
SECTION 11 24 00
EXTERIOR BUILDING MAINTENANCE EQUIPMENT

PART 1 GENERAL**1.1 SUMMARY**

- A. This is a "Performance Specification" to guide a manufacturer to create a "design – build" "Crane-Style" Building Maintenance Unit (BMU) as part of a complete exterior building maintenance equipment system within the parameters and requirements of this specification for exterior building maintenance equipment. The completed system shall operate in accordance with industry standards and it shall be based upon practicality when considering the end user as the worker operates the equipment system. All equipment shall be designed for a "heavy-duty" work cycle and shall operate with a high degree of durability and reliability.
- B. Furnish labor and materials to design, fabricate and install a complete exterior maintenance equipment system for all roof areas, providing access to all facade surfaces (except for aerial lift access regions as shown on the contract drawings), including the following equipment and work scope:
1. Provide adequate project management to:
 - a. Assure the job progresses within the project schedule;
 - b. Coordinate and direct all field activities within this specification section; and
 - c. Provide and maintain timely liaison with the client.
 2. Long boom roof carriage with service platform for building maintenance and track system, including an auxiliary hoist, and transferable stabilization system.
 3. Design, Layout, & Supply (installation is excluded): Intermittent Stabilization Anchors, Pull-Over Anchors, and Transferable Stabilization Anchors.
 4. Platform storage tie-down anchors (rated at 5000 pounds minimum) and weather resistant tie-down straps.
 5. Design, manufacturer and install one new exterior long boom BMU whose characteristics meet the requirements of this specification.
 6. Operational Procedures and Maintenance Manuals.
- C. Related Work Not Included in this Contract:
1. Installation of fixtures embedded into concrete.
 2. Electrical wiring and fixtures on the building (up to and including outlets)
 3. Light-duty anchors to secure electrical cords.
 4. Hose bibs
 5. Hand-held radio communication equipment
 6. Aerial work platform
 7. OPOS

1.2 SUBMITTALS

- A. Product Data: All submittal information shall be in English. Within 45 calendar days after the Manufacturer/ Contractor has received the Construction Manager's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this section.
 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements including a written procedure of how the components of the system work together to gain access to the façade from one drop to another, particularly when equipment is transferred from one area or level to another.
 3. Provide written confirmation that all portions of the technical specification have been considered and are being complied with on an itemized basis.
 4. Scaled shop drawings, as a minimum, shall include:
 - a. Large-scale roof plans (plotted paper size shall be 24 in. x 36 in., minimum.) showing typical equipment rigging at all the various launch points to assure clearances and space restrictions have been considered and have been accommodated and accounted for. Shop drawings shall include all MEP equipment near façade access equipment.
 - b. Provide auxiliary hoist catalog cur-sheets and details.
 - c. Revisions to previously submitted shop drawings shall use a "cloud" or bubble to denote those portions of the drawing that have been changed.
 - d. All measurements, reactions and/ or forces shall be in English units.

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- e. Composite roof plans detailing all "drops"; building elevations indicating the locations of required tie-in receptacles; plus sections and details as necessary to adequately describe the work to be performed.
 - f. Work platform drawings, including but not limited to: overall dimensions, wire rope size and construction, specific accessories such as building face rollers, ISA insert details, modular platform connection details, wheels, load rating plate information, and the weight of the fully assembled platform.
 - g. Transferable Stabilization system details and component cut-sheets.
 - h. Transferable Stabilization system detailed functional (step-by-step) description in notated pictorial format.
 - i. BMU Reactions on the building's structure.
 - j. Clear designation of the work to be performed by other Trade Contractors and note indications that their work has been coordinated and considered by the work to be performed as part of this contract.
5. Long Boom BMU Calculations:
 - a. Roof car and its boom, providing as a minimum, maximum deflection of the boom under operating conditions.
 - b. Provide bolt torqueing requirements for all structural bolt connections, including bolts that connect the rig to its roof-top supporting structure.
 - c. Seismic design and maximum deflection restrictions.
 - d. Wind load on platform and the resulting pull-out loads on the building.
 - e. Transferable stabilization load calculations.
 - f. If hydraulic rams are used to luff the boom, provide structural calculations for the hydraulic cylinder.
 6. ISA's, Pull-over Anchors, and Transferable Stabilization Anchors: Catalogue cut sheets for the detent/lifting pin, including its diameter, number of locking balls, shank (grip) length, and pull-out strength.
 7. Manufacturer's recommended installation procedures which, when approved by the Contracting Officer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
- B. All designs, calculations and drawings shall be performed and sealed by or under the direct supervision of a Professional Engineer, registered in the State of California, with specific experience and expertise in permanent window cleaning equipment.
- C. Welder's certification for shop and field welders, in triplicate from the testing lab, shall be submitted directly to the Construction Engineer/Architect.
- D. Manufacturer's certification for the actual wire rope used, including the wire rope's construction and breaking strength.
- E. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Contracting Officer three copies of an Operation and Maintenance Manual compiled in accordance with provisions of Division 1 of these Specifications and per 1.02 F, below.
- F. Maintenance, Operations, Service Manual: As a minimum, shall include:
1. TABLE OF CONTENTS
 2. General Data Summary
 - a. Location: site
 - b. Hoist serial numbers (traction hoist, only)
 - c. Year of Construction
 - d. Manufacturer & address
 - e. Type of equipment
 - 1) Long Boom BMU
 - f. Wire rope:
 - 1) Size
 - 2) Construction and finish
 - 3) Number
 - 4) Length
 - 5) Minimum Breaking Strength
 - g. All shop drawings plus Equipment Layout for all Drops, signed and sealed by P.E.
 - h. Calculations that are signed and sealed by P.E.
 - i. Bolt torqueing requirements for all structural connections that are bolted.
 - j. Service drops, number configuration and height

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- k. Power supply
 - l. After sales service
 3. Definitions
 4. Warnings
 - a. General
 - b. Duty to understand and comply
 - c. Duty to inspect and maintain
 - d. Duty to train and control
 - e. Duty to avoid taking chances
 5. Introduction and System Description: Use extensive illustrations to describe means and methods for the entire system.
 - a. Support Equipment: list with illustrations
 - b. Suspended Equipment: list with illustrations
 - c. Safety equipment
 - d. Stabilization method
 6. Component check list for both "Pre-wash" and "Annual" inspections.
 7. Checks before rigging and use
 - a. Maintenance logs/Usage logs
 - b. Wire rope
 - c. Electric supply/cords
 - d. Platform, cage or chair
 - e. Safety equipment
 - f. labels/instructions
 8. Rigging, Set-up and de-rigging
 - a. Support equipment
 - b. Platform set-up
 - c. Safety equipment
 - d. Barricades, ground level protection and notice
 9. Checks before Operation
 - a. Loading
 - b. Wire rope tag
 - c. Limit switches
 - d. Communication system
 - e. Security of tools, etc.
 - f. Fire protection
 - g. Safe access/egress
 10. Operation
 - a. Controls and functional checks
 - 1) Lifting
 - 2) Lowering
 - 3) Traversing
 - b. Safety devices
 - c. Deployment from roof
 - d. Stabilization of platform, cords, lines and ropes
 - e. Adverse weather
 11. Troubleshooting
 - a. Pre-deployment troubleshooting
 - b. Troubleshooting once deployed
 12. Emergency Recovery Procedure/Rescue
 13. Final Safety Do's and Don'ts or Checklist
 14. Maintenance
 - a. General Maintenance-Lubrication
 - b. Wiring diagram depicting electrical connections, name and symbol for each relay, switch or other device;
 - c. Parts catalog, providing replacement parts list, including identifying numbers and manufacturer;
 - d. Lubrication chart & schedule for lubrication, including the manufacturer's recommended type of lubricant;
 - e. Handling and Storage.
 15. Warranty
 16. Electrical Diagrams

17. Illustration of all labels affixed to equipment
18. List of Reference Material

1.3 QUALITY ASSURANCE

- A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. In addition to complying with pertinent requirements of governmental agencies having jurisdiction, comply with:
 1. City and State Building Codes, as applicable.
 2. CAL OSHA Division of Industrial Safety, General Industry Safety Orders, Title 8, Articles 5 & 6;
 3. Federal OSHA Part 1910, Paragraph 1910.66, Powered Platforms for Building Maintenance;
 4. IWCA I-14.1, Window Cleaning Safety;
 5. ASME A 120.1, Safety Requirements for Powered Platforms and Traveling Ladders and Gantries for Building Maintenance;
 6. AISC "Specification of the Design, Fabrication, and Erection of Structural Steel for Buildings;"
 7. The Aluminum Association's "Aluminum Design Manual";
 8. AWS D1.1-96 "Structural Welding Code-Steel;" and
 9. Pertinent standards of NEMA and NESC.
 10. Underwriters Laboratory: UL 1322 (platform), UL 1323 (hoist) and UL 508A (Control Panel).
 11. In the case of a Code or Standard conflict, the more stringent of requirements or interpretations shall govern.

1.4 WARRANTY

- A. Manufacturer's Warranty: Submit three executed copies of Manufacturer's Warranty for material and workmanship of the window cleaning equipment and system, demonstrating compliance in every respect with 1.03B, above. Any defects (not due to ordinary wear and tear, improper use or care) detected within the first two years after date of Owner acceptance shall be corrected by manufacturer, to the full satisfaction of the Owner and at no additional expense to the Owner.
- B. Certification of compliance: Upon completion of the installation, the Window Cleaning Equipment Manufacturer shall issue a certificate confirming entire compliance with the Specification and any applicable codes, standards and regulations. Additionally, the manufacturer shall certify that the equipment is compatible with the building and that the equipment system is safe to use.

PART 2 PRODUCTS

2.1 AVAILABLE MANUFACTURERS

- A. The Manufacturer or his installation subcontractor (as applicable) shall have a valid California Contractor's License and a valid city Fabrication License (as applicable).
Manufacturers offering products which may be incorporated in the work include:
 1. EW Cox USA, Inc.
216 North End Ave. East
Cranford, NJ 07016
Jonathan Lin, Sales Engineer
(908) 325-6587 FAX: (908) 967-6042
E-mail: jonathan.lin@coxqomyl.com
 2. Manntech North America, Inc.
2520 State Route 35, Suite 305
Manasquan, NJ 08736
Dan Johnson, President
(732) 722-7290 FAX (866) 401-8899
E-mail: DanJohnson@ManntechNorthAmerica.com
www.ManntechNorthAmerica.com
 3. Sky Rider Equipment Co. Inc.
1181 N. Blue Gum Street
Anaheim, CA 92806
(714) 632-6890 FAX (714) 632-0818

4. Tractel Ltd., Swingstage Division
Allen Kanarek - Western US
North American Sales Director/ Manager
7 Mt. Lassen Dr., Suite D-132
San Rafael, CA 94903
(415) 446-7232 FAX (415) 446-7233

2.2 GENERAL REQUIREMENTS

- A. Structural components, except wire rope, shall have a safety factor of four-to-one (4:1) or greater. Design wire rope to have a safety factor of not less than ten-to-one (10:1).
- B. The façade access system and its work platform shall be designed and installed to provide direct "hands-on" access to all windows. In addition to operating wind loads as directed by ASME A120.1, the installation shall be designed to withstand 100 miles per hour wind in its stored position.
- C. The façade access system and its work platform shall be designed and installed to provide direct "hands-on" access to all windows and shall be designed to provide continuous contact between the platform and the building as the platform moves up or down.
- D. Power Supply: Electrical control panels within the Exterior Building Maintenance (EBM) equipment system shall be designed to accommodate irregular power supply voltage. In the event of a power surge or a supply of low voltage, means shall be incorporated to protect the equipment's motors and circuitry. Fuses are prohibited.
- E. Prime mover hoists and Control panels shall be housed in a water-proof housing, complying with NEMA Type 3 or Type 4 enclosure. Control panels and other electrical equipment, such as switchboards and panel-boards that are likely to require inspection, adjustment, servicing or maintenance while energized, shall be marked to warn of potential electric arc flash hazards. The marking shall be located as to be clearly visible to personnel before inspection, adjustment, servicing or maintenance of the equipment
- F. Roof Top Controls: Control systems using inverters, drives or other sensitive electronic devices shall be provided with a means to filter or stabilize the incoming power against noise and transient voltage conditions that may otherwise cause damage or improper operation. The control box or cabinet shall employ means to shield its components from outside RF signals that may be extremely intense.
- G. Using the services of an engineer currently licensed by the State of California and in accordance with pertinent provisions of these Specifications, provide a complete design of the system and all of its components. Affix the signature and verification stamp or seal of the engineer on all design data and Reports that are submitted by the manufacturer.
- H. Oil leakage and drips: Provide means to catch and drain oil (hydraulic and lubricant) that may inadvertently fall from the BMU.
- I. All electrical components shall meet the specific requirements of U.L., including U.L. labeling for each part or subassembly.
- J. All rigging hardware such as shackles, wire rope thimbles, forged loops, etc., shall be manufactured by the Crosby Group, LLC, Tulsa Oklahoma.
- K. All running wire rope sheaves shall be lubricated. Unless sealed roller bearings are used, provide means and personnel access to lubricate all sheaves.
- L. All "load-bearing" parts shall be constructed of metal.

2.3 LOAD-RATING AND WEIGHT IDENTIFICATION

- A. EQUIPMENT: Each suspended unit of an equipment installation shall be provided with a load-rating plate, stating the weight of the unit and load rating of the suspended unit. Additionally, the auxiliary hoist shall have a load-rating plate. The load-rating plate shall be conspicuously located (on fully assembled and erected equipment), stating the weight of the unit and stating the equipment's load rating. All detachable components (such as a davit boom that disengages from the davit mast for transport) shall be provided with an identification plate that states the detached components weight and load rating. The load-rating plate shall be of non-corrosive, permanent-type, made of metal, and securely fastened to the unit. All letters and figures

- on the plate shall be made by stamping, or etching, or shall be cast on the surface of the plate. The letters and figures shall be not less than 1/4 in. (6.35 mm), with the load indicated in 1/2 in. high (13 mm) figures. The letters and figures shall be maintained in a legible condition. Load rating information adhered to a plate is prohibited.
- B. **WIRE ROPE:** All wire ropes, including horizontal lifelines, wire rope linking systems, and suspension wire ropes, shall be permanently tagged and identified. The metal tag shall be made of brass whose thickness meets long-term durability needs when exposed to roof friction (as applicable), equipment relocation and other job-related challenges. A stainless steel ring or small-diameter stainless steel lanyard shall be used to connect the metal tag to the wire rope. Included on the metal tag shall be the following information: Name of company that supplied the ropes; date of installation, catalog breaking strength, and construction of the rope, and the length of the assembly or of the rope, as applicable. All lettering on the tags shall be stamped or etched into the metal.
 - C. **TRANSFERABLE STABILIZATION LANYARD (TSL) LINE:** All TSL lines shall be permanently tagged and identified. The metal tag shall be made of brass whose thickness meets long-term durability needs when exposed to friction (as applicable), equipment relocation and other job-related challenges. A stainless steel ring or small-diameter stainless steel lanyard shall be used to connect the metal tag to the line or highly visible at the storage location. Included on the metal tag shall be the following information: Name of company that supplied the lines; date of installation, catalog breaking strength, and construction of the line, and the length of the assembly, as applicable. All Lettering on the tags shall be stamped into the metal.

2.4 FABRICATION

- A. Structural Aluminum Welding shall be inspected by an independent test lab using dye-penetrant (or equal). Any defects found shall be cut out, re-welded, and retested.
- B. Galvanizing:
 - 1. All portions of steel assemblies, except for mechanical parts such as pins, shackles and bolts, shall be hot dipped galvanized after fabrication in strict accordance with ASTM A123/A123M-09. Local areas of weldment that are field welded to other steel shall be stripped of galvanizing prior to welding and after assembly is welded, provide generous quantities of cold galvanizing repair paint in accordance with ASTM A780.
 - 2. Holes in tubes and pipes, required to relieve pressure during the galvanizing process, shall be plugged with lead to permanently seal the holes from moisture intrusion.
- C. **Painting:** All carbon steel portions of the roof carriage and its arms or boom shall be hot-dipped galvanized and then painted. After the galvanizing procedure is completed, prime paint steel assemblies using a paint coating product that bonds with the galvanized surface. Apply two coats of finish enamel, color to be selected by Owner, using a paint coating product that bonds with the prime paint.
- D. **Bolts and Fasteners:** All bolts shall be stainless steel, except as allowed for below. All rivets, fasteners and washers shall be stainless steel. Bolted connections shall employ means to prohibit the nut from unintentional loosening or dislodging from its bolt. Intentional damage to the fastener's threads is an unacceptable means to achieve the above requirement for threaded portions that are not embedded in concrete. Rivets shall not be used as fasteners to connect members through which the load chain passes unless the rivets have been specifically designed for cyclic loading. EXCEPTIONS: 1. Fasteners for rail/ track beam connection hardware; 2. Prime mover (hoisting machines); and slewing gear bolt attachment to structural frame.
- E. **Springs:** All mechanical springs shall be constructed of Stainless Steel.

2.5 LONG BOOM ROOF CAR (BMU), CRANE STYLE RIG

- A. Design, fabricate, install and commission one counterweighted, long boom roof car with a slewing, telescopic boom and a rotatable spreader boom. The rig shall be equipped with a 1,250 pound capacity auxiliary hoist, primarily used for exterior glazing replacement. Additionally, the rig shall be capable of telescoping or extending vertically to clear the top edge of the tower, OR the rig shall have a luffing boom to enable the suspended work platform to clear the top edge of the tower. The entire rig shall stow at an elevation below the top edge of the tower.
- B. **Wind Stabilization:** Provide the necessary number of adjustable Intermittent Stabilization tie-in lanyards and detent pins. Detent pins shall properly engage in the façade inserts. Use four-ball pins. Lanyards shall be

- constructed of stainless steel wire rope and shall be adjustable in length to maintain the work platform in a snug position against the façade at all times.
- C. Wind Stabilization: The work platform shall be capable of being secured for wind stabilization using two methods: "Transferrable Stabilization" (see section below); Intermittent stabilization as the building's face becomes completely vertical. Adjustable tie-in lanyards, constructed of wire rope, are required for each end of the stage. Each wind stabilization method shall have a minimum capacity of 600 pounds in any outward direction. Provide a wind force analysis based on a 25 mph operating wind, multiplied by a safety factor of at least 4. If this analysis results in "factored" forces on the lanyards that exceed 600 pounds, use the larger value.
- D. Install "information" Signage (can be vinyl) to the BMU on the control panel door. The sign shall include language that directs user on where to find the OPOS and O&M Manuals, and Phone #, etc...
- E. WHERE APPLICABLE: Telescopic Mast: The roof car shall have a mechanism, enabling the suspended powered platform to clear the very tall glass parapet as the platform is swung into its work position. Additionally, it shall be capable of retracting the boom and lowering the assembly to a storage position above the tracks.
1. A failsafe mechanism shall be employed to hold the telescoping mast from vertical travel if the mast's primary raising mechanism (wire ropes, hydraulic or rack and pinion) fails.
 2. If a hydraulic ram or jack is used to control the mast's elevation, it shall comply with the National Standard, ASME B30.1.
 3. The fully extended and fully laden mast shall have a lateral deflection that does not exceed L/120.
 4. Provide means to access the BMU's hoist package for emergency rescue in any given mast extension position. If the bottom of the hoist cabinet exceeds four feet above the roof or other safe surface when the mast is fully elevated, provide a catwalk with handrails around the hoist and control cabinet(s) for service access. The catwalk handrail configuration shall permit hoist cabinet doors to open fully.
- F. Telescopic Boom: The operational characteristics of the long boom machines are limited by LA County's rules for operating exterior building maintenance equipment over and around the building's helipad. Further size restrictions are imposed by the building's architectural features and storage area restrictions.
1. A failsafe or redundancy mechanism such as a secondary brake shall be employed to hold the telescoping boom from unintended extension or retraction if the boom's primary extension mechanism (wire ropes, hydraulic or rack and pinion) fails.
 2. If a hydraulic ram or jack is used to control the boom's extension, it shall comply with the National Standard, ASME B30.1.
 3. The fully extended and fully laden boom shall have a vertical deflection that does not exceed L/120.
- G. WHERE APPLICABLE Luffing Boom:
1. A failsafe or redundancy mechanism such as a secondary hydraulic ram shall be employed to hold the boom luffing mechanism from unintended extension or retraction if the boom's luffing mechanism fails.
 2. If a hydraulic ram or jack is used to luff the boom, it shall comply with the National Standard, ASME B30.1.
- H. Slewing. Provided a geared rotational mechanism to slew the boom. The slewing mechanism shall incorporate a redundancy mechanism such as a secondary brake to halt rotation if the primary mechanism fails. The rotational speed of the suspended cradle will vary as the telescopic boom is extended or retracted. The rotational speed of the suspended cradle shall not be less twenty-five feet per minute and shall not exceed fifty feet per minute.
- I. Furnish and install the powered roof car system with all-digital circuitry (Program Logic Controllers). Provide a guide schematic to enable the operator to match a specific drop number to a work platform position on the building's façade. The PLC computer shall incorporate a surge protector to protect all data in the event of "brown power" or a power surge. All programming code and supporting documentation shall be delivered in the English language.
- J. The BMU shall also have the following features:
1. Electrically powered 460V, 3 phase, 30 Amp. "utilization rating".
 2. The BMU's shall be hard-wired into the building with a disconnect switch at the control panel.
- K. All operating/ control signals from the operator's station in the platform(s) to the roof car unit shall be accomplished without reliance on radio signals. Control signals traveling through the platform suspension wire ropes shall not be "shorted out" if the suspension ropes contact the building face.

1. Roof powered units shall utilize a control conductor core in the primary suspension wire rope for control signals between the work platform and the roof hoists unless a traction hoist is used as the hoisting mechanism,.
2. Traction hoists shall incorporate a "Magtron" (or approved equal) control signal transmitting system with the following features:
 - a. Provide signal isolating collars around ISA tie-in lanyards to capture suspension wire ropes without shorting out the signal.
 - b. Provide additional battery units in the work platform, enabling the worker to exchange batteries, at least two times in any given workday, permitting uninterrupted signals from the work platform to the roof-top control system.
- L. Maintenance and service work access: Service work shall not be performed from a ladder. If the service technician's access to the winding drum machinery, secondary brake and/ or control panels requires him to work on a surface that is more than 30 inches above the roof, provide a permanent work platform with handrails to support his service work activities. Provide steps that lead up to the track and provide a standing area for users to stand on at the control button area. This is for the workers that will be servicing the BMU. If the auxiliary material handling hoist is mounted on the boom, means shall be provided to safely access this hoist for service and maintenance.
- M. The prime mover hoist motor and the auxiliary hoist motor shall be equipped with an hour meter to record and display its time in operation, not plug in time.
- N. Wire Rope Abrasion Blocks: Provide a set of portable rope abrasion blocks that are secured on the façade using detent pins secured to the wire ropes with lanyards. The blocks shall be constructed of durable material so the long boom hoist wire ropes do not damage the building's façade.
- O. Where components of steel and aluminum are to be directly affixed to each other, special surface preparations must be used to prohibit galvanic corrosion between the dissimilar metals.
- P. The roof car's booms (primary and secondary) shall be designed to safely accept eccentric loading of the platform, assuming both operators are on the same end of the platform.
- Q. Spare parts: Provide replacement parts for all items that typically wear out or are damaged within the first five years of use. Provide a locking bin or box to hold all spare parts.
- R. Material Handling Hoisting Mechanism:
 1. Provide a material handling (façade or glazing unit) system whose suspension point is located at the end of the main boom, capable of lifting and securing a payload of 1,250 pounds.
 2. Provide a load rating for the auxiliary hoist, displayed on both the work platform and on the roof car.
 3. The system's hoisting mechanism shall include overload protection, an over-speed brake and a secondary brake.
 4. Controls: Means to operate the material handling hoist system shall be provided at both the primary work platform and at the building's main roof.
 5. All mechanical components of the system shall have a minimum safety factor of 5 to one.
 6. All structural components shall have a minimum safety factor of four to one.
 7. Wire rope shall have a minimum safety factor of ten to one. If a traction hoist is utilized, it shall be equipped with a powered wire winder.
 8. Service/ maintenance access to the hoist shall be provided, including fall protection provisions if service and maintenance is performed from an elevated height. Service work shall not be performed from a ladder.
 9. The location of the auxiliary hoist shall be such that it is accessible for maintenance and servicing, including emergency access, in all working positions of the boom.
- S. Work Platform:
 1. The four-wire rope suspended platform shall have a minimum capacity of 600 pounds.
 2. A spring-loaded upper limit switch shall be provided at each end of the platform.
 3. The maximum out of level distance, as measured from one end of the platform to the other, shall be the lesser of 10 degrees or one foot. The rocker arm to equalize wire rope pairs at the platform stirrups shall have enough play in the arm to provide rope equalization at all times, considering the roof car drum spooling inconsistencies and considering the overall length of wire rope and its propensity to stretch at different rates. Suspension wire ropes shall have termination eyes that are formed using thimbles and mechanically crimped sleeves.

4. Adjustable tie-in lanyards, constructed of wire rope, are required for each end of the stage. Each lanyard shall have a minimum capacity of 600 pounds in any outward direction. The detent pins shall have four balls and shall be the "lift pin" style. Provide a wind force analysis based on a 25 mph operating wind, multiplied by a safety factor of at least 4. If this analysis results in "factored" forces on the lanyards that exceed 600 pounds, use the larger value.
 5. Provide limit switch assembly at each end of the platform to detect the ISA lanyard (or guide rope) as the platform is ascending. The limit switch shall halt power to the hoisting mechanism if the lanyard (or guide rope) has not been removed.
 6. Reinforced "foot holes" in the perimeter screening for access into the platform, creating steps at each end of the platform to assist its operator's easy ingress and egress.
 7. Spring loaded upper/tie-in lanyard limit switches, plus overload, and slack wire limits. If the upper limit switch is activated by a block clamped to the suspension wire ropes, provide means to allow the wire ropes to rotate freely with respect to the upper limit block.
 8. Lower obstruction bar with electric interlock to halt downward travel of stage. The obstruction bar shall extend for the full length of the platform. Photo electric eyes are prohibited for use as the lower limit on modular platforms. The obstruction, lower limit, system shall deploy and halt the downward travel when the platform encounters an irregular shaped object and/ or when it encounters a level lower surface such as a skylight.
 9. Power cord collection bin mounted on the stage's exterior.
 10. Non-marking, non-scuffing building face rollers (permitting the stage to maintain contact with building face and to adjust to the facade's convex faces), constructed of spongy polyurethane, 5 inch diameter, minimum, with sliding adjustable mountings to the stage for lateral adjustment.
 11. Stowage tie-downs for the stage, securing it to the upper catwalk.
 12. Trolley line (dog line) affixed (at a height of 42 inches) to the stage's back rail and to the stage's structure. The use of wire rope clips to form the eye ends of the wire ropes is strictly prohibited.
 13. A portable instrument which will accurately measure wind velocity, provided to alarm the equipment's operators in the even wind speeds exceed 25 MPH. During an excessive wind event, primary power to the suspended unit shall not be interrupted for up or down travel. Provide a "holder" for the instrument to be affixed to the powered platform.
 14. Fire extinguisher.
 15. Pullover anchors shall be designed for the combined maximum wind load calculated and the maximum force exerted on the anchors when the platform traverses laterally.
- T. Transferable Stabilization System
1. Identical to the rest of this specification, this section is also a "Performance Specification" section to guide a manufacturer in the creation of a "design – build" as part of a complete exterior building maintenance equipment system.
 2. The maximum vertical interval between building anchors shall be three floors or 50 feet, whichever is less. The vertical interval between building anchors shall occur vertically more often if required to limit the transferable stabilization lanyard length.
 3. Plan, Elevation, and section views of the anchor layout shall be submitted with the shop drawings. Section views shall be provided for every drop location along the East Elevation.
 4. The Transferable Stabilization Lanyard (TSL) length, as measured perpendicularly between building face and platform suspension lines, shall not be required to exceed six (6) feet except at any horizontal building "step-outs".
 5. The transferable stabilization system building anchors and components shall be capable of sustaining without failure at least four times the maximum anticipated load applied or transmitted to the components and anchors. All components of the system shall be designed to support the combined vector loading calculated from the 600 pound minimum or the resultant force imposed based on the wind loading applied from the calculated full platform sail area, whichever is greater. The force applied to the facade connection shall be provided in a specifically identified calculation that demonstrates the combined loading from both sides of the connection (the force can be amplified because of the sheave).
 6. Provide a wind force analysis based on a 25 mph operating wind.
 7. All components in the system, including but not limited to the building anchors, shall be designed to accommodate the worst-case loading, including, but not limited to, a worker inadvertently (not following the operating procedures) causing the platform suspension ropes to angulate by not extending the TSL.
 8. The building anchors and stabilizer ties shall be capable of sustaining anticipated horizontal and vertical loads from winds specified for roof storage design which may act on the platform and wire ropes if the platform is stranded on a building face.

9. The system shall keep the equipment in continuous contact (10 pounds force during work from the platform) with the building facade, and shall prevent sudden horizontal movement of the platform. If wind causes the platform to lose contact with the face of the building, the TSL shall not extend more than 6 inches before holding the full required maximum factored load.
 10. As the BMU boom translates the platform over the complex building shape, the transferable stabilization lanyard shall have the capacity to extend to ensure vertical and plum platform suspension wire ropes.
 11. As the BMU boom translates the platform over the complex building shape, the TSL shall have the capacity to retract to ensure the lanyard is taut in all conditions, except when work station stabilization is engaged.
 12. Electronically coordinate the payout (and pull in) of the TSL line with boom positioning.
 13. Provide individual control of each TSL line.
 14. Provide a physical barrier on the platform stirrup design to prevent the TSL sheave (that captures the suspension wire rope) from inadvertently contacting worker.
 15. A workstation stabilization lanyard shall be provided to stabilize the platform when relocating the TSL. An interlock switch shall be connected to the workstation stabilization lanyard that prevents the platform from ascending or descending when engaged. The same interlock switch shall also prevent the TSL from being relocated without the workstation stabilization attached.
 16. Building anchors shall be easily visible to employees and shall allow a connection the both ends of the platform suspension ropes at each vertical interval.
 17. The entire portion of the assembly that extends beyond the face of the building shall be free of sharp edges or points.
 18. The transferable stabilization controls shall be integrated into the same control system that adjusts the BMU positioning, utilizing the same communication method.
 19. The manufacturer shall account for all conditions on the varying facade upon which the wind stabilization anchors and bearing roller assemblies will mount.
 20. The transferable stabilization line shall be stored in location protected from sun and moisture exposure.
 21. The material selected for the TSL line shall be that which both is resistant to abrading the facade and also that minimizes the maximum stretch of the line to 6 inches, as measured perpendicularly between building face and platform suspension lines under maximum load.
 22. A retrieval line shall be provided that can assist in relocation of the TSL if needed.
 23. Friction at each connection shall be minimized to reduce the weight required to overhaul the spooling device and reduce the need for a retrieval line.
 24. Portable TSL bearing roller assemblies shall be provided to prevent the TSL from bearing on the facade. Bearing roller assemblies shall have a dedicated storage location on the platform that does not interfere with operator movement. Bearing roller assemblies shall employ a safety lanyard that prevents the roller assembly from falling if inadvertently dropped during attachment.
 25. A limit switch that when triggered halts the platform travel, to prevent the platform from descending or ascending past the elevation of an anchor (without disconnecting it), shall be provided.
 26. The system's hoisting mechanism shall include overload protection, an over-speed brake and a secondary brake.
 27. Controls: Means to operate the material handling hoist system shall be provided at both the primary work platform and at the building's main roof.
 28. All mechanical components of the system shall have a minimum safety factor of 5 to one.
 29. All structural components shall have a minimum safety factor of four to one.
 30. The transferable stabilization hoist shall be equipped with an hour meter to record and display its time in operation, not plug in time.
 31. The location of the transferable stabilization hoist shall be such that it is accessible for maintenance and servicing, including emergency access, in all working positions of the boom.
 32. Service/ maintenance access to the hoist shall be provided, including fall protection provisions if service and maintenance is performed from an elevated height. Service work shall not be performed from a ladder.
- U. Provide a schematic or easy to follow drawings for use by the worker on the platform to follow the intended path for the platform to follow on the building elevation or facade.

PART 3 – EXECUTION

3.1 EXAMINATION

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- A. Examine the areas and conditions under which work in this Section will be performed. Correct conditions Detrimental to timely and proper completion of work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

- A. Coordinate as required with other trades to assure proper and adequate provisions in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION AND SERVICE

- A. Install the work of this Section in strict accordance with the original design, the approved Submittals and Shop Drawings, pertinent requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Construction Engineer. All welding shall be performed by AWS certified welders. Field welding shall be inspected by an independent test lab.
- B. Offer a pricing option to provide service and maintenance of the equipment for a period of 5 years, utilizing factory trained service technicians twice a year, including one annual inspection each year during that time frame. If the manufacturer utilizes an outside agency to service the equipment, identify that firm.

3.4 TESTING

- A. All equipment shall be tested and so certified prior to completion of the installation and prior to the demonstration.
- B. Shop Test: Prior to shipping the BMU, the manufacturer shall perform a system test to confirm the equipment's proper functioning. Additionally, perform a shop test, indicating the exact weight of the fully equipped platform, without occupants, using a calibrated weighing device to measure the platform's weight. Submit certification of calibration for the weighing device.
- C. Powered Platform Shop weigh test certification: Perform a shop test, indicating the exact weight of the fully equipped platform, without occupants, using a calibrated weighing device to measure the platform's weight. Submit certification of calibration for the weighing device.
- D. Portable Davit Shop weigh test certification: Perform a shop test, indicating the exact weight of the fully assembled portable davits using a calibrated weighing device to measure the davit's weight. Submit certification of calibration for the weighing device.
- E. Mock-up: Construct a mock-up of the transferrable stabilization system with hoisting unit, example façade connection, and suspension line connection. The test shall demonstrate the: a) overall ability of the assembly to function in its most stringent condition.
- F. GENERAL EQUIPMENT AND SYSTEM TEST: Upon completion of the equipment installation, and prior to the demonstration, perform a complete test of the equipment, verifying that the equipment performs in complete accordance with the contract documents, over the full range of motions and positions, on one typical drop for each apparatus within the system plus one test on each atypical drop of the system. Correct all deficiencies prior to demonstration. Upon completion of the system test and any consequential equipment deficiencies, prepare and submit a written report to declare that the system test and the deficiency corrections are completed. The report shall identify the test locations in drawing form and contain a photograph of each test.

3.5 DEMONSTRATION AND TRAINING

- A. Upon completion of all installations and prescribed equipment test(s), schedule a time with the Owner and Consultant and conduct a full demonstration of the equipment, including two full days of instructions. Provide a minimum of two skilled, qualified and competent workers to perform the demonstration. Every worker shall be equipped with his own personal fall protection gear including a full body harness and energy absorbing lanyard.
- B. If there is a significant delay between the system test and the demonstration, perform a visual inspection to verify that all equipment is still present, in the correct locations, and is not damaged. Correct all deficiencies prior to demonstration.

- C. If more than one demonstration is required because the contractor/ manufacturer failed to adequately demonstrate the façade access system's workability, the contractor/ manufacturer shall pay for all travel time, on-site time, plus direct expenses of the consultant to witness subsequent demonstrations.
- D. Upon completion of the demonstration, provide training and instructions to the Owner's personnel on a separate day.

END OF SECTION