SECTION 11 81 29 - Exterior BUILDING MAINTENANCE SYSTEM

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. These performance specifications shall be read in conjunction with the Exterior Building Maintenance design drawings that are part of the construction documentation for this trade package, specifically sheets with “EBM” prefix.
				2. Provide all design, engineering, materials, manufacturing, and installation labor required to deliver a compliant Facility Fall Protection and Exterior Building Maintenance (EBM) system. This project will result in an overall system complete with the designated equipment, professional documentation, and specific work. Where noted, provisions marked **[California Projects]** shall only apply to projects located within the State of California. Projects are subject to omission in other states.
				3. Work excluded:

Fixed Ladders and other related access equipment

Electronic two-way communication devices

Electrical power receptacles and NEMA standards as identified on drawings

Water supply hose bibs as identified on drawings

Waterproofing, flashings, etc

Reinforcing of the building structure as required to withstand design loads. All loads transferred to the building structure by the equipment in this section are to be clearly denoted on drawings and calculations for review of the overall Structural Engineer of Record.

All parapets or building components upon which safety lines are resting to be designed with consideration of the dynamic loading from the potential shock loading of a fall arrest incident.

Operating Procedures Outline Sheet (OPOS)

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

**[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.

**[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.

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

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."

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."

**[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."

**Cal/OSHA Title 8, GISO, Articles 5 and 6.**

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

American Society of Mechanical Engineers (ASME) / ANSI A120.1 Safety Requirements for Powered Platforms for Building Maintenance

* + - 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.

* + - * 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.

* + - 1. INFORMATIONAL SUBMITTALS
				1. Manufacturers’ instructions for each product.
				2. Sustainable Design **[LEED]** Submittals:

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

* + - * 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.

Certification

Provide a written Certificate of Compliance for all components and equipment installed under this specification certifying the following:

All components and equipment have been manufactured and installed according to all Project requirements.

The components and equipment have been inspected and tested according to the provisions of Section 3.06 and have passed.

The system is operational and ready for owner turnover.

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.

**[California Projects: Operating Procedures Outline Sheet (OPOS)]:**

Submit an Operating Procedures Outline System (OPOS) including necessary elements in both pictorial and written form, to instruct employees in safe use of roof supported building maintenance equipment or window cleaning procedures not covered by California Labor Code orders. Ensure that OPOS contains as a minimum, elements as follows:

 Isometric or plan view pictorial drawing of building's roof, including building's name, address, and date OPOS was prepared. Ensure drawing is legible and kept with building's written assurance.

 Identification of drop zones, recommended drop sequences, scaffold configurations, and specific building maintenance procedures including equipment to be used.

 Identification of anchorage points for personal fall arrest systems and building maintenance equipment.

 Identification of personal fall protection requirements and procedures for securing equipment.

 Identification of dangerous areas on roof by highlighting of "Danger Zone" on pictorial drawing.

 Description of means and methods to be used to transfer equipment from drop location or between building levels.

 Identification of equipment limitations, load ratings, and special use conditions.

 Provisions for pre-operational, operation and maintenance inspections.

 Identification of access and egress to work locations and storage area(s) for permanent or transportable building maintenance equipment.

 Indication of location and method of stabilization provided for suspended equipment.

 Emergency and rescue procedures and means of communications to be used during such procedures.

 Method to be used to control employee exposure to falls while in "Danger Zone."

* + - 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.

**[California Projects]:** All equipment is to be manufactured and installed by a manufacturer possessing a current and valid Scaffold Inspection and Testing Agency (SIT) designation by the California Department of Industrial Relations, Division of Occupational Safety and Health.

Manufacturer shall maintain specific liability insurance (products and completed operations) in the amount of **[$10,000,000.00]** 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.

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

Design Professional Qualifications:

Professional engineer experienced in design and engineering of fall protection equipment, its application and safety requirements, licensed in jurisdiction in which Project is located, and who assumes responsibility for the following:

Preparation of engineering calculations.

Preparation of shop drawings and other submittals.

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:

Inspection certificates for fall protection equipment. CCR Title (8) 3282 and 3296.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Delivery Requirements: Deliver materials in manufacturer’s undamaged packaging, complete with installation instructions.
			2. 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:

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
				1. Manufacturers: Subject to compliance with requirements, provide products as furnished by the following:

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

**[Rigid Anchorages]**

**[Intermittent stabilization anchorage]**

**[Horizontal lifelines]**.

**[Vertical lifelines]**

**[Rigid** **trolley rails]**

**[Overhead monorails]**

**[Davit assemblies]**

**[Outrigger beams]**

**[Rigging sleeves]**

**[Ballasted** **guard rails]**

**[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. performance / design criteria
				1. The complete Facility Fall Protection system including individual components and overall functionality is to be design by or under the direction of a Professional Engineer registered in the state where the project is located. Duties and responsibilities include verification that all components supplied comply with the applicable portions of section 1.03(C) above.
			2. RIGID ANCHORAGE
				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 A Anchorages, Designed for an active fall protection system: Minimum Safety Factor: 2:1

Type T Anchorages, Designed to support a suspended component/tie-back line or for an active fall protection system: **[5,000 pounds (2268 kg)]**

**Supports for suspended platforms including davits, rigging sleeves, and monorail:**

Vertical Service Load: 1,000 lbs minimum

Fracture / Ultimate Load: 4,000 lbs minimum

* + - * 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.

Loop: Galvanized steel and designed for a minimum 5,000 lbs factored load applied in any direction of the attachment point without any permanent deflection. The inside diameter of all anchor loops shall be no less than 2”.

Stanchion Post: Galvanized steel **pipe**, with wall thickness to comply with design criteria. Posts are to be filled with polyurethan foam.

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: 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

Loop:. Galvanized steel and designed for a minimum 5,000 lbs factored load applied in any direction of the attachment point without any permanent deflection. The inside diameter of all anchor loops shall be no less than 2”.

Baseplate: Provide galvanized steel baseplate as required to facilitate attachment to structure and with thickness to comply with design criteria.

Steel Finish: Hot-dip galvanized.

Stainless Steel Finish: As fabricated.

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

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” or 20’-0” lengths.

Maximum allowable force on rail: 2,700 lbs

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

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.

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

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

* + - 1. OVERHEAD Suspended Access Monorail SYSTEMS

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:

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.

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 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: 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.

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

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

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

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.

* + - * 1. Overhead Horizontal Track System: Hands-free fixed track type for overhead **[suspended]** **[direct]** mounting from structure. Design system for 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

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

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

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

* + - 1. INTERMITTENT STABILIZATION ANCHORS
				1. Stabilization anchoring systems must be installed in buildings over 130 ft.

Horizontal spacing: Equal to the center-to-center distance of the stage platform suspension wire ropes at all required service drop positions.

Vertical spacing: First anchor to be 50 ft maximum from top of building. Vertical distance between anchors below must be 50ft or (3) floors, whichever is less.

Ultimate Strength: 600 lbs in any direction

Coordinate location and method of connection with the wall supplier.

Façade Maintenance Equipment contractor to provide shop drawings indicating the location, loads imposed and structural requirements of the intermittent stabilization system.

* + - * 1. Detent Pin Intermittent Stabilization Anchors

ISA Receptacles: Mounted to Structure with attachment as coordinated

Lanyards: SS vinyl coated, with adjustable length and sufficient quantity for use along the building elevation.

* + - 1. LADDER SAFETY SYSTEMS
				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

MSA Latchways Vertical Ladder Lifeline Kits

Anchorage: Design for anchorage to fixed ladders 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]**; 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
				1. Design Criteria: Design for the following:

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

Roof-rigged davit systems

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

Davit Height: **[As required based on design conditions, 13’-0” max]**

* + - * 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.

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.]**

Base Mounting: Provide galvanized steel baseplate where indicated on construction drawings to facilitate attachment to structure and with thickness to comply with design criteria

Mast: Round aluminum tube capable of rotating 360 degrees in socket. Equip with carrying handles, connecting pins, and **[dual wheels]** 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 shape with end brackets, angle-braced to mast with fastenings bolted to boom and mast.

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: Hot dip galvanized.

Stainless Steel Finish: As fabricated.

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

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.

Steel Finish: 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
				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
				1. Design Criteria: Design for the following:

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.

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

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

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

Basis of Design Product: SafePro Counterweighted Warning Line Bases

Roof Protection Pads: **[1/4 inch (12.7 mm)]** thick, resilient pad larger than bases and compatible with roof membrane.

Posts: ASTM A 500/A500M, galvanized tubing.

Lines: Stainless Steel Vinyl Coated Wire rope

Flags: Heavy duty molded plastic.

Finish of Component Parts: Hot-dip galvanized

* + - 1. 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) [**California Projects:** or 20 plf, whichever is greater] applied in any direction at any point. [**California Projects**: At rigging locations, 50 plf shall be applied.]

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.

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

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]**.

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

* + - * 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.

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

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.

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.

Fasteners: Stainless steel, through-bolted to curb.

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

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

* + - 1. Steel MATERIALS
				1. Steel Plates, Shapes, and Bars: ASTM A36/A 36M.
				2. Steel Pipe: ASTM A53/A 53M, Standard Weight (Schedule  as indicated) unless otherwise indicated.
				3. Steel Tubing: ASTM A500 Hollow Structural Sections (HSS)
				4. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
			2. STAINLESS Steel MATERIALS
				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]**.
				6. 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.

* + - * 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:

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]

* + - * 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 anchorsor 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
				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.

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

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

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

Proceed with installation only after unsatisfactory conditions have been corrected.

* + - 1. 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.
				5. 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, 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.

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. REPAIR
				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. Functional Testing

Manufacturer's Field Services:

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

Testing Services: The following inspections and tests shall be conducted on components and installed equipment to ensure compliance with this specification and full operational functionality of the overall system. Any material, equipment functionality and operational deficiencies noted as a result of these inspections and tests shall be corrected and re-inspected/tested to verify compliance with this specification. .

Each anchorage is to be tested in a manner as prescribed by the manufacturer.

Inspect operating equipment as recommended by equipment manufacturer.

Prepare a written report to Contractor 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 equipment which was inspected.

* + - * 1. Do not load or stress system until materials and fasteners are properly installed and ready for service.
				2. Remove and replace work where test results indicate that it does not comply with specified requirements.
				3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
			1. ADJUSTING
				1. Adjust facility fall protection components to function smoothly and safely and as necessary to ensure compliance with reference standards.
			2. CLOSEOUT ACTIVITIES
				1. Demonstration: Demonstrate system function, operation, maintenance, and safety procedures to owner’s designated representative. .
				2. 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. Maintenance 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