

Specification Guide Note: This specification section is written following the recommendations of the Construction Specifications Institute (CSI) Project Resource Manual, including **MasterFormat™**, **SectionFormat™** and **PageFormat™**. Optional text is indicated by brackets []; delete optional text in final copy of specification. Specification Guide Notes precede specification text; delete notes in final copy of specification. Trade/brand names with appropriate product model numbers; styles and types are used in Specification Guide Notes and in the specification text Article titled "Acceptable Material". Metric conversion, where used, is shown in parentheses ().

Specification Guide Note: Revise the section number and title below to suit project requirements, specification practices and section content. Refer to CSI **MasterFormat** for other section numbers and titles, which may be suitable for the project.

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: This Section specifies design, supply and installation of window washing systems and suspended maintenance equipment.

1.02 RELATED SECTIONS

Specification Guide Note: Include in this Article only those sections that directly affect the work of this section. Do not include Division 00 or Division 01 sections since it is included that all technical sections are related to all project Division 00 and Division 01 sections to some degree.

- A. Section [01 31 19 – Project Meetings]
- B. Section [01 61 00 – Common Product Requirements]
- C. Section [01 74 00 – Cleaning and Waste Management]
- D. Section [03 30 00 - Cast-in-Place Concrete: concrete runway, piers and sleepers for roof cars].
- E. Section [05 05 23 - Metal Fastenings: horizontal lifeline fasteners].
- F. Section [05 50 00 - Metal Fabrications: monorail and davit system cantilevered support brackets].
- G. Section [07 62 00 - Sheet Metal Flashing and Trim: aluminum flashing for davit bases].
- H. Section [08 44 00 - Curtain Wall and Glazed Assemblies: mullion and stabilization co-ordination].
- I. Section [26 00 00 - Electrical: climbing monorail power supply].
- J. Section [26 25 00 - Enclosed Bus Assemblies: climbing monorail busbar].
- K. Section [01 78 00 - Closeout Submittals].

Specification Guide Note: Article below may be omitted when specifying manufacturer's proprietary products and recommended installation. Retain Reference Article when specifying products and installation by an industry reference standard. Indicate issuing authority name, acronym, standard designation and title. Contract Conditions or Section 01 42 19 - Reference Standards may establish the edition date of standards. This Article does not require compliance with standard, but is merely a listing of references used. Article below should list only those industry standards referenced in this section. Retain only those reference standards to be used within the text of the project specific Section. Add and delete as required for specific project.

1.03 REFERENCES

- A. American Institute of Steel Construction (AISC).
 - 1. AISC S342L [1993], Load and Resistance Factor Design Specification for Structural Steel Buildings (including Supplement No.1).
- B. Aluminum Association (AA).
 - 1. AA DAF 45, Designation System for Aluminum Finishes.
 - 2. AA ADM-1 [2000], Aluminum Design Manual.
- D. American Society of Mechanical Engineers (AMSE).
 - 1. ASME A120.1 [2006], Safety Requirements for Powered Platforms and Traveling Ladders and Gantries for Building Maintenance.
- E. American National Standards Institute / International Window Cleaning Association (ANSI/IWCA).
 - 1. ANSI/IWCA I-14.1 [2006], Window Cleaning Safety Standard.
- F. American Welding Society (AWS).
 - 1. AWS D1.2/D1.2M [2003], Structural Welding Code - Aluminum.
 - 2. AWS D1.1/D1.1M [2006], Structural Welding Code—Steel.
- G. ASTM International (ASTM).
 - 1. ASTM A123/A123M [2002], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A167 [1999 (2004)], Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip.
 - 3. ASTM A276 [2006], Standard Specification for Stainless Steel Bars and Shapes.
 - 4. ASTM A492 [1995 (2004)] Standard Specification for Stainless Steel Rope.
 - 5. ASTM B221 [2006], Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- H. International Code Council (ICC).
 - 1. International Building Code.
- I. Occupational Safety and Health Administration (OSHA).
 - 1. OSHA 1910, Subpart D, Walking and Work Surfaces.
 - 2. OSHA 1910, Subpart F, Appendix C, Personal Fall Arrest Systems.
 - 3. OSHA Ruling on Window Cleaning by Bosun's Chair.
 - 4. OSHA 1910.66 Subpart F, Powered Platforms.
- J. National Roofing Contractor's Association (NRCA)

1. The NRCA Roofing and Waterproofing Manual, Fifth Edition.

K. Uniform Building Code (UBC).

1.04 ACTION SUBMITTALS

A. General: Submit listed action submittals in accordance with Contract Conditions and Section [01 33 00 - Submittal Procedures].

B. Shop Drawings: Indicate information on shop drawings as follows:

1. Submit shop drawings showing complete layout and configuration of window cleaning and suspended maintenance system, including components and accessories.
2. Indicate design and fabrication details, window "drops", hardware, and installation details.
3. Include installation and rigging instructions and:
 - a. Required restrictive working usage and general safety notes.
 - b. Non-restrictive working usage and general safety notes.

Specification Guide Note: Owner or Owner's representative may request either submission of calculations or test reports, or they may require submission of both. Edit the following Paragraph to meet project requirements.

4. Ensure Shop Drawings are reviewed by Engineer licensed in State of [_____] and submit [calculations] [and] [test reports] to [Architect] [Consultant] [Owner].

C. Samples as follows:

1. [Duplicate] [12] inches ([305] mm) samples of monorail sections.
2. [_____].

D. Submit product data, including manufacturer's technical data sheet, for specified products.

1.05 INFORMATION SUBMITTALS

A. Quality Assurance:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
3. Manufacturer's installation instructions.

Specification Guide Note: Include the following Article for projects in California.

B. Operating Procedures Outline Sheet (OPOS):

Specification Guide Note: An OPOS establishes safe window cleaning and exterior maintenance procedures for buildings and structures.

1. 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:

- a. 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.
- b. Identification of drop zones, recommended drop sequences, scaffold configurations, and specific building maintenance procedures including equipment to be used.
- c. Identification of anchorage points for personal fall arrest systems and building maintenance equipment.
- d. Identification of personal fall protection requirements and procedures for securing equipment.
- e. Identification of dangerous areas on roof by highlighting of "Danger Zone" on pictorial drawing.
- f. Description of means and methods to be used to transfer equipment from drop location or between building levels.
- g. Identification of equipment limitations, load ratings, and special use conditions.
- h. Provisions for pre-operational, operation and maintenance inspections.
- i. Identification of access and egress to work locations and storage area(s) for permanent or transportable building maintenance equipment.
- j. Indication of location and method of stabilization provided for suspended equipment.
- k. Emergency and rescue procedures, and means of communications to be used during such procedures.
- l. Method to be used to control employee exposure to falls while in "Danger Zone."

Specification Guide Note: Coordinate Paragraph below with Part 3 Field Quality Requirements Article. Retain or delete as applicable.

C. Manufacturer's field reports specified.

1.06 CLOSEOUT SUBMITTALS

A. Submit 1-year standard manufacturer warranty documents specified.

B. Operation and Maintenance Data: Submit Operation and Maintenance data for installed products in accordance with Section [01 78 00 - Closeout Submittals].

1. Include:
 - a. Manufacturer's instructions covering maintenance requirements and parts catalog giving complete list of repair and replacement parts with cuts and identifying numbers.
 - b. [1] copy of system Equipment Manual & Inspection Log Book, with "Initial Inspection - Certification for Use" and "Inspection Sign-Off" forms completed.
 - c. [2] copies of reduced, "as-built shop drawing" showing equipment locations and details. Ensure drawing is posted adjacent exits to roof.

A. Qualifications:

1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

Specification Guide Note: Article below should list obligations for compliance with specific code requirements particular to this section. General statements to comply with a particular code are typically addressed in Contact Conditions and Section 01 41 00 - Regulatory Requirements. Repetitive statements should be avoided. Current data on building code requirements and product compliance may be obtained from manufacturer technical support specialists.

B. Regulatory Requirements.

Specification Guide Note: Window washing equipment systems must also meet the requirements of building codes and zoning bylaws issued by Federal, State and local government authorities having jurisdiction. Ensure that project specification section reflects the need to meet these requirements. Edit Article below as applicable.

1. Comply with [Uniform Building Code (UBC)] [International Building Code (IBC)] [Building Code for [State] [City] of [_____]].
2. Comply with OSHA regulations as follows:
 - a. 1910, Subpart D, Walking and Working Surfaces.
 - b. Appendix C to 1910 Subpart F, Personal Fall Arrest Systems.
 - c. OSHA Ruling on Window Cleaning by Bosun's Chair.
 - d. 1910.66, Subpart F, Powered Platforms.

Specification Guide Note: Include the following Paragraph for projects in California.

3. Comply with California State regulations as follows:
 - a. Code of Regulations, Title 8 - Industrial Relations, Article 5 (Window Cleaning), Article 6 (Powered Platforms for Exterior Building Maintenance), and Appendix C to Article 6 (Personal Fall Arrest System).

C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with [Section 01 31 19 - Project Meetings].

1.08 DELIVERY, STORAGE AND HANDLING

A. General: Comply with [01 61 00 - Common Product Requirements].

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery:

1. Deliver materials in manufacturer's original packaging with identification labels intact and in sizes to suit project.

- D. Storage and Protection:
1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
- E. Transportation and Handling:
1. Ensure center of gravity of davits weighing [80] lbs ([36.3] kg) or greater remains [36] inches ([915] mm) maximum above safe surface while transporting.
 2. Ensure davits requiring [80] lbs ([36.3] kg) or greater lifting effort are equipped with are equipped with mechanical means of hoisting into position.
- F. Packaging Waste Management:

Specification Guide Note: The disposal of packaging waste into landfill sites demonstrates an inefficient use of natural resources and consumes valuable landfill space. Specifying appropriate packaging and construction waste management and disposal procedures may contribute to points required for LEED® construction project certification. Specify Leed requirements for project here.

1. Separate waste materials for [reuse] [and] [recycling] [_____] in accordance with [Section 01 74 19 - Construction Waste Management and Disposal] [_____].

Specification Guide Note: Manufacturer may take back packaging and delivery materials for recycling.

2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] [_____] packaging material [in appropriate onsite bins] [_____] for recycling.

1.09 PROJECT AMBIENT CONDITIONS

- A. Installation Location: Assemble and erect components only when temperatures are above [40] degrees F ([4] degrees C).

1.10 SEQUENCING

- A. Sequence with other Work and Comply with window washing equipment manufacturer's written recommendations for sequencing construction operations.

Specification Guide Note: Coordinate Article below with Contract Conditions and with 01 78 36 - Warranties.

1.11 WARRANTY

- A. Project Warranty: Refer to Contract Conditions for additional project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

Specification Guide Note: Coordinate Article below with manufacturer's warranty requirements.

- C. Warranty: Commencing on date of substantial completion set by [Owner] [Architect] [Consultant].

2.01 MANUFACTURERS

- A. Ensure manufacturer has minimum [5] years experience in manufacturing window washing and suspended maintenance system components similar to or exceeding requirements of project.
- B. **Manufacturer's Insurance:** Ensure manufacturer carries liability insurance to protect against product and system failure in amount of [five million dollars US (\$5,000,000)] minimum.

Specification Guide Note: Retain Article below for proprietary method specification. Add product attributes, performance characteristics, material standards and descriptions as applicable. Use of such phrases as "or equal" or "or approved equal" or similar phrases may cause ambiguity in specifications. Such phrases require verification (procedural, legal and regulatory) and assignment of responsibility for determining "or equal" products.

2.02 PROPRIETARY PRODUCTS AND SYSTEMS

- A. **Manufacturer:** Pro-Bel Group of Companies, Phone: (905) 427-0616, USA Toll Free: (800) 461-0575, Fax: (905) 427-2545, E-mail: info@pro-belgroup.com, Internet URL: <http://www.pro-belgroup.com>

2.03 DESIGN PERFORMANCE REQUIREMENTS

- A. Design window cleaning and suspended maintenance system to suit project requirements to [AISC S342L] [and as indicated].
- B. Locate anchorages to suit suspension equipment specified.
- C. Design anchor components for cleaning and suspended maintenance equipment to [ASME A120.1].
 - 1. Ensure compatibility with industry standard equipment.
 - 2. Anchorage and anchor components: Designed by Engineer qualified in design of window cleaning and suspended maintenance equipment and licensed in State of [_____].
- D. Design system fall arrest safety anchors and equipment supports to [AISC S342L (including supplement No.1)] [and ANSI/IWCA I-14.1], and as follows:
 - 1. Comply with OSHA 1910, Subpart F, Appendix C.
 - 2. Supports for Suspended Platforms including davits, rigging sleeves and monorail:
 - a. Safety factor against fracture or detachment: 4 to 1.
 - a. Vertical service load: [1000] lbs ([4.45] kN) minimum.
 - b. Rated load against fracture: [4000] lbs ([17.8] kN) minimum.
 - 3. Fall Arrest Safety Anchors:
 - a. Fall arresting force safety factor of 2 to 1 without permanent deformation: [1800] lbs ([8.0] kN) minimum.

Specification Guide Note: For projects in California specify fall arrest force against fracture or detachment of 5400 lbs (24 kN) minimum.

- b. Fall arrest force against fracture or detachment: [5,000] [5,400] lbs ([22.4] [24] kN) minimum.
- E. Trolley Systems: Design, fabricate and finish trolleys to ensure no structural or mechanical deterioration over designed life that could affect security and operation considering permanent exposure to elements.
 - 1. Provide rotating components with sealed-for-life rolling element bearings protected from environment.

2.04 EQUIPMENT

Specification Guide Note: Edit the following list to include only those pieces of equipment that meet the requirements for the project.

- A. Anchors.
- B. Davits.
- C. Outrigger Beams.
- D. Monorails.
- E. Horizontal Trolley Rail Systems.
- F. Permanent Powered Platforms.
- G. Work Cages.
- H. Rigging Sleeves.
- I. Hands-Free Horizontal Lifelines.
- J. Double Lanyard Horizontal Lifeline Systems.
- K. Davit Carriages.
- L. Traveling Gantries.
- M. Rolling Ladders.
- N. Powered Roof Cars
- O. [_____].

Specification Guide Note: As well as items listed in the following Article, a complete Anchor system may also include other items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

Specification Guide Note: Delete the following Paragraph for projects in California.

- A. Safety U-bars: [Stainless steel to ASTM A276, Type 304 with [35] Ksi ([240] MPa) minimum yield strength] [Mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M].
1. U-bar: [0.75] inches ([19] mm) minimum diameter material with [1.5] inches ([38] mm) eye opening.

Specification Guide Note: Specify safety anchor eye plates for projects in California.

- B. Safety Anchor Eye Plate: Mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M.
1. Plate: [0.875] inches ([22] mm) diameter material with [2] inches ([50] mm) eye opening.
- C. Hollow Steel Section (HSS) Piers: Mild steel, Type 300W with [50] Ksi ([350] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M] [manufacturer's polyurethane/polyurea coating system].
1. Wall thickness [to suit application] [as indicated].
- E. Plate and other sections: Mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M] [manufacturer's polyurethane/polyurea coating system].
1. Wall thickness [to suit application] [as indicated].

Specification Guide Note: Specify aluminum flashing for BUR or modified bitumen roofs only (membrane above or below insulation). For single ply roofs, refer to roofing membrane manufacturer's written instructions. Specify conformable mastic tape and heat-shrink rubber collar flashing for PBE Series roof anchors (BUR or modified bitumen roofs) or stainless steel cap for Pro-Bel series roof anchors for all roof types.

- F. Seamless Spun Aluminum Flashing (for Roof Anchors): To AA ADM-1 Type 6061-T6 alloy and to ASTM B221.
1. Deck flange flashing: [To NRCA Roofing and Waterproofing Manual recommendations] [In accordance with Section 07 62 00 Sheet Metal Flashing and Trim], [conformable mastic tape and torch applied heat-shrink rubber collar flashing] [detachable watertight stainless steel cap].
 2. Acceptable material: Pro-Bel Group, Aluminum Deck Flange Flashing.
- G. Miscellaneous Bolts, Nuts and Washers: [Mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M] [Stainless steel to ASTM A276, Type 304 with [35] Ksi ([240] MPa) minimum yield strength].

Specification Guide Note: As well as items listed in the following Article, a complete Davit system includes some or all of those items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

Specification Guide Note: Edit the following Paragraphs to suit project requirements.

- A. Davit Booms: [Ground] [Roof] rigged, aluminum sections of engineered length and size [to suit application] [as indicated], equipped with: carrying handles; [stainless steel rolling trolley] [stainless steel friction trolley] [galvanized fixed shackle] on outboard end, designed to carry [1000] lbs ([4.5] kN) vertical service load, minimum.
1. Ensure non-corrosive UV resistant data plate stating Maximum Service Capacity of boom, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed.
- B. Davit Masts: Round tubular [aluminum][steel] section capable of rotating through 360° with carrying handles and connecting pins.

Specification Guide Note: Maximum allowable weight of davit arm pieces is 80 lbs (36.3 kg) throughout the USA with the exception of projects in California which allows pieces to be 140 lbs (73 kg) without mechanical means of hoisting into position.

- C. Davit Arms: Davits to be demountable, portable, capable of being easily and quickly broken down into pieces weighing [80] [140] lbs ([36.3] [73] kg) maximum.
1. Ensure davit arm booms equipped with rolling trolleys or friction trolleys have stops to prevent detachment from boom.

Specification Guide Note: For tall davit arms greater than 6 feet (1.83 m) high, specify hoisting winches to safely raise and lower davit arms and dolly wheels to roll davit arms into place.

2. Provide hoisting winches and dolly wheels.

Specification Guide Note: U-bar safety (lifeline) anchors secured to davit bases are optional. If lifeline anchors are required farther back on the roof refer to manufacturer's written instructions.

- D. Davit Bases: Round, mild steel, hollow section piers, Type 350W with [50] Ksi ([350] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M] [manufacturer's polyurethane/polyurea coating system] [with [0.75] inches ([19] mm) diameter U-bar safety anchor, and securement [to suit application] [as indicated].
- E. Acceptable Material: Pro-Bel Group, Davit System

Specification Guide Note: As well as items listed in the following Article, a complete Outrigger Beam system includes some or all of those items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

2.07 OUTRIGGER BEAMS

- A. [Aluminum "I" beam] [Galvanized steel "I" beam] [Galvanized hollow steel section] of engineered length and size [to suit application] [as indicated], equipped with shackle] [friction U-bar] [trolley] on outboard end and designed to carry [1000] lbs ([4.5] kN) vertical service load, minimum.

1. Ensure non-corrosive UV Resistant data plate stating Maximum Service Capacity of boom, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed.
2. Ensure outrigger beams equipped with rolling or friction trolleys have stops to prevent detachment from beam.

Specification Guide Note: Some very long outrigger beams are designed specifically for bosun's chairs with descent control equipment. For this restrictive application, vertical service load will be less than 1000 lbs (4.5 kN). Refer to Pro-Bel's instructions for bosun's chair applications.

3. Safety U-bars: [Stainless steel to ASTM A276, Type 304 with [35] Ksi ([240] MPa) minimum yield strength] [mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M].
 - a. U-bar: [0.75] inches ([19] mm) minimum diameter with [1.5] inches ([38] mm) minimum eye opening.
- B. Outrigger Base/Roof Anchor Hollow Steel Section (HSS) piers: Hollow steel section (HSS) piers: Mild steel, Type 300W with [50] Ksi ([350] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M] [manufacturer's polyurethane/polyurea coating system].
 1. Wall thickness [to suit application][as indicated].
- C. Swivel-type Beam Base: Round hollow section (HSS) piers of mild steel, Type 350W with [50] Ksi ([350] MPa) minimum yield strength [hot-dip galvanized to ASTM A123/A123M-2002] [manufacturer's polyurethane/polyurea coating system] [with [0.75] inches ([19] mm) diameter U-bar safety anchor, and securement [to suit application] [as indicated].
 1. Ensure base allows swivel-type beam to rotate 360° under load.
- D. Beam Dolly: [Galvanized steel] [Aluminum] with pneumatic type rubber wheels, sized [to suit beam] [as indicated].
- E. Acceptable Material: Pro-Bel Group, Outrigger Beam System.

Specification Guide Note: As well as items listed in the following Article, a complete Monorail system includes some or all of those items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

2.08 MONORAILS

- A. Monorails and Mounting: [Aluminum extrusions to ASTM B221] [Cold rolled hollow steel sections, Type 350W, galvanized to ASTM A123/A123M], [50] Ksi ([350] MPa) minimum yield strength and [65] Ksi ([450] MPa), minimum tensile strength and designed to carry [1000] lbs ([4.5] kN) minimum vertical service load.
- B. Monorail Finish:
 1. Exterior: [Aluminum] [Mill] [Anodized], to AA DAF-45 [galvanized steel] with [polyester or polyurethane powder coated baked enamel color], [from manufacturer's standard range] [custom color].
 2. Interior: [Epoxy] [Hybrid powder coated] include Mill Finish [Enamel painted on site].

- C. Capacity/Data Plates: Ensure non-corrosive data plate stating Maximum Service Capacity of monorail, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed.
- D. Trolleys: Heavy-duty, Corrosion resistant, weatherproof rollers, [0.625] inches ([16] mm) minimum diameter stainless steel U-bar safety anchors to ASTM A276, Type 304 exterior finish.
1. Interior finish to be powder coated mild steel to match monorail.
 2. Ensure trolleys to run freely under load with minimum discontinuity at rail splices.

Specification Guide Note: Specify end stops to ensure that trolleys cannot become detached. Ensure that the end stops are removable to allow service to the trolleys.

3. Provide removable end stops.
- E. Support Brackets: Cantilevered [aluminum] [stainless steel] [galvanized steel] brackets [as indicated] [in accordance with Section [05 50 00 - Metal Fabrications].
1. Locate brackets as close to and no greater than [16] inches ([400] mm) from monorail joints.
- F. Acceptable Materials: Pro-Bel Group, Monorail System.

Specification Guide Note: As well as items listed in the following Article, a complete Climbing Monorail system includes some or all of those items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

2.09 CLIMBING MONORAILS

- A. Monorails and Mounting: [Aluminum extrusions to ASTM B221] [Cold rolled hollow steel sections, Type 350W, galvanized to ASTM A123/A123M], [50] Ksi ([350] MPa) minimum yield strength and [65] Ksi ([450] MPa), minimum tensile strength and designed to carry [1000] lbs ([4.5] kN) minimum vertical service load.
- B. Monorail Finish:
1. Exterior: [Aluminum, [Mill] [Anodized], to AA DAF-45] [galvanized steel] with [polyester or polyurethane powder coated baked enamel color], [from manufacturer's standard range] [custom color].
 2. Interior: [Epoxy] [Hybrid powder coated] [Enamel painted on site].
- C. Capacity/Data Plates: Ensure non-corrosive data plate stating Maximum Service Capacity of climbing monorail, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed.
- D. Trolleys: Corrosion resistant, weatherproof electric powered climbing trolleys with heavy-duty rollers and [0.625] inches ([16] mm) minimum diameter stainless steel U-bar safety anchors ASTM A276, Type 304 exterior finish.
1. Interior finish to be powder coated mild steel to match monorail.
 2. Ensure trolleys to run freely under load with minimum discontinuity at rail splices.

Specification Guide Note: Specify end stops to ensure that trolleys cannot become detached. Ensure that the end stops are removable to allow service to the trolleys.

3. Provide removable end stops.
 4. Provide locking facility at parking location.
 5. Traversing speed: [20] feet per minute ([6] metres per minute).
- E. Drive System: Mechanically positive trolley drive system.
1. Equip trolleys with 2 power packs employing friction between trolley wheels and track.
 2. Ensure trolleys operate safely even on wet or frost covered tracks.
 3. Incorporate backslide safety prevention devices to ASME A120.1.
- F. Operation: Provide pendant control operable from [platform] [bosun's chair] including separate, sufficiently long plug-in pendant control to drive trolleys to upper limit when not in use.
1. Controls: Constant pressure type with "Forward", "Reverse" and "Emergency Stop" buttons.
- G. Electrical Busbar System: In accordance with Section [26 25 00 - Enclosed Bus Assemblies].
1. Connect to building power supply in accordance with Section [26 00 00 Electrical].
 2. Ensure system has capacity to provide power for powered [platform] [bosun's chair] suspended from climbing monorail.
- H. Automatic Braking System: Provide each trolley with brake to engage whenever power to trolley is interrupted by controls or power failure.
1. Ensure brakes can hold trolley on sloped monorail during operation of powered [platform] [bosun's chair].
 2. Equip brakes with overspeed sensor capable of stopping trolley during overspeed or free movement due to failure of drive train system.
- I. Power Supply: Co-ordinate location of receptacles with Section [26 00 00 - Electrical].
- J. Support Brackets: Cantilevered [aluminum] [stainless steel] [galvanized steel] brackets [as indicated] [in accordance with Section [05 50 00 - Metal Fabrications].
1. Locate brackets as close to and no greater than [16] inches ([400] mm) from monorail joints.
- K. Acceptable Material: Pro-Bel Group, Climbing Monorail System.

Specification Guide Note: As well as items listed in the following Article, a complete Rigging Sleeve system includes some or all of those items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

2.10 HORIZONTAL TROLLEY RAIL SYSTEM

- A. Horizontal Rails and Mounting: [Aluminum extrusions to ASTM B221] [Cold rolled hollow steel sections, Type 350W, galvanized to ASTM A123/A123M], [50] Ksi ([350] MPa) minimum yield strength and [65] Ksi ([450] MPa), minimum tensile strength and designed to carry [1000] lbs ([4.5] kN) minimum vertical service load.
- B. Monorail Finish:

1. Exterior: [Aluminum, [Mill] [Anodized], to AA DAF-45] [galvanized steel] with [polyester or polyurethane powder coated baked enamel color], [from manufacturer's standard range] [custom color].
 2. Interior: [Epoxy] [Hybrid powder coated] [Enamel painted on site].
- C. Capacity/Data Plates: Ensure non-corrosive data plate stating Maximum Service Capacity of trolley rail system, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at rail entry system.
- D. Trolleys: Heavy-duty, Corrosion resistant, weatherproof rollers, [0.625] inches ([16] mm) minimum diameter stainless steel U-bar safety anchors ASTM A276, Type 304 exterior finish.
1. Interior finish: Powder coated mild steel to match monorail.
 2. Ensure trolleys to run freely under load with minimum discontinuity at rail splices.

Specification Guide Note: Specify end stops to ensure that trolleys cannot become detached. Ensure that the end stops are removable to allow service to the trolleys.

3. Provide removable end stops.
- E. Acceptable Materials: Pro-Bel Group, Horizontal Trolley Rail System.

Specification Guide Note: Equipment supports and the structure to which Permanent Powered Platforms are attached must be designed to support the rated working load, which is the combined static weight of the workers, materials, and the total weight of the platform. The support equipment must be designed to support this increased weight. The reactions will have to be adjusted for supports (davits, monorails, outriggers and equipment) to reflect the increased loads. Contact the manufacturer for weights and dimensions of equipment, davits, outriggers and monorails.

2.11 PERMANENT POWERED PLATFORMS

- A. Suspended Platform: Type 6061-T6 aluminum alloy to ASTM B221, mill and powder coated finished modular platform system to ASME A120.1, engineered length and width [to suit application] [as indicated] and based on load bearing frame, with non-slip, aluminum deck, soft rubber wall rollers and caster wheels.
1. Provide integral, detachable [36] inches ([915] mm) long single work cage at one end complete with necessary components to meet project requirements.
 2. Comply with OSHA 1910.66 Subpart F, Powered Platforms.
- B. Frame and Rails:
1. Side frames and connecting frames: [Structural aluminum] [Galvanized mild steel] [Powder coated steel].
 2. Guard rails and guard rails posts: Square, thick wall aluminum extrusions with rails [36] inches ([915] mm) minimum, above deck level at working side of platform, [42] inches ([1067] mm) at non-working side.
 3. Include [3.5] inches ([90] mm) high toe-board around circumference of platform with spaces between toe-board and top guardrails covered with expanded aluminum screen.

Specification Guide Note: Front side of platform is the side facing the building.

- a. Leave space between intermediate guardrail and top guardrail open without aluminum screen at front side of platform.

- C. Stirrups: [Structural aluminum] [Galvanized mild steel] [Powder coated steel] fitted with manufacturer's standard hoist unit, top limit switch assembly, striker plate, and high "fair lead".

Specification Guide Note: To ensure that drums wind evenly and prevent loose wires from jamming, specify wire winders with drums built into the stirrups.

1. Wire winders: [Electric powered] [Passive type] with [single] [twin] drum built into stirrups.
 - a. Capacity: [____], [to suit project requirements] [as indicated].
 - b. Dimensions: [____], [to suit project requirements] [as indicated].

- D. Cable Storage Bin: Include cable storage bin on rear guard rail.

1. Capacity: [____], [to suit project requirements] [as indicated].
2. Dimensions: [____], [to suit project requirements] [as indicated].

- E. Safety Controls:

1. Electro mechanical overload system: Integral with each hoist preset to safe working load plus 25% minimum, and designed to operate limit switch and cut power supply if platform overloads.
2. Include upper limit switch assembly at each stirrup top and ensure system cuts electric power supply when switch contacts striker plate on suspension rope at top limit of travel.
3. Lower limit trip bar assembly: Hinged aluminum bar at each end of platform working face underside.
 - a. Design to ensure limit switch interrupt electric power supply to both hoists if bar is pushed upwards by obstruction on building facade during descent. Ensure system continues to allow platform to operate in upward direction.

- F. Main and Auxiliary Control Boxes: Include electric control gear for both hoists and wire winder motors contained in central control box and mounted on rear guardrail. Include components as follows:

Specification Guide Note: Edit the following list to suit project requirements.

1. Switches marked "UP/DOWN" and "HOLD TO RUN".
2. Hoist selector switch marked "LEFT/RIGHT/BOTH".
3. Bottom trip bar over-ride button.
4. Emergency stop button.
5. Platform self-leveling system.
6. Power "ON" indicator light.
7. Three phase protection and light indicator.
8. Locking facility on main switch.
9. Hand wheel for manual hoist operation.
10. Watertight electrical "quick" connections.
11. [_____]

G. Hoist Unit: Power platform using 2 UL listed traction type hoists with features as follows:

Specification Guide Note: Edit the following list to suit project requirements.

1. 30 amp 230 volt 60 Hertz hoist with lift capacity to suit platform weight and live load.
2. [35] feet per minute ([10.7] metres per minute) minimum speed.
3. Slack rope safety device acting on safety rope.
4. Electro mechanical overload system.
5. Electro mechanical main brake.
6. "No Power" controlled emergency descent system.
7. Hoist protection cover.

Specification Guide Note: Specify HBL2620SW, NEMA No. L6-30R only if the powered platform is rental and not a permanent installation.

8. Main line power protection: [HBL2720SW, NEMA No.15-30R] [HBL2620SW, NEMA No. L6-30R].
 - a. Acceptable material: Hubbell Twist-Lock 230 volts, 3 phase, 60 Hertz, 30 amps receptacle .
9. [_____].

Specification Guide Note: Specify four wire ropes for buildings over 300 feet (91.4 m) high. If two wire ropes are specified, separate lifeline anchors are required for workers. See Pro-Bel Safety & Tie-back Anchors literature for specific requirements.

- H. Steel Wire Rope: Ensure platform is complete with [2] [4], 6 x 19 Seale and IWRC, [0.3125] inches ([8] mm) minimum diameter galvanized high tensile steel wire ropes, length to suit project requirements.
1. Ensure each rope include [3] lbs ([1.4] kg) minimum safety hook with thimble talurit clamp and brazed "bullet-end".
- I. Electrical Supply Cable: Fit trailing supply cable with cable support clamp and CEE plug for connection to central control box. and supplied with cable support clamp.

Specification Guide Note: Specify electrical supply cables for buildings over 350 feet (107 m) high to be equipped with reinforced core.

1. Electrical supply cables: [100] [400] feet ([30] [120] m) long with reinforced core.

J. Powered Platform Accessories:

Specification Guide Note: Edit the following list to suit project requirements.

1. Portable fire extinguisher securely attached to platform.
2. Water container attached to rear guard rail.
3. Electric power tool receptacle on central control box.

Specification Guide Note: See Pro-Bel literature on Code Requirements for specified item here.

K. Powered Platform Stabilization (Tie-In Guides):

1. Continuous stabilization: Provide guide roller/sliding shoe assembly at each end of bottom of platform designed to provide continuous engagement between platform and internal tracks.
 - a. Co-ordinate design with [curtain wall manufacturer] [Section 08 44 00 -Curtain Wall and Glazed Assemblies] to ensure smooth operation.
 - b. Internal track tie-in guides: Opening [1] inch ([25] mm) minimum with [2.5 x 2.5] inches ([64 x 64] mm) minimum inside dimensions. Design tracks to ensure platform trolleys can be inserted from top and bottom of building.
2. Intermittent stabilization anchor buttons: Buttons:[Stainless steel] [1.5] inches diameter x [0.1875] inches ([38] mm diameter X [5] mm) thick with Allen head recess, with threaded [stainless steel] building anchor insert of size and configuration to suit building facade. Include sufficient quantity of [stainless steel] stabilizer ties.
 - a. Working load: To AISC S342L, [300] lbs ([1.33] kN) minimum.
 - b. Load against fracture or detachment: To AISC S342L, [600] lbs ([2.67] kN) minimum.

Specification Guide Note: If the building has been designed with davit bases to suit roof rigged davit arms, locate buttons/detent pins every third floor or 50'-0" (15.3 m) whichever is less in line with davit base suspension points. Note that New York Department of Labor recommends 40 feet (12.2 m) maximum.

- c. Locate buttons [every third floor] [[40] [50] feet ([12.2] [15.3] m) maximum] in line with davit base suspension points.
- d. Acceptable material: Pro-Bel Group, Stainless Steel Stabilization Buttons.

Specification Guide Note: Specify detent pins only where flush building appearance is critical.

3. Detent pins: [Stainless steel], [0.3125] [0.375] inches ([8] [10] mm) diameter tie handles with spring loaded ball lock to suit building facade. Include sufficient quantity of [stainless steel] stabilizer ties.
 - a. Working load: To AISC S342L, [300] lbs ([1.33] kN) minimum.
 - b. Load against fracture or detachment: To AISC S342L, [600] lbs ([2.67] kN) minimum.

Specification Guide Note: If the building has been designed with davit bases to suit roof rigged davit arms, locate buttons/detent pins every third floor or 50'-0" (15.3 m) whichever is less in line with davit base suspension points. Note that New York Department of Labor recommends 40 feet (12.2 m) maximum.

- c. Locate detent pins [every third floor] [[40] [50] feet ([12.2] [15.3] m) maximum] in line with davit base suspension points.
- d. Acceptable material: Pro-Bel Group, Stainless Steel Detent Pins.

L. Acceptable Material: Pro-Bel Group, Permanent Powered Platform.

Specification Guide Note: Delete the following Article if a single work cage is included as part of the Permanent Powered Platform previously specified.

Specification Guide Note: Equipment supports and the structure to which Single Work Cages are attached must be designed to support the rated working load which is the combined static weight of the workers, materials, and the total weight of the work cage. The support equipment must be designed to support this increased weight. The reactions will have to be adjusted for supports (davits, monorails, outriggers and equipment) to reflect the increased loads. Contact the manufacturer for weights and dimensions of equipment, davits, outriggers and monorails.

2.12 SINGLE WORK CAGE

- A. Work Cage: Type 6061-T6 aluminum alloy to ASTM B221, mill and powder coated finished modular platform system to ASME A120.1, [36] inches ([915] mm) long, width [to suit application] [as indicated] and based on load bearing frame, with non-slip, aluminum deck, soft rubber wall rollers and caster wheels.
1. Comply with OSHA 1910.66 Subpart F, Powered Platforms.
- B. Frame and Rails:
1. Side frames and connecting frames: [Structural aluminum] [Galvanized mild steel] [Powder coated steel].
 2. Guard rails and guard rails posts: Square, thick wall aluminum extrusions with rails [36] inches ([915] mm) minimum, above deck level at working side of platform, [42] inches ([1067] mm) at non-working side.
 3. Include [3.5] inches ([90] mm) high toe-board around circumference of platform with spaces between toe-board and guardrails covered with expanded aluminum screen.

Specification Guide Note: Front side of platform is the side facing the building.

- a. Leave space between intermediate guardrail and top guardrail open without aluminum screen at front side of platform.
- C. Stirrups: [Structural aluminum] [Galvanized mild steel] [Powder coated steel] fitted with manufacturer's standard hoist unit, top limit switch assembly, striker plate, and high "fair lead".

Specification Guide Note: To ensure that drums wind evenly and prevent loose wires from jamming, specify wire winders with drums built into the stirrups.

1. Wire winders: [Electric powered] [Passive type] with [single] [twin] drum built into stirrups.
 - a. Capacity: [____], [to suit project requirements] [as indicated].
 - b. Dimensions: [____], [to suit project requirements] [as indicated].
- D. Cable Storage Bin: Include cable storage bin on rear guard rail.
1. Capacity: [____], [to suit project requirements] [as indicated].
 2. Dimensions: [____], [to suit project requirements] [as indicated].
- E. Safety Controls:
1. Electro mechanical overload system: Integral with each hoist preset to safe working load plus 25% minimum, and designed to operate limit switch and cut power supply if platform overloads.
 2. Include upper limit switch assembly at each stirrup top and ensure system cuts electric power supply when switch contacts striker plate on suspension rope at top limit of travel.

3. Lower limit trip bar assembly: Hinged aluminum bar at each end of platform working face underside.
 - a. Design to ensure limit switch interrupt electric power supply to both hoists if bar is pushed upwards by obstruction on building facade during descent. Ensure system continues to allow platform to operate in upward direction.
- F. Main and Auxiliary Control Boxes: Include electric control gear for both hoists and wire winder motors contained in central control box and mounted on rear guardrail. Include components as follows:

Specification Guide Note: Edit the following list to suit project requirements.

1. Switches marked "UP/DOWN" and "HOLD TO RUN".
 2. Hoist selector switch marked "LEFT/RIGHT/BOTH".
 3. Bottom trip bar over-ride button.
 4. Emergency stop button.
 5. Platform self-leveling system.
 6. Power "ON" indicator light.
 7. Three phase protection and light indicator.
 8. Locking facility on main switch.
 9. Hand wheel for manual hoist operation.
 10. Watertight electrical "quick" connections.
 11. [_____].
- G. Hoist Unit: Power platform using 2 UL listed traction type hoists with features as follows:

Specification Guide Note: Edit the following list to suit project requirements.

1. 30 amp 230 volt 60 Hertz hoist with lift capacity to suit platform weight and live load.
2. [35] feet per minute ([10.7] metres per minute) minimum speed.
3. Slack rope safety device acting on safety rope.
4. Electro mechanical overload system.
5. Electro mechanical main brake.
6. "No Power" controlled emergency descent system.
7. Hoist protection cover.
8. [_____].

Specification Guide Note: Specify four wire ropes for buildings over 300 feet (91.4 m) high. If two wire ropes are specified, separate lifeline anchors are required for workers. See Pro-Bel Safety and Tie-back Anchors literature.

- H. Steel Wire Rope: Ensure platform is complete with [2] [4], 6 x 19 Seale and IWRC, [0.3125] inches ([8] mm) minimum diameter galvanized high tensile steel wire ropes, length to suit project requirements.
1. Ensure each rope includes [3] lbs ([1.4] kg) minimum safety hook with thimble talurit clamp and brazed "bullet-end".
- I. Electrical Supply Cable: Fit trailing supply cable with cable support clamp and CEE plug for connection to central control box.

Specification Guide Note: Specify electrical supply cables for buildings over 350 feet (107 m) high with reinforced core.

1. Electrical supply cables: [100] [400] feet ([30] [120] m) long with reinforced core].

J. Powered Platform Accessories:

Specification Guide Note: Edit the following list to suit project requirements.

1. Portable fire extinguisher securely attached to platform.
2. Water container attached to rear guard rail.
3. Electric power tool receptacle on central control box.
4. [_____].

K. Acceptable Material: Pro-Bel Group, Single Work Cage.

2.13 RIGGING SLEEVES

- A. Hollow Steel Section (HSS) Sleeves: Mild steel, Type 300W with [50] Ksi ([350] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M] [manufacturer's polyurethane/polyurea coating system].
1. Wall thickness [to suit application][as indicated] and with [6] inch ([150] mm) inside diameter.
 2. Wall mounted rigging sleeves: Fabricate with flip-up hinged door to accommodate push/pull outrigger.

Specification Guide Note: To protect suspension or safety lines from chafing specify smooth radius bends for curved rigging sleeves.

3. Curved rigging sleeves: Ensure bend are finished with smooth radius.
- B. Straight Suspension Bars: Hot-dip galvanized to ASTM A123/A123M, [0.75] inches ([19] mm) minimum diameter mild steel with [35] Ksi ([240] MPa) minimum yield strength.
- C. Acceptable Material: Pro-Bel Group, Steel Rigging Sleeves.

Specification Guide Note: As well as items listed in the following Paragraph, a complete Hands-Free Horizontal Lifeline system includes some or all of those items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

2.14 HANDS-FREE HORIZONTAL LIFELINE

- A. Stainless steel to ASTM A492, Type 316, [0.3125] inches ([8] mm) minimum diameter cable, [9127] lbs ([40] kN) minimum breaking strength with permanently swaged cable ends.
- B. Data plate: Ensure non-corrosive data plate stating Maximum Service Capacity of cable, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at cable system entry points.

- C. Standard intermediate support brackets: Stainless steel to ASTM A167, Type 316, multi-position, with reinforcing end caps and suitable for installation at any height.
1. Secure using [0.5] ([13] mm) minimum diameter [stainless steel] [galvanized] fasteners [in accordance with Section 05 05 23 - Metal Fastenings].

Specification Guide Note: Specify mobile intermediate support brackets when project requires working on both sides of a sloped roof at the ridge point.

- D. Mobile intermediate support brackets: multi position, stainless steel to ASTM A167, Type 316, multi-position, with reinforcing end caps and suitable for installation at any height.
1. Secure using [0.5] ([13] mm) minimum diameter [stainless steel] [galvanized] fasteners [in accordance with Section 05 05 23 - Metal Fastenings].

Specification Guide Note: Specify corner units as needed to meet project requirements.

- E. Corner units: [90 degrees] [and] [135 degrees] flexible corner units from manufacturer's standard components [to meet project requirements] [as indicated].
- F. End terminal hardware: Stainless steel swedged termination at one end and stainless steel tensioner with shock absorber at other end [to meet project requirements] [as indicated].
- G. Lanyard cable runner: Stainless steel to ASTM A167, Type 316 with automatic runner bypass for continuous "hands-free" operation.
1. Ensure lanyard can be inserted or removed anywhere on cable.
- H. Harness: Manufacturer's standard full body harness and lanyard with shock absorber.
- I. Acceptable Material: Pro-Bel Group, Hands-Free Horizontal Lifeline System.

Specification Guide Note: As well as items listed in the following Paragraph, a complete Double Lanyard Lifeline system includes some or all of those items listed in the Article titled "Accessories". Edit this section to include those accessories necessary for the project requirements.

2.15 DOUBLE LANYARD HORIZONTAL LIFELINE SYSTEM

- A. Stainless steel to ASTM A492, Type 316, [0.3125] inches ([8] mm) minimum diameter cable, [9127] lbs ([40] kN) minimum breaking strength with [permanently] [mechanically] swedged cable ends.
- B. Data plate: Ensure non-corrosive data plate stating Maximum Service Capacity of cable, Manufacturer's Name, Serial No., Manufacturing Date, rated load and other pertinent information is prominently displayed at cable system entry points.
- C. Tensioner: Stainless steel turnbuckle to ASTM A167, Type 316.
- D. Harness: Manufacturer's standard full body harness with double shock absorber lanyard.
- E. Acceptable Material: Pro-Bel Group, Double Lanyard Horizontal Lifeline System.

- A. Carriages: [Electric powered] [Manually operated], mounted on horizontal rails, with two piece tip-up davit arm system operating on trolleys.
 - 1. Raise and lower carriage using portable winch.
 - 2. Ensure davit arms can be locked into position.

- B. Stability Factor: [Calculate] [Test] while considering suspended platform is in most outboard traversing positions for traversing, operating and storage.
 - 1. Obtain system stability by attachment to structural supports and track system, as follows:
 - a. Horizontal traversing stability factor: 4 to 1 minimum including impact effect when using [10] psf ([0.479] kPa) minimum wind load applied to equipment.
 - b. Ensure equipment can withstand wind loads expected in geographic area of project. Maximum wind velocity: [100] mph ([61] kph).
 - 2. Submit calculations and test reports in accordance with Contract Conditions and Section [01 33 00 - Submittal Procedures].

Specification Guide Note: Specify safety enclosures or guards at all moving parts to prevent accidental personnel contact with moving parts or pinch points.

- C. Safety Guards: Include [enclosures] [guards] at moving parts.

- D. Track Works: Mild steel, Type 350W with [50] Ksi ([350] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M].

- E. Work Station Markings: Identify each work station location by [markings on tracks] [and] [indexing vanes and positioning switches].

Specification Guide Note: Include the following Paragraph only if electric powered davit carriages are used.

- F. Controls: Locate continuous pressure, weatherproof electric controls and operating devices on [carriage] [and] [working platform].
 - 1. Ensure single operating device can simultaneously move multiple carriages.
 - 2. Include lock out feature of operating devices other than device in use.
 - 3. Ensure carriages operate only when:
 - a. Platform is located at uppermost position of travel and is not in contact with building face or fixed vertical stabilizer guides.
 - b. Platform is at innermost position on davit arms.
 - c. Protective devices and interlocks are in position for traversing.

- G. Electrically Operated Carriage Speed: [39.33] feet per minute ([12] metres per minute) maximum.

- H. Electrically Operated Carriage Accessories:

Specification Guide Note: Edit the following list to suit project requirements.

Specification Guide Note: Specify an automatically applied braking system to prevent unintentional traversing of the powered davits.

1. Auto brakes: Include automatically applied braking system.

Specification Guide Note: Specify a key lockout system to prevent unauthorized use of the davit carriages.

2. Key lockout system

Specification Guide Note: Specify interlock devices on carriages and power cord reel to prevent undue strain on power cord and to prevent cord from being trapped between the carriage wheels and tracks.

3. Power cord interlocks.

Specification Guide Note: Specify the Pro-Bell davit carriage which meets project requirements.

- I. Acceptable Material: Pro-Bel Group, [Electrically Powered Davit Carriage] [Manually Operated Davit Carriage].

2.17 TRAVELING GANTRY

- A. Operation: [Manually operated] [Electric powered] to suit profile of [interior] [exterior] atrium.
- B. Gantry Platform: Type 6061-T6 aluminum alloy to ASTM B221, mill and powder coated finished modular platform system to ASME A120.1, engineered length and width [to suit application] [as indicated] and based on load bearing frame rated for two person operation, with non-slip, aluminum deck, soft rubber wall rollers and caster wheels.
 1. Provide integral, detachable [36] inches ([915] mm) long single work cage at one end complete with necessary appurtenances to meet project requirements.
 2. Comply with OSHA 1910.66 Subpart F, Powered Platforms.
 3. Ensure gantry will not rack or twist during use.
 4. Include locking facility at each workstation and in parking location.
- C. Frame and Rails:
 1. Side frames and connecting frames: [Structural aluminum] [Galvanized mild steel] [Powder coated steel].
 2. Guard rails and guard rails posts: Square, thick wall aluminum extrusions with rails [42] inches ([1067] mm) above deck level.
 3. Include [localized stainless steel fall protection anchors] ["dogline" for securing lifelines] [and spring loaded, sliding/retractable gates].
- D. Monorail tracks and supports as previously specified in this section.
- E. Large Diameter Wheels: [Nickel cadmium plated steel] [Stainless steel] with sealed ball bearings.
- F. Interior trolleys: [Stainless steel to ASTM A276, Type 304] [Powder coated mild steel] with heavy-duty rollers. Designed for [straight] [radiused rails]. Provide means for servicing, repair or replacement of trolleys as necessary.

Specification Guide Note: Specify safety enclosures or guards at all moving parts to prevent accidental personnel contact with moving parts or pinch points.

- G. Safety Guards: Include [enclosures] [guards] at moving parts.
- H. Controls: Locate continuous pressure, weatherproof, electric type controls and operating devices on working platform.

Specification Guide Note: Specify an automatically applied braking system to prevent unintentional traversing of the working platform.

- 1. Include automatically applied braking system.

Specification Guide Note: Specify a key lockout system to prevent unauthorized use of the gantry.

- 2. Include key lockout system.
- I. Gantry Traversing Speed: [39.33] feet per minute ([12] metres per minute) maximum.
- J. Manual Operation: Geared crank handle, mild steel hot-dip galvanized to ASTM A123/A123M.

2.18 ROLLING LADDERS

- A. Ladder: Type 6061-T6 aluminum alloy to ASTM B221 and to ASME A120.1, designed to support two workers weighing [250] lbs ([113] kg) minimum each.
 - 1. Size: [27] inches ([686] mm) wide x [30] inches ([762] mm) deep with serrated step rungs and [36] inches ([915] mm) high guardrails.
- B. Ladder Exterior Finish: [Mill] [Clear anodized] [[Polyester] [Polyurethane] powder coated baked enamel to AA DAF-45
 - 1. Color: [Custom color] [[_____] from manufacturer's standard range].

Specification Guide Note: Specify spring release brakes to assist in positioning ladder at work locations or parking and locking at the end of the building to prevent inadvertent movement due to wind.

- C. Brakes: Spring release type.
- D. Fall Protection: Include continuous fall arrest system on both sides of ladder.
- E. Pipe or I-Beam Tracks: [Type 6061-T6 aluminum alloy to ASTM B221, mill and powder coated finished modular platform system to ASME A120.1] [Mild steel, Type 300W with [50] Ksi ([350] MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M].
- F. Manual Traversing Ladder Force: [11.2] pound- force ([50] Newtons) maximum.

Specification Guide Note: Specify guide rollers to ensure that ladder maintain adequate clearance from building facade.

- G. Guide Rollers: Adjustable, anti-crabbing, anti-lift type acting on top track.
 - 1. Flanged support rollers not acceptable.
 - 2. Ensure rotating components include sealed for life rolling element bearings protected from environment.

Specification Guide Note: If safe access other than a horizontal lifeline is to be used, specify it in the following Paragraph.

- H. Safe Access: Include safe access to ladder using [horizontal lifeline].
- I. Acceptable Material: Pro-Bel Group, Aluminum Rolling Ladder.

Specification Guide Note: Items from the following list should be included with the equipment specified in this section to ensure the various systems are complete. Follow manufacturer's recommendations and edit the list of "Accessories" to suit project requirements.

2.19 ACCESSORIES

Specification Guide Note: Equipment supports and the structure to which Bosun's Chairs are attached must be designed to support the rated working load which is the combined static weight of the workers, materials, and the total weight of the bosun's chair. The support equipment must be designed to support this increased weight. The reactions will have to be adjusted for supports (davits, monorails, outriggers and equipment) to reflect the increased loads. Contact the manufacturer for weights and dimensions of equipment, davits, outriggers and monorails.

- A. Motorized Bosun's Chair
 - 1. Chair Framework: High quality structural steel with shot blasted powder coated [blue] [] finish, foldable upper frame with removable water buckets and holders.
 - a. Overall dimensions: [51] inches ([1285] mm) long x [43] inches ([1132] mm) wide x [71] inches ([1810] mm) high.
 - b. Rated load: [200] lbs ([90] kg) minimum.
 - c. Weight (without wires, electrical cable and rated load): [370] lbs. ([168] kg).
 - 2. Chair Components: Include components as follows:

Specification Guide Note: Edit the following list to suit project requirements.

- a. Traction hoist.
- b. Type 3 overspeed safety brake and bracket.
- c. Overload assembly.
- d. Top limit switch.
- e. Wall rollers.
- f. Caster wheels.
- g. Safety belt.
- h. Powered twin wire reeler assembly.
- i. Water buckets and holders.
- j. Adjustable foot support.
- k. Control station.
- l. [].
- 3. Suspension: Galvanized steel wire ropes, [0.375] inches ([8.3] mm) minimum diameter, [284] psi ([1960] n per mm²) tensile strength.
 - a. Wire breaking load: [5.395] ton-force ([48] kN) minimum.
 - b. Reeler capacity: [131] feet ([40] meters).
- 4. Hoist:
 - a. Lifting capacity: [882] lbs ([400] kg) minimum.
 - b. Speed: [28] feet per minute ([8.5] metres per minute) minimum.

5. Power supply: [Single phase, 220/240 volts] [Three phase, 380/440 volts].
 - b. Control voltage, 24 volts AC.
6. Acceptable material: Pro-Bel Group, Motorized Bosun's Chair Model H400.

Specification Guide Note: Delete the following Paragraph for projects in California.

- B. Safety U-bars: [Stainless steel to ASTM A276, Type 304 with [35] Ksi ([240] MPa) minimum yield strength] [Mild steel, Type 300W with 44 Ksi (300 MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M].
 1. U-bar: 0.75 inches (19 mm) minimum diameter material with 1.5 inches (38 mm) eye opening.

Specification Guide Note: Specify safety anchor eye plates for projects in California.

- C. Safety Anchor Eye Plate: Mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M.
 1. Plate: [0.875] inches ([22] mm) diameter material with [2] inches ([50] mm) eye opening.
- D. Tethers: Secure pins and loose pieces with [0.125] inches ([3] mm) stainless steel cable with easily inserted lead connectors.
- E. Hollow Steel Section (HSS) Piers: Mild steel, Type 300W with [50] Ksi ([350] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M] [manufacturer's polyurethane/polyurea coating system].
 1. Wall thickness [to suit application] [as indicated].
- F. Plate and other sections: Mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M] [manufacturer's polyurethane/polyurea coating system].
 1. Wall thickness [to suit application] [as indicated].

Specification Guide Note: Specify aluminum flashing for BUR or modified bitumen roofs only (membrane above or below insulation). For single ply roofs, refer to roofing membrane manufacturer's written instructions. Specify conformable mastic tape and heat-shrink rubber collar flashing for PBE Series roof anchors (BUR or modified bitumen roofs) or stainless steel cap for Pro-Bel series roof anchors for all roof types.

- G. Seamless Spun Aluminum Flashing (for Roof Anchors): To AA ADM-1 Type 6061-T6 alloy and to ASTM B221.
 1. Deck flange flashing: [To NRCA Roofing and Waterproofing Manual recommendations] [In accordance with Section 07 62 00 Sheet Metal Flashing and Trim], [conformable mastic tape and torch applied heat-shrink rubber collar flashing] [detachable watertight stainless steel cap].
 2. Acceptable material: Pro-Bel Group, Aluminum Deck Flange Flashing.
- H. Miscellaneous Bolts, Nuts and Washers: [Mild steel, Type 300W with [44] Ksi ([300] MPa) minimum yield strength, hot-dip galvanized to ASTM A123/A123M] [Stainless steel to ASTM A276, Type 304 with [35] Ksi ([240] MPa) minimum yield strength].

- I. Manufacturer's polyurethane/polyurea coating system: [0.09375] inches ([2.4] mm) minimum thickness, black colored, two-component TPU polyurethane/polyurea coating system].

Specification Guide Note: If project requirements include the use of the TPU polyurethane/polyurea coating system, specify Pro-Bel Protex as the acceptable material. If this coating is not to be used, delete the following Paragraph.

1. Acceptable material: Pro-Bel Group, Pro-Bel Protex.

2.20 ELECTRICAL REQUIREMENTS

Specification Guide Note: Except where specified elsewhere for powered platforms and hoists use the following Paragraph for electrical requirements.

- A. Receptacles: Waterproof, independently protected main line power receptacles rated 208 volts, 3 phase, 60 Hertz, 30 amperes.
 1. Acceptable material: Hubbell Twist-Lock.
- B. Ensure main line power is located [100] feet ([30] m) maximum from powered window washing equipment.
- C. Ensure power outlets experience 3% maximum voltage drop under full load.

Specification Guide Note: Use wall and roof anchors as a means of supporting main line electrical cables and taking the strain from connectors and the cable itself.

- D. Cable Wall and Roof Anchors
 1. Acceptable material: Pro-Bel Group, Wall and Roof Anchors.

Specification Guide Note: Delete the following Article in its entirety if the project does not include roof cars.

2.21 POWERED ROOF CARS

Specification Guide Note: A roof car should be provided whenever it is necessary to move a working platform horizontally to or from a working or storage position. Edit the list of Roof Cars below to specify the one which best suits the project requirements. Delete all other Roof Cars from the list.

- A. Roof Car: Electric powered, supported on hard rubber tired wheels operating on reinforced concrete bearing or similar surface cast on top of roof finish in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 1. Ensure roof trolley is guided by L-shaped steel angle fixed to concrete runway in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 2. Steel base frame and [telescoping] suspension jib: Capable of 360 degree slewing (rotating) and luffing (up and down).
 3. Acceptable material: Pro-Bel Group, Model PT 3008 Fully Balanced Trackless Trolley .
- B. Roof Car: Electric powered, fully balanced, on freestanding, twin track, galvanized I-beam work track system supported by galvanized steel crossbeams over support foot assemblies.

1. Mount system on reinforced [concrete pads] [sleepers] bedded on top of roof finish in accordance with Section 03 30 00 - Cast-in-Place Concrete.
 2. Weight balance ratio: As approved by authorities having jurisdiction.
 3. Steel base frame and [telescoping] suspension jib with luffing (up and down) capability.
 4. Acceptable material: Pro-Bel Group, Model FS-3000 Free Standing Trolley.
- C. Roof Car: Electric powered with trolleys supported on four wheel assemblies operating on galvanized track mounted on [concrete piers] [crossrails] cast into roof slab in accordance with Section 03 30 00 - Cast-in-Place Concrete.
1. Steel base frame and [telescoping] suspension jib: Capable of 360 degree slewing (rotating) and luffing (up and down).
 2. Acceptable material: Pro-Bel Group, Model RA-3004 Roof Anchored Trolley.
- D. Roof Car: Electric powered with trolleys supported on four wheel assemblies operating on galvanized track mounted on [concrete piers] [crossrails] cast into roof slab in accordance with Section 03 30 00 - Cast-in-Place Concrete.
1. Steel base frame and [telescoping] suspension jib: Capable of 360 degree slewing (rotating) and luffing (up and down).
 2. Ensure pantograph assembly remains horizontal when inclination of jib changes.

Specification Guide Note: To provide added access to the platform, specify that the upper turret connection be rotated 90 degrees.

3. Ensure connection to upper turret is rotated 90 degrees.
 4. Acceptable material: Pro-Bel Group, Model RA 3006 Roof Anchor Trolley with Jib End Pantograph Assembly.
- E. Roof Car: Electric powered with trolleys supported on four wheel assemblies operating on galvanized track mounted on [concrete piers] [crossrails] cast into roof slab in accordance with Section 03 30 00 - Cast-in-Place Concrete.

Specification Guide Note: Telescoping jib is standard with this model.

1. Steel base frame and telescoping suspension jib: Capable of 85 degree slewing (rotating) in each direction.

Specification Guide Note: To provide added access to the platform, specify that the upper turret connection be rotated 90 degrees.

2. Ensure connection to upper turret is rotated 90 degrees.
 3. Acceptable material: Pro-Bel Group, Model RA-T09 Roof Anchored Trolley with Short Single Telescopic Jib.
- F. Roof Car: Electric powered with trolleys supported on four wheel assemblies operating on galvanized track mounted on concrete piers cast into roof slab in accordance with Section 03 30 00 - Cast-in-Place Concrete.
1. Steel base frame and long reach suspension jib: Capable of 360 degree slewing (rotating) capability and luffing (up and down).
 2. Ensure pantograph assembly remains horizontal when inclination of jib changes.

Specification Guide Note: To provide added access to the platform, specify that the upper turret connection be rotated 180 degrees.

3. Ensure connecting upper turret and suspension beam assembly allow platform to rotate 180 degrees.
 4. Acceptable material: Pro-Bel Group, Model RA/22.5 Special Type/Long Reach.
- G. Roof Car: Electric powered with twin track trolley supported on four wheel assemblies operating on galvanized lower I-beam and upper galvanized steel channel track and mounted onto structural parapet wall.
1. Steel base frame and long reach suspension jib: Capable of 360 degree slewing (rotating) capability and luffing (up and down).
 2. Acceptable material: Pro-Bel Group, Model WA 3007 Parapet Mounted with Twin Track Trolley and Single Jib.
- H. Platform: [82.25] inches ([2.7] metres) long, Type 6061-T6 aluminum alloy to ASTM B221, mill and powder coated finished modular platform system to ASME A120.1, engineered length and width [to suit application] [as indicated] and based on load bearing frame, with non-slip, aluminum deck, soft rubber wall rollers and caster wheels.
1. Suspension system: 2 primary wire ropes and 2 safety wire ropes operating at hoist speed of [29.5] feet per minute ([9] metres per minute) maximum.
 2. Ensure platform hoist system is designed for horizontal travel with [39.33] feet per minute ([12] metres per minute) maximum traversing speed.
- I. Roof Car Controls as follows:
1. Key operated power supply "On/Off" control mounted on trolley.
 2. Key operated traversing operation control [mounted on trolley] [mounted on push button pendant control suspended from jib head].
 - a. Ensure movement control push buttons require continuous finger pressure to operate.
 - b. Include "Emergency Stop" push button at each control position.
 3. House main electrical control panel in key secured weatherproof compartment on rear of base frame.
 - a. Include ground protection unit within panel.
 4. Attach platform electrical power supply cable to trolley jib head.
 - a. Include cable storage compartment fitted to platform.
 5. Ensure other device controls are locked when traversing control at location is used.
 6. Ensure roof car operates only under conditions as follows:
 - a. Platform is located at its uppermost position of travel; is not in contact with building face; and is not in contact with fixed vertical stabilizer guides located building facade.
 - b. Protective devices and interlocks are in position for traversing.

Specification Guide Note: Edit the following list of roof car accessories to meet project requirements.

- J. Roof Car Accessories:
1. Roof trolley: Steel fabrication, shot blasted, hot zinc sprayed and blue color, powder coated.
 2. Lower base frame assembly: Heavy duty steel box section with wheel unit bearing housings incorporated into frame.

- a. Include attachment points for slewing assembly.

Specification Guide Note: Hydraulic cylinder is optional.

3. Upper base frame assemblies: Heavy duty steel box sections [with attachment points for hydraulic cylinder jib assembly].

Specification Guide Note: Optional hydraulic cylinder allows the jib assembly to be luffed from the maximum to the minimum working positions as shown on manufacturer's drawings.

4. Jib assembly: Heavy duty steel box section [with attachment points for hydraulic cylinder as indicated] [and] [slewing bearing at jib end].
 - a. [Jib luffing speed: [10.25] feet per minute ([3] metres per minute) minimum.]
 - b. [Standard forward reach: [60] inches ([1500] mm) minimum.]
5. Slewing assembly: Attach to upper and lower base frame.
 - a. Ensure 360 degree powered rotation using electric geared motor transmission with push buttons controls from either control station.
 - b. Slewing speed: [0.5] rpm minimum.

Specification Guide Note: Luffing assembly is optional.

6. Luffing assembly: Heavy duty, double acting, hydraulic cylinder with electrically operated power pack including hydraulic tank, filter, pressure relief valve, motorized pump unit and solenoid operated directional control valves.
 - a. System working pressure range: [1200 to 1500] psi ([8274 to 10 342] kPa).

Specification Guide Note: For added safety, fit an Anti-Pipe Burst valve to base of hydraulic cylinder to lower the jib assembly at a controlled rate in the event of an hydraulic pipe failure. Incorporate hydraulic power pack within the trolley base frame.

- b. Include anti-pipe burst valve.
7. Supply cable reeling drum: Fit roof trolley with spring loaded reeling drum capable of automatically reeling electrical power supply cable in and out between roof power sockets and trolley.
 - a. Capacity: [65] feet ([20] m) minimum.
8. Stability: Include roof car continuous stabilization
 - a. Determine overturning moment as 125% rated load, plus maximum dead load plus prescribed wind load.
9. Roof car access: Include safe access to roof car and from roof car to working platform in accordance with manufacturer's written recommendations.
10. Storage: include provisions to secure roof car in stored position using tie-down anchors in accordance with manufacturer's written recommendations.
 - a. Ensure cars subject to wind forces are stored in accordance with ASME A120.1.
11. Track works: Mild steel, Type 350W with [50] Ksi ([350] MPa) minimum yield strength, [hot dipped galvanized to ASTM A123/A123M].

2.22 SOURCE QUALITY CONTROL

- A. Ensure window washing equipment components and materials are from single manufacturer.

Specification Guide Note: Edit Article below to suit project requirements. If substitutions are permitted, edit text below. Coordinate with Section 01 25 13 - Product Substitution Procedures.

2.23 PRODUCT SUBSTITUTIONS

- A. Substitutions: [In accordance with Section 01 25 13 - Product Substitution Procedures]] [No substitutions permitted].

PART 3 EXECUTION

3.01 INSTALLERS

- A. Provide experienced and qualified technicians to carry out erection, assembly and installation of window washing and suspended maintenance equipment system.
- B. Do steel welding to AWS D1.2/D1.2M.
- C. Do aluminum welding to AWS D1.1/D1.1M.

3.02 MANUFACTURERS INSTRUCTIONS

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions and Pro-Bel Group technical data sheets.

3.03 EXAMINATION

- A. Site Verification of Conditions:
1. Verify that substrate conditions which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of window washing equipment.
 2. Inform [Owner] [Architect] [Consultant] of unacceptable conditions immediately upon discovery.
 3. Proceed with installation only after unacceptable conditions have been remedied.

3.04 PREPARATION

- A. Ensure structure or substrate is adequate to support complete window washing equipment system.
- B. Ensure structural steel to receive safety anchors [has adequate bearing surface as indicated on shop drawings] [and] [has 100% welds between anchors and structural steel].

3.05 INSTALLATION

Specification Guide Note: Co-ordinate installation with the manufacturer's written installation details and instructions.

- A. Coordinate window washing equipment work with work of other trades, for proper time and sequence to avoid construction delays.
- B. Install window washing equipment plumb and level in accordance with manufacturer's written instructions.
- C. [Mechanically fasten anchors in accordance with manufacturer's recommendations] [Install anchors in concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete and with manufacturer's recommendations.
- D. Accurately fit and align, securely fasten and install free from distortion or defects.
- E. Deform threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal and vandalism.

Specification Guide Note: Use the following Paragraph for all pipe and I-beam tracks for monorails, carriages, gantries and ladders.

- F. Track Works: Install tracks straight, true and level, with [0.125] inches ([3] mm) maximum step deviation and in accordance with manufacturer's written instructions.
- G. Rolling Ladder: Ensure rolling ladder is positioned parallel to building elevation with [12] inches ([305] mm) minimum clearance between rear side of ladder and building facade.
 - 1. Maintain clearance by means of roller guides on ladder end.
- H. Roof Car Runways: Install [runways] [concrete piers] [crossrails] [sleepers] in cast-in-place concrete in accordance with Section [03 30 00 - Cast-in-Place Concrete].

3.06 FIELD QUALITY CONTROL

Specification Guide Note: Use the following Paragraphs when manufacturer's field services are desired to verify the quality of the installed components. Establish the number and duration of periodic site visits required by the Manufacturer and specify below. Consult with the Manufacturer for services required. Delete if field services are not required.

- A. When necessary have the manufacture assist in installation.
- B. Manufacturer's Field Services: Have manufacturer's technical representative schedule site visits to review work as follows:
 - 1. After delivery and storage of products.
 - 2. When preparatory work for which work of this Section depends is complete, but before installation begins.
 - 3. [Weekly] [2 times] during progress of work [at [25%] and [60%]] of completion.
 - 4. Upon completion of work, after cleaning is carried out.
- C. Testing: Test on site 100% of anchors relying upon chemical adhesive fasteners using load cell test apparatus in accordance with manufacturer's written recommendations.

- A. Lubricate moving parts to operate smoothly and fit accurately.
- B. Complete "Initial Inspection - Certification for Use" form included in Equipment Manual and Inspection Log Book provided by manufacturer.

3.08 FINAL CLEANING

- A. Do cleanup in accordance with Section [01 74 00 - Cleaning and Waste Management].
- B. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

3.09 PROTECTION

Specification Guide Note: Co-ordinate the following Paragraph with Section 01 76 00 - Protecting Installed Construction.

- A. Protect installed product from damage during construction in accordance with Section [01 76 00 - Protecting Installed Construction].
- B. Make good damage to adjacent materials caused by window washing equipment installation.

3.10 MAINTENANCE

- A. Include complete maintenance on window washing equipment for [12] months after date of acceptance by [Owner] [Architect] [Consultant].
- B. Regularly and systematically [weekly] [semi- monthly] [monthly] examine, clean, adjust and lubricate moving parts.
- C. Repair or replace parts of window washing equipment whenever required due to defect and normal wear and tear.
- D. Use only standard parts of product line of manufacturer of window washing equipment.
- E. Maintain locally adequate stock of parts for replacement or emergency purposes.
- F. Provide personnel to perform work under supervision and in direct employ of window washing equipment system manufacturer or manufacturer's licensed agent.
- G. Perform work during regular trade working hours satisfactory to [Owner] [Architect] [Consultant].
- H. Provide emergency call-back at no extra cost and ensure fulfillment of maintenance and emergency service without undue loss of time to [Owner] [Architect] [Consultant].
- I. Ensure that maintenance personnel register with designated building personnel at time of inspections and maintenance.

END OF SECTION