall not exceed 5 psi (34 kPa).

Fulcrum Support Wheels: **[Pneumatic]** **[Non-pneumatic]** tire type.

Transporting Wheel(s): **[Pneumatic]** **[Non-pneumatic]** tire type.

Mill finish is standard. Powder coating and anodizing are available.

Steel Finish: **[Thermal diffusion galvanized]** **[Hot-dip galvanized]**.

Stainless Steel Finish: As fabricated.

Finish for Aluminum Components: [Mill Finish]**[Clear Anodized]**

* + - * 1. Affix permanent, non-fading, legible labels indicating maximum working load and ultimate load capacity of each outrigger beam.
			1. RIGGING SLEEVES

Rigging sleeves are used to redirect suspension cables and lifelines through roofs or walls or around architectural obstructions. Wall-mounted sleeves are used with outrigger beams. Recommended when all other conventional means of performing window cleaning/maintenance cannot be used.

Used where certain building features make various areas seem inaccessible. Rigging sleeves can provide a solution when the following features exist:
• Overhangs
• Skylights
• Rotunda ceilings
• Sloped roofs
• High parapet walls
• High penthouse walls

How they work - After securing his lifeline to an independent anchorage, a maintenance worker simply ties his suspension line to the steel rod on the top/end of the rigging sleeve, removes the rigging sleeve cap, suspends both lines through the rigging sleeve, then returns to a lower level where a platform is located to secure himself and the platform to the suspension and lifelines.

* + - * 1. Design Criteria: Design to accommodate anticipated loads.

Safety Factor: 4:1

* + - * 1. Rigging Sleeves: Hollow galvanized steel pipe with wall thickness to comply with design criteria. Fabricate with straight suspension bar welded to supporting side plates for attachment of safety line connectors.

Through-Roof Rigging Sleeves: Fabricate with removable cap to accommodate push/pull outrigger beams.

Through-Wall Rigging Sleeves: Fabricate with open face, unless otherwise indicated.

Curved Rigging Sleeves: Bend with smooth radius finish to protect suspension or safety lines from chafing.

Custom fabricate in configurations and attachment methods to suit condition as follows:

For attachment to steel framing, provide **[weld plates]** **[bolt-on plates]** **[cast-in-place anchorage]** **[through-bolted plates]** **[drilled plates for epoxy anchors]** **[<insert as required>]**.

* + - * 1. Tethers: Secure all caps, pins, and loose pieces using 1/8 inch (3 mm) stainless steel cable complete with easily inserted connectors to avoid loss.
			1. WARNING LINES

Per 1910.29(d)(1)(ii) warning lines must have minimum breaking strength of 200 lbf (0.9 kN) and be erected not less than 6 feet (1.8 m) from the roof edge for work that is both temporary and infrequent, or not less than 15 feet (4.6 m) for other work.

* + - * 1. Design Criteria: Design for the following:

SEE 1910.28 OR 29
Only use Warning Line Systems on low-slope roofs (10 degrees or less).
Access path to the designated area must be clearly defined with lines meeting the same requirements as warning lines.
Adequate lighting must be provided to allow users to identify warning lines.

Constructed with wire rope or chains of at least 500 lbf (2.22 kN) tensile strength.

Flag top line at not more than 6-foot intervals with high-visibility material.

Horizontal members shall be 34 to 39 inches high and capable of withstanding a horizontal force of 16 lbf (71 N) at a point 30 inches (762 mm) high on the stanchions.

There are additional distance requirements when mechanical equipment operation is involved below.

Locate not less than 15 feet (4572) from unprotected edges.

* + - * 1. Non-Penetrating Warning Line System:

Movable Base: Formed concrete base with integrated stanchion receiver socket.

Nominal Size: 14 inch deep by 14 inch wide by 4 inch high design to prevent water ponding. Use integrated rubber pad to protect roof membrane.

Basis of Design Product: Counterweighted Warning Line Bases by Diversified Fall Protection

Roof Protection Pads: **[1/4 inch (12.7 mm)]** thick, resilient pad larger than bases and compatible with roof membrane.**[ Scrap roof membrane may be used for protection if approved by roof system manufacturer.]**

Posts: ASTM A 500/A500M, galvanized tubing.

Lines: **[Wire rope]**

Flags: Heavy duty **molded** plastic.

Finish of Component Parts: **[Hot-dip galvanized]** **[Manufacturer's standard powdercoat finish in color as selected from manufacturer's standards]**.

* + - 1. guardrails

Retain first option below for projects outside California, Retain second option below for projects in California.
29 CFR 1910.29(b) - Guard Rail Systems
Cal-OSHA §3209. Standard Guardrails

* + - * 1. Design Criteria: Design for the following:

Top rail 42 inches high and capable of withstanding a load of at least 200 lbf (0.89 kN) applied in any direction at any point.

Midrail at 21 inches high and capable of withstanding a force of at least 150 lbf (0.67 kN) applied in any downward or outward direction at any point.

First option below is federal standard; second option below is CALOSHA standard.

Supports every **[10 feet (3048 mm)]** **[8 feet (2438 mm)]**.

Maximum Assembled System Weight: Not more than 5 psi (34 kPa) at bases.

For movable railing retain "Portable" paragraph below. For permanent, non-penetrating railing retain either "Modular" or "Contoured" paragraph.

* + - * 1. Ballasted Guard Railing System: **[29 CFR 1910.29(b)]** **[Cal-OSHA §3209]** compliant, free-standing, non-penetrating, counterweighted, 42 inch high guardrail system to prevent falls from open sides of roof including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation.

Basis of Design Product: Sector Ballasted Counterweighted Guardrail by Diversified Fall Protection

Counterweighted Guardrail Bases: Cast iron with three off-centered stanchion receiver sockets.

Nominal Size: 24 inch deep by 18 inch wide by 2-1/2 inch high (609 mm deep by 457 mm wide by 64 mm high) design to prevent water ponding. Cast or smooth edges to prevent damage to roof.

Finish: Galvanized

Roof Protection Pads: **[1/4 inch (12.7 mm)]** thick, resilient pad larger than bases and compatible with roof membrane.**[ Scrap roof membrane may be used for protection if approved by roof system manufacturer.]**

Tubing: ASTM A 500/A500M, Galvanized

Rail Units: Single length pipe bent into inverted U with factory welded midrail.

Finish: **[Hot-dip galvanized]** **[Manufacturer's standard powdercoat finish in color as selected from manufacturer's standards]**.

Retain below if required for access to areas beyond the railing.

Gates: Self-closing swing gates where indicated. Match railing materials and finish.

If retaining below detail means to prevent water penetration at each post penetrating roof membranes.

* + - * 1. Permanent Penetrating Guard Railing System: See Div. 05 Section "**[METAL RAILINGS]** **[PIPE AND TUBE RAILINGS]**"."

Delete subparagraphs below if retaining above reference to a Div. 05 Section for railings.

Tubing: ASTM A 500/A500M, Galvanized.

Base Bracket: Galvanized steel plate pre-punched for screw attachment through metal roof deck with post socket bolted to base plate. Design to allow application of roof membrane patch for water tight seal.

Basis of Design Product: WeatherTite Guardrail Base Bracket by Diversified Fall Protection

Finish of Component Parts: **[Galvanized]** **[Manufacturer's standard powdercoat finish in color as selected from manufacturer's standards]**.

Retain first option below for projects outside California, Retain second option below for projects in California.
29 CFR 1910.23 - Ladders
29 CFR 1910.29(b) - Guard Rail Systems
Cal-OSHA §3212. Floor Openings, Floor Holes and Roofs
Cal-OSHA §3209. Standard Guardrails

* + - * 1. Roof Hatch Guardrails: **[29 CFR 1910.23(a)(2) and 29 CFR 1910.29(b)]** **[Cal-OSHA §3212 and §3209]** compliant system to protect open sides of roof hatch opening including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation. Designed for attachment to roof hatch curb with no roof membrane penetrations.

Product below is available in standard and custom sizes: standard sizes include 30x36, 36x36, 30x54, 48x48, 30x96.

Basis of Design Product: Safepro Roof Hatch Fall Protection Safety Rail

Retain first subparagraph below if railing system is not fully detailed on Drawings.

Height: Not less than 42 inches above finished roof deck when mounted on roof hatch cap flashing.

Posts and Rails: ASTM A 500, galvanized-steel tube, round, 1-1/4 to 1-5/8 inch size.

Normally retain first subparagraph below. Some authorities having jurisdiction do not permit chain passway barrier in 2nd subparagraph.

Rooftop Anchor, Inc. gate product is the only one patented for use as ladder extension thus eliminating the need for a ladder post extension.

Self-Closing Gate: Fabricated of same materials and rail spacing as safety railing system. Provide non-corrosive metal, self-closing, hinges opening gate away from hatch ladder. Gate shall be designed with two horizontal rungs suitable for climbing support.

Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.

Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.

Fabricate joints exposed to weather to be watertight.

Fasteners: Stainless steel, through-bolted to curb.

First finish option in paragraph below offers 5 year warranty; second finish option below offers 10 year warranty.

Finish: **[Manufacturer's standard powder coat finish]** **[Hot-dip galvanized and unpainted]**.

Color: **[Safety yellow]** **[Custom color as selected]**.

Below is an OSHA requirement for protection against objects falling over edge of traffic surfaces above people, machinery, or equipment. OSHA requires a 4" height with no more than a 1/4" gap at the bottom. Retain if required. Delete if curb or other construction under rail satisfies toe-board requirement.

* + - * 1. Toe Boards: Provide toe boards at railings around openings and at edge of open-sided roofs, floors, and platforms. Fabricate to 4 inch height above adjacent surface with no more than a 1/4 inch gap at the bottom.

Guardrails for mounting to walls and parapets are also available. Contact Diversified Fall Protection for more information and details.

* + - 1. SKYLIGHT SAFETY SYSTEMS
				1. Design Criteria: Design for the following:

Guardrails may be used in place of skylight screens and must meet the requirements of standard guardrail systems.

Verify required load below.
A Feb 16, 1984 interpretation of (then) paragraphs 29 CFR 1910.23(a)(4) and 1910.23(e)(8) reads "the skylight must at a minimum be provided with a skylight screen capable of withstanding a load of at least 200 pounds applied perpendicularly at any one area on the screen."
1910.29(e)(1) for "covers" over "holes" (which includes skylights per 1910.28(b)(3)(i)) reads "Is capable of supporting without failure, at least twice the maximum intended load that may be imposed on the cover at any one time"

Skylight covering screens shall be of such construction and mounting that they can withstand twice the maximum intended load.

* + - * 1. Skylight Screen: Non-penetrating wire screen with an angle frame for securement to skylight curb that prevents workers from stepping on, or falling through, a skylight. Designed for attachment to skylight curb with no roof membrane penetrations.

Angle Frame: 1-1/2 by 1-1/2 by 7/8 inch (38 by 38 by 4.76 mm) galvanized steel angles along two opposing edges and protruding beyond each end of the skylight frame.

Screen Wire: galvanized steel wire welded into a screen with openings not more than 4 inches square.

Guardrails used to guard skylights must meet the requirements of standard guardrail systems. If guard railing systems are not specifed above, copy and paste required language from that Article here.

* + - * 1. Movable Guardrails: **[As specified above.]** **[<copy and paste required language from GUARDRAILS Article >]**
			1. SAFETY SIGNAGE AND DATA PLATES
				1. Safety Signage: Removable, non-fading, non-corrosive, multi-language, legible, preprinted metal or plastic label. Include the following information:

The words “DANGER. Fall Protection Must be Used Beyond this Point.”

* + - * 1. Allowable Load Data Plates: Permanent, non-fading, non-corrosive, legible, preprinted metal or plastic labels complying with ANSI Z359.18. Omit for rigid anchoragess. Include the following information on data plates:

Maximum rated service or working load capacity and maximum number of users per device or system.

Manufacturer's name, address, phone number, web address, , and system serial number(s), and date of installation.

Other pertinent information.

Permanently attach to each fall protection device or system so labels will be visible to anyone seeking to use anchorage

* + - * 1. Service Labels: Removable, non-fading, non-corrosive, multi-language, legible, preprinted metal or plastic label at each overhead horizontal track system and horizontal lifeline system. Include the following information on service labels:

Installer's name, phone number, and date of original installation.

Date of latest inspection and certification.

System capacity.

Manufacturer’s name, address, phone number, web address, and date of installation.

Attach labels in manner to prevent unintentional removal

* + - 1. Steel MATERIALS
				1. Steel Plates, Shapes, and Bars: ASTM A36/A 36M.

Round steel tubing and pipe are sized differently. Pipe is designated by the terms "nominal pipe size (NPS)" in inches and by "weight" or "schedule number." The NPS is approximately equal to the ID for Schedule 40 or Standard Weight pipe. For other weights, the size is neither OD nor ID because the OD is kept the same for all weights (to allow use of the same pipe fittings) and the ID is varied to provide the required wall thickness. Round tube is designated by OD and wall thickness. Although the size designations are different, only the round tube sizes that match pipe sizes are generally available.

* + - * 1. Steel Pipe: ASTM A53/A 53M, Standard Weight (Schedule  as indicated) unless otherwise indicated.

In 2013, a new standard for HSS, ASTM A1085 Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS), was developed to enhance the performance of HSS and make designing with HSS easier and more efficient for structural engineers. ASTM A1085 has increased the lower bound bend radius to address corner cracking during galvanizing so it is much less frequent and the need for heat treatment is less common. Although the specification of A500 is still very abundant, the design and material improvements within A1085 are leading to increased availability and use in seismic, bridge, and transportation structure applications.

• ASTM A500/A500M-20 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
• ASTM A1085/A1085M-15 Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS), 2015
• ASTM A1065/A1065M-18 Standard Specification for Cold-Formed Electric-Fusion (Arc) Welded High-Strength Low–Alloy Structural Tubing in Shapes, with 50 ksi (345 MPa) Minimum Yield Point

* + - * 1. Steel Tubing: ASTM **[A1085]** **[ or ]** **[A500]** **[ or ]** **[A1065]**, cold-formed **[Hollow Structural Sections (HSS)]** **[steel tubing]**.

Below is available in 3-wire, 7-wire, and 19-wire lays and in five grades: utilities, common, Siemens-Martin, high-strength, and extra high-strength. Sizes range from 1/8 to 1-1/4 inch diameter. Zinc coating weights include Class 1 (formerly galvanized" applies only to common grade), Class A or "extra galvanized" or "double galvanized", Class B, and Class C, each having hevier coating then the previous class.

* + - * 1. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
			1. STAINLESS Steel MATERIALS

Retain next two paragraphs below if any of the following was retained above and specified to be made of stainless steel:
Alternating tread ladders
Ships' ladders
Grating

Usually retain Type 304 in first two paragraphs below; Type 316 is better for corrosive environments. The difference between 316 and 316L stainless steel is that 316L has a 0.03 max carbon and is good for welding whereas 316 has a mid range level of carbon. Both 316 alloys contain molybdenum, which also makes them more corrosion resistant. Even greater corrosion resistance is delivered by 317L, in which molybdenum content increases to 3 to 4% from the 2 to 3% found in 316 and 316L.

* + - * 1. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A 240M or ASTM A666, **[Type 304]** **[Type 316]** **[Type 316L]**.
				2. Stainless Steel Bars and Shapes: ASTM A276, **[Type 304]** **[Type 316]** **[Type 316L]** with minimum yield strength of 35 ksi.
				3. Stainless Steel Anchor Rods: **[Type 304]** **[Type 316]** **[Type 316L]** with minimum tensile strength of 100 ksi and minimum yield strength of 65 ksi.
				4. Stainless Steel Tubing: ASTM A554, **[Grade MT 304]** **[Grade MT 316L]**.
				5. Stainless Steel Pipe: ASTM A312/A312M, **[Grade TP 304]** **[Grade TP 316L]**.

Below is available in 3-wire, 7-wire, and 19-wire lays and in Types 302, 304, 305, 316, and variations. Sizes range from 13/64 to 3/8 in 3-wire, 7/32 to 1/2 in 7-wire, and 3/8 to 7/8 inch in 19-wire.

* + - * 1. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A368, Type 316.

Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

Below is available as 1x7, 1x19, 3x7, 7x7, and 7x19 constructions.

* + - * 1. Cast Stainless Steel: ASTM A747/A747M precipitation hardened casting.
			1. FASTENERS
				1. General: Select fasteners and anchors for type, grade, and class required. Unless otherwise indicated, provide fasteners as follows:

The three options below are listed best, better, good for exterior use.

Usually retain Type 304 stainless; retain Type 316 if required for corrosive environments.

ASTM F2329 specifies avg hot-dip zinc thickness of 0.0020" (50 microns).

ASTM B633 electro-deposited zinc coating classes (Service Condition = SC) - ASTM F1941 uses same designations but doesn't mention Service Conditions:
Fe/Zn 5 = SC 1 (mild) at 5 micron thickness
Fe/Zn 8 = SC 2 (moderate) at 8 micron thickness
Fe/Zn 12 = SC 3 (severe) at 12 micron thickness
Fe/Zn 25 = SC 4 (very severe) at 25 micron thickness

Material for exterior **[and interior ]**locations in contact with stainless steel **[and aluminum]**: Type **[304]** **[316]** stainless-steel fasteners.

Material for exterior locations exposed to weather: **[Type [304]** **[316]** stainless steel fasteners] **[hot-dip galvanized fasteners per ASTM F2329]** service condition].

Material for interior locations or where built into exterior walls or below roof flash point: [Hot-dip galvanized fasteners per ASTM F2329] [Zinc-plated fasteners with coating per ASTM B 633, Class Fe/Zn]

Retain Group 1 option in first paragraph below for use with Type 304; retain Group 2 option for use with Type 316.

* + - * 1. Stainless Steel Bolts and Nuts: ASTM F593 **[regular]** **[heavy]** hexagon-head annealed stainless steel bolts; with ASTM F594 hex nuts; and, where indicated, flat washers; Alloy **[Group 1]** **[Group 2]**.
				2. Stainless Steel Washers: ASTM A240/A 240M, **[Type 304]** **[Type 316]** and ANSI B18.22.1, Type A Plain.
				3. High-Strength Steel Bolts and Nuts: ASTM A325, Type 3 regular hexagon-head bolts; with ASTM A563, Grade C3 hex nuts; and, where indicated, flat washers.
				4. Steel Bolts and Nuts: ASTM A307, Grade A regular hexagon-head bolts; with ASTM A563 hex nuts; and, where indicated, flat washers.
				5. Post-Installed Anchors: Torque-controlled expansion anchors **or chemical anchors** designed for and recommended by anchorage manufacturer for conditions encountered.
			1. MISCELLANEOUS MATERIALS
				1. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
				2. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
				3. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
			2. STEEL AND IRON FINISHES

ThermaGalvTM Thermal Diffusion Galvanizing provides the same cathodic protection as HDG without the need for inefficient processing facilities that are damaging to the environment. ThermaGalv™ carries the same warranty as hot-dip products while allowing more control over application quality and delivery timelines.

Currently ThermaGalvTM is only offered for rigid anchors.

* + - * 1. Thermal Diffusion Galvanizing: Proprietary, factory-applied, thermal diffusion coating applied per AWS C2.2, 1967 Edition "Recommended Practices for Metallizing with Aluminium and Zinc for Protection of Iron and Steel" and providing the same warranty and corrosion protection as hot-dip galvanizing.

Basis of Design Product: ThermaGalvTM by Diversified Fall Protection

Substitutions will [not] be considered.

Hot-Dip Galvanization (HDG) has been the standard for corrosion protection in manufacturing but cannot be done in-house, is labor intensive, has a high energy requirement, represents a large carbon footprint which is hard on the environment, and it requires shipping products from manufacturer to galvanizer and back.

* + - * 1. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

Retain subparagraph below if galvanized items are painted.

Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

* + - * 1. Pigmented Organic Finish: Manufacturer's standard **[powder coat]** comparable in performance to AAMA 621 coatings.

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Color: **[High visibility yellow]** **[As selected from manufacturer's full range]**.

1. EXECUTION
	* + 1. INSTALLERS

Under most standard forms of contract, any installer who can perform the work as specified is acceptable. The two primary reasons to list names of installers are (1) to contractually limit the Contractor's options and (2) to give the Contractor the information necessary to find an installer who can do the work specified. Examples of work that might require limiting the Contractor's options are historical restoration work, testing and balancing of mechanical systems, and special finishes where an unusually high level of workmanship is required. When using this Article, coordinate its use with Part 1 Article "Qualifications." If installer names are listed, use the Article "Substitution Limitations" to define the purpose of the installer list. The term "Installers" may be replaced by "Applicators," "Erectors," or "Constructors," as appropriate to the operation to be performed.

Retain "Installers" Paragraph below if a list of preapproved firms is used as a quality-control procedure. Retain first or second option if additional firms will not be considered; retain third option if they will. If retaining third option, include procedure for approving other firms in the Instructions to Bidders.

The term "Installers" may be replaced by "Applicators," "Erectors," or "Constructors," as appropriate to the operation to be performed.

* + - * 1. Installer List: Installation contractor shall be trained or qualified by the manufacturer.

See association member lists for names of potential firms.

* + - 1. EXAMINATION
				1. Verification of Conditions:**[<insert as required**

**Examine walls, roofs, and other mounting surfaces for suitable conditions where fall protection equipment will be installed**for compliance with requirements for, installation tolerances, operational clearances, and other conditions affecting performance of work.

Verify that **structural** members to which anchorage is to be attached have adequate bearing surface required to ensure proper attachment per manufacturer's requirements.

Delete subparagraph below if not required.

Proceed with installation only after unsatisfactory conditions have been corrected.

* + - 1. PREPARATION
				1. Coordinate location of fall protection equipment indicated to be attached to permanent structure elements or surface of roofing system and provide appropriate anchoring devices with installation templates, diagrams, and manufacturer's instructions.
			2. INSTALLATION, GENERAL
				1. Comply with manufacturer's written installation instructions and recommendations, referenced standards, requirements of authorities having jurisdiction, and approved submittals.
				2. Securely and rigidly install products in place to obtain the required working loads without exceeding allowable loads for each item of fall protection equipment.
				3. Field Welding: Welding methods shall comply with AWS D1.1
				4. After installation, clean and paint as necessary any field welds with cold galvanizing compound to prevent corrosion.Fastening to In-Place Construction: Provide anchorage devices and fasteners where fall protection devices are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

Install fasteners in accordance with fastener manufacturer's recommendations to obtain the allowable working loads published in their product literature.

Retain first option below to allow for future intentional removal of bolts.

**[Apply thread-locking fluid or deform threads of tail end of anchor studs after nuts have been tightened** to prevent accidental removal or vandalism at pedestrian accessible equipment

* + - * 1. Coordinate installation of flashed roof anchorage with roofing trades to ensure a roofing manufacturer-approved, water-tight flashing method is used.
			1. REPAIR

Div. 01 Section "Execution" covers general requirements for repairing, replacing, or restoring defective and damaged new and existing work other than operating products, systems and equipment.

Describe how existing work is to be repaired and/or restored.

* + - * 1. Repairing Damaged Finishes: Immediately after installation, clean **field welds and/or** abraded and other areas where coatings are damaged.

Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish per manufacturer's written instructions.

* + - 1. FIELD QUALITY CONTROL
				1. Manufacturer's Field Services:

Delete the option in the following paragraph if the manufacturer is also the installer.

Require product manufacturers to provide field surveillance of the installation of their products and to **[observe installation of equipment and ]**assist in Owner's demonstration and training.

Delete subparagraph below if the manufacturer is also the installer.

Monitor and report installation procedures, and unacceptable conditions.

Engage manufacturer's Qualified Person to perform field tests and inspections and to prepare test reports.

* + - * 1. Testing Services: Testing and inspecting of completed applications of fall protection equipment work shall take place in successive stages as facility fall protection equipment is installed. Do not proceed with work for the next area until test results for previously completed applications of work show compliance with requirements.

Prepare a written report to Contractor with copy to Architect and Owner including the date and results of the inspection, the signature of the person who performed the inspection, and the number, or other identifier, of the building support structure and equipment which was inspected.

* + - * 1. Do not load or stress system until materials and fasteners are properly installed and ready for service.
				2. Field Tests: Test using load cell test apparatus in accordance with applicable OSHA and ANSI requirements, supervising engineer, and manufacturer’s recommendations.

Test 100 percent of anchorage that rely on chemical adhesive fastening.

Serviceability load testing is not required for Type A anchorage by ANSI Z359.

Test **[Type T]** anchorage by applying the greater of twice the working load or 2,500 pounds (1134 kg), applied at up to 900 pounds (408 kg) per minute and maintained for at least 3 minutes.

Test **[Type D]** anchorage by applying the greater of twice the working load or 450 pounds (204 kg), applied gradually over at least 1 minute and maintained for at least 3 minutes.

Test tension of cable lifelines using a calibrated tension meter.

* + - * 1. Field Inspections:

Inspect each anchorage attachment to building structure for proper installation.

**[Inspect operating equipment as recommend by equipment manufacturer.]**

* + - * 1. Remove and replace work where test results indicate that it does not comply with specified requirements.
				2. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
				3. Do not allow use of fall protection equipment until users have been trained in the use of the systems.
			1. ADJUSTING
				1. Verify that products have been installed in accordance with manufacturer's instructions.
				2. Adjust facility fall protection components to function smoothly and safely and as necessary to ensure compliance with reference standards.
				3. Correct component deficiencies to assure compliance prior to Substantial Completion
			2. CLOSEOUT ACTIVITIES
				1. Demonstration: Demonstrate function, operation, maintenance, and safety procedures for each fall protection component.

State requirements for demonstrating, instructing, and training Owner on sequence of operations, general facility operation, and facility maintenance procedures.

State requirements of the installer or manufacturer to demonstrate the proper operation of equipment.

State requirements of the installer or manufacturer to train the Owner's personnel in the operation and maintenance of equipment for ongoing facility management and maintenance.

* + - * 1. Training: Train Owner's personnel in proper use and maintenance of facility fall protection equipment.

Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

* + - 1. PROTECTION
				1. Protect roof surfaces from damage during installation.
			2. RECERTIFICATION AGREEMENT
				1. Agreement: Furnish a proposal to Owner for an annual recertification program per the manufacturers recommendations.

Furnish proposal in the form of a standard yearly agreement.

State services, obligations, conditions, and terms for agreement period and for future renewal options.

END OF SECTION 11 81 29

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