

# OUTRIGGER BEAM SYSTEMS

### DESCRIPTION

Outrigger beams, used singularly or in pairs, provide a practical means of suspending bosun's chairs, single work cages or platforms.

### Outrigger Types

*Portable Outrigger Beams* are designed to suit a specific roof area and can be relocated within the dedicated work zone. Typically, they are aluminum I-beam sections that provide 6'-0" (1830 mm) cantilever beyond the fulcrum. Portable outriggers are attached to permanently installed bases/anchors during maintenance operations and placed in storage when not in use. Securing or pinning the inboard end to bases/anchors attached to the roof structure eliminates human error associated with the loading or use of counterweights.

*Fixed Outrigger Beams* are designed to remain at a fixed location. Available in steel or reinforced aluminum in long span sliding beam models that typically span over 10'-0" (3050 mm) beyond the fulcrum and telescoping beam models that are used when inboard roof space is restricted.

### USE

Outrigger beams are suitable for buildings under 300 feet (91.4 m) in height and are usually ground rigged.

Long span beams are ideal for accessing difficult to reach areas e.g. beyond sloped roofs, terraces or sunscreens. Often equipped with winches, sheaves or rollers to facilitate the blind raising and lowering of suspension lines.

### FEATURES

**All corrosion resistant materials;** components are stainless steel, aluminum and hot dipped galvanized steel.

**Easily relocated;** portable beams are quickly dismantled into lightweight pieces equipped with convenient handles for carrying.

**Standards conformance;** all outrigger beam systems comply with OSHA and ASME/ANSI/IWCA safety requirements for window cleaning, and various materials standards.



This Pro-Bel portable long reach outrigger beam system was designed to clear a high parapet wall and features a light weight reinforced aluminum beam with dolly wheels for ease of movement. Outrigger materials i.e. aluminum, stainless steel, rubber wheels, etc. withstand year-round exposure when stored on the roof. HealthSouth Corporation, Melbourne, Florida.

**Engineer Certified;** OSHA requires that outrigger beams and bases be designed by or under the direction of a registered professional engineer experienced in such design. Pro-Bel outrigger performance is based on data derived from independent testing and/or engineering calculations. Outriggers provide minimum 1,000 lb (4.5 kN) vertical service load.

**Compatible with roofing;** an important consideration in the design of Pro-Bel outriggers is the need to maintain the long term watertight integrity of the building. Pro-Bel products are designed with a full understanding of reliable flashing/sealing techniques to satisfy virtually any roof condition.

**Cover photo:** Workman setting up portable outrigger. Rear jack wheel permits correct height adjustment for roof anchor and prevents tail of beam from damaging roof membrane.

**Sole Responsibility;** Pro-Bel provides complete primary suspension and fall protection products/systems from concept to the supply and installation of same, including annual inspection.

**Specific liability insurance;** all Pro-Bel installations automatically carry \$2,000,000.00 coverage against product/system failure.



Outrigger tie-back anchor (Pro-Bel EPB Series roof anchor). Separate independent lifeline anchor is same type.

## MATERIALS/FABRICATION (as applicable)

**Outrigger beams:** custom aluminum or steel beams, or hollow steel sections of engineered length and size to suit application, complete with noncorrosive, prominently displayed data plate clearly stating maximum service capacity of beam, Pro-Bel Global Ltd. Name, Serial No. and Man-ufacturing Date.

Outboard end is equipped with various suspension pick-up point devices such as U-bar, trolley, or shackle. In some cases the beam is designed with a rigging sleeve capability to assist in raising and lowering lines beyond obstructions. When the outboard end is supported by the parapet, a protective nylon pad is recommended between the beam and the parapet.

Inboard end options include: the direct connection to roof anchors; 360 degree swivel base; yoke-type base for both sliding and telescoping beams.

**Beam bases:** round hollow steel section (HSS) piers of mild steel to ASTM A36, Type 350W with yield strength of 50 Ksi (345 MPa), designed to suit beam reach and applicable horizontal and uplift forces, various inboard beam connections, and capable of rotating when required; connecting pins having retaining end gravity locks, friction locks or cotter pins.

**Tethers;** all pins and loose pieces are secured using 1/8" (3 mm) stainless steel cable complete with easily inserted lead connectors to avoid loss.

**Beam Dolly:** galvanized steel or aluminum with semi-pneumatic type rubber wheels, sized to suit beam.

**Plate and all other sections:** galvanized mild steel as per beam bases above with yield strength of 44 Ksi (300 MPa).

**Seamless spun aluminum flashing (for steel pier and anchor bases):** 6061-T6 alloy to ASTM B221-2006 with deck flange flashed in using felt plies to NRCA or CRCA recommendations or roofing membrane manufacturer's instructions, as applicable.

**Top of base sealing (for steel pier and anchor bases);** torch applied heat-shrink rubber collar flashing or detachable watertight Type 304 stainless steel cap.

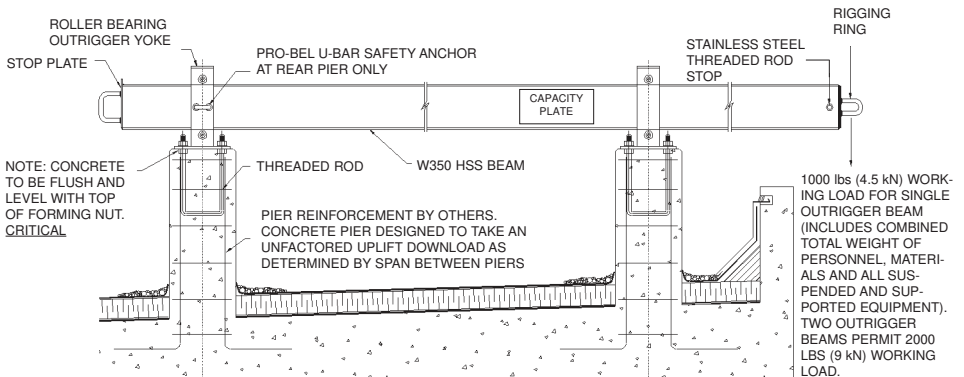
**Bolts, nuts and washers:** Type 304 stainless steel or galvanized steel to ASTM A325.



Outboard end of beam equipped with stainless steel U-bar. Bolt at inboard end and stop plate at inboard end prevents beam from sliding out of yokes.



Beam in the fully extended position.

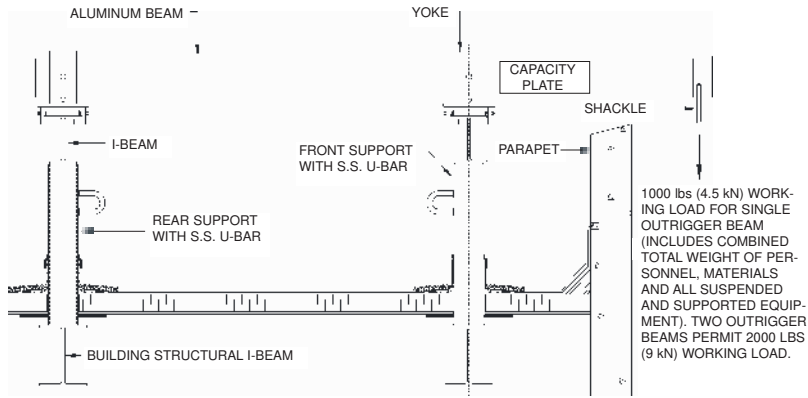


### PRO-BEL FIXED OUTRIGGER BEAM WITH SLIDING BEAM

Recommended for use where added reach is required by the sliding beam to clear terraces, sloped glazing or other obstructions in building facades.

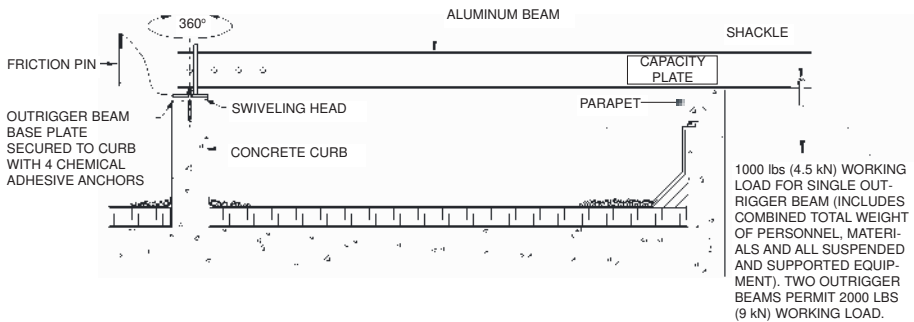


Workman demonstrating how sliding beam is pushed into position (fixed outrigger beam) in preparation for window cleaning operations using a platform.



### PRO-BEL ROLLING OUTRIGGER BEAM WITH SLIDING BEAM

Recommended for use where parapet is not structurally capable of supporting outboard end of outrigger beam and imposed loads, and where lateral movement over long distances is required.



### PRO-BEL FIXED OUTRIGGER BEAM WITH SWIVEL HEAD

Recommended for use where parapet is structurally capable of supporting outboard end of outrigger beam and imposed loads, and where some lateral movement is required.



Photo (left) shows outboard end of outrigger equipped with trolley for attachment of primary suspension line. Stainless steel locking pin tethered to beam locks trolley in desired position.

Note: Illustrated are only a few of the many model variations of outrigger beam systems available. Beams can be engineered to satisfy virtually any access requirement.

### DESIGN CONSIDERATIONS

**Beam base locations;** placement of bases must be coordinated with intended work method i.e. bosun's chair, single work cage, or suspended platform.

**Roof protection;** if employing a beam dolly to clear a non-structural parapet, consider roofing detail to reduce damage from loading on front dolly wheel. Load reaction on roof deck and/or membrane is directly related to beam reach beyond the fulcrum (consult with Pro-Bel for structural data). Pavers, walkway products, sheet plywood or planking may be used to distribute load. If membrane cannot be protected, consider employing a Pro-Bel Davit system.

**Platform (stage) application:** when using outrigger beams, platforms are primarily "ground rigged" i.e. set up and moved from one drop location to another on the ground. In multi-level buildings, ground rigging may not be practical and roof rigged davit systems will need to be considered.

**Beam end pick-up point suspension options;** outboard end of beams can accommodate chair, single work cage or stage using either of four options:

1. Shackle (provides fixed point of suspension).
2. Friction U-bar (provides flexibility in choice of suspension points along beam; stays in place under load).
3. Trolley (can roll along beam under load to access recess at underside of overhangs, soffits and similar areas; necessary for roof rigging).
4. Rigging sleeve capability (suspension lines can be passed through beam to allow for raising and lowering of lines beyond obstruction).

**Outriggers with beam dollies:** to reduce possibility of overturning of some heavily cantilevered outriggers when moving outriggers about on the roof, equipment must be tied back at all times and suspension lines disconnected. Alternatively, outriggers must be turned completely inboard before moving about.

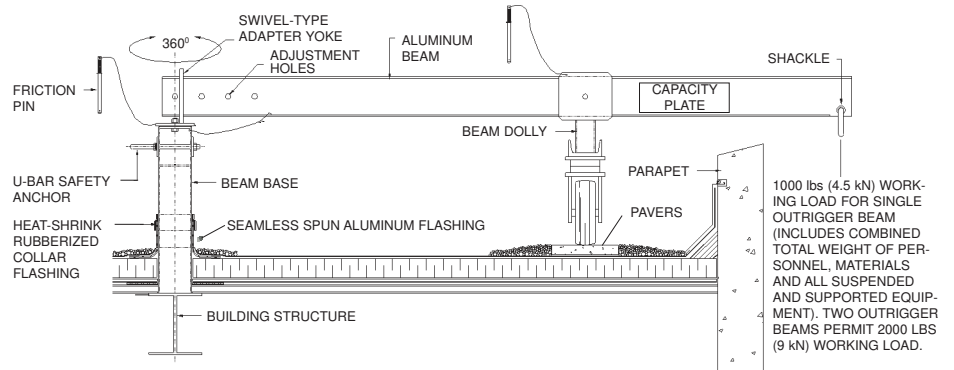
**Stabilization:** outrigger beam systems are typically ground rigged, Buildings 130'-0" (39.6 m) or less in height do not require stabilization. Buildings over this height should consider stabilization in the form of mullion tracks, buttons or detent pins. Refer to Pro-Bel Stabilization Systems literature.

## BEAM TYPES

Pro-Bel outrigger beams are designed to suit each building or structure. Generally portable outrigger beams are made of aluminum and are designed to cantilever up to 6'-0" (1830 mm) past the fulcrum point.

Long span outrigger beams that cantilever beyond 6'-0" (1830 mm) are usually permanently installed, are normally made of steel, and require substantial inboard roof distance for retracting the outrigger beam to the parked position. Alternatively, telescoping beams may be used.

The full range of Pro-Bel outrigger beams include simple, transportable beam systems to more complex designs which include track mounted manual and motorized systems.



**PRO-BEL SWIVEL-TYPE PORTABLE OUTRIGGER BEAM WITH DOLLY**

Recommended for use where parapet is not structurally capable of supporting outboard end of outrigger beam and imposed loads, or for clearing safety railings, or other similar building elements.



Inboard end of outrigger beam is equipped with a swivel-type adapter and safety anchor attached to the beam base.



Pro-Bel portable swivel-type outrigger beam with dolly wheels. Pavers are recommended to facilitate wheel movement and protect roof from loading on front dolly wheels. Note pier mounted independent lifeline U-bar anchors in field of roof.



Beam end (left) shows suspension shackle plate and bolt-type stop. Steel pier (right) shows stainless steel rollers that provide for easy beam movement.



Pro-Bel fixed outrigger beam(s) with sliding beam provides an ideal solution for reaching over wide parapet for ground rigging of platform. Separate lifeline anchors (not shown) are located further back on roof. Amerisuites Hotel, Chicago, Illinois.

### OUTRIGGER LAYOUT PROCEDURE

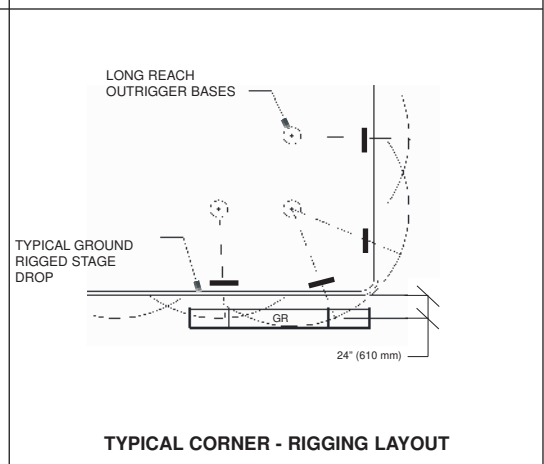
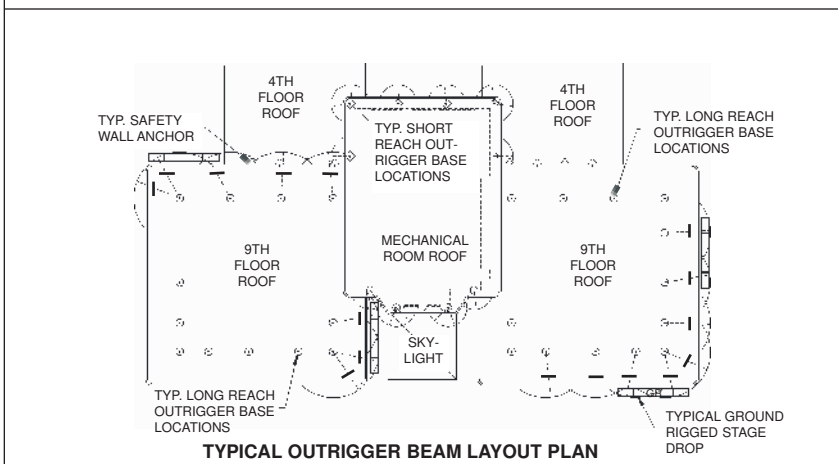
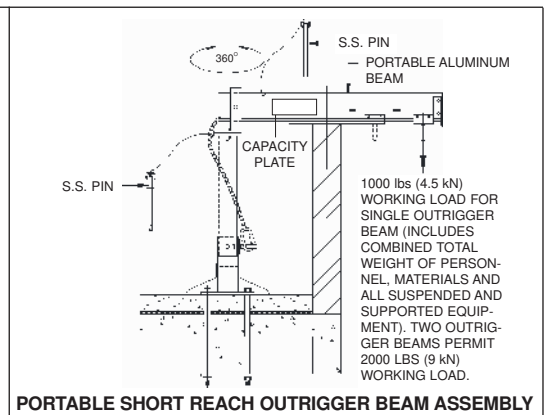
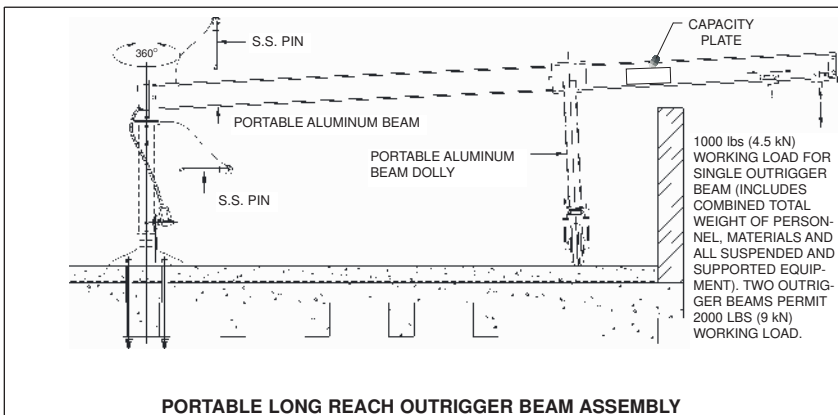
1. Review the Pro-Bel **System & Equipment Introduction literature (pages G-6 to G-18)**. This data provides an overview of the various equipment options used to clean windows or perform other suspended building maintenance.
2. Identify all roof levels. Mark window locations or other areas requiring access on the architectural roof plan drawing(s).
3. Examine building elevations or other drawings to identify any setbacks, recesses or other unusual features.
4. Examine building section details to assess construction of parapet wall, mechanical room wall and roof assembly as necessary.
5. Examine roof structural drawings for possible anchorage or beam base locations. Typically, tie-back and lifeline anchors and/or beam bases are anchored to concrete structural roof

slabs, piers, the steel superstructure, or similar elements.

6. Review the Design Considerations on page O-4 to assist in making a "rigging" decision.
7. When locating outrigger beam bases or anchors, the distance from the roof edge and base/anchor centers should be consistent throughout the roof. Generally the location of bases/anchors are 8'-0" (2440 mm) from the roof edge and at 8'-0" (2440 mm) centers. Make adjustments to the placement of bases/anchors after reviewing steps 8 and 9.
8. If window locations are occasional or sporadic, determine if windows can be cleaned using a bosun's chair or single work cage. A "drop" for a chair is a 6'-0" (1830 mm) wide area and a cage is typically 8'-0" (2440 mm). The outrigger beam platform pick-up point should maintain a 24" (610 mm) outreach beyond the face of the building. Consider the range of motion that can be obtained from an outrigger beam dolly.

9. If it is more practical to clean windows or perform maintenance using a temporary contractor supplied platform i.e. conventional equipment, as in the case of continuous windows or curtain wall, outrigger tie-back anchors or beam bases should be located to suit building configurations. The designer should consider as few platform sizes as possible. The average drop for a platform is 20'-0" (7000 mm), evenly divided around roof perimeter.

10. a. Regardless of access equipment used with outrigger beams, separate lifeline anchors are required for each worker using the equipment.
- b. Lifeline anchors should be separate and independent from the outrigger. In some cases if a 6'-0" (1830 mm) vertical free fall can be maintained, lifeline anchors may be secured to outrigger beam bases and/or somewhere on the roof as outlined in the Pro-Bel Safety & Tie-Back Anchors literature.



## SPECIFICATION

*SPEC NOTE: This basic guide specification (Section 11 24 23 - Window Washing Systems) is devoted exclusively to outrigger beams and related safety anchors and is written in accordance with the CSI/CSC Three Part Section Format. It must be adapted to suit the requirements of individual projects. If other equipment such as davits, monorails, horizontal cable lifelines or other equipment is required, refer to appropriate Pro-Bel literature and incorporate materials and/or other clauses as required. Square brackets [ ] indicate choice, alternatives, data required or need for the specifier to make a decision.*

### PART 1 - GENERAL

#### 1.01 General Requirements

- A. Comply with the conditions of the Contract and Division 1 - General Requirements

#### 1.02 Section Includes

- A. Work of this section includes the design, supply and installation of window cleaning/suspended maintenance equipment.

#### 1.03 Related Sections

- 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 31 13 - Access Doors and Frames: rigging access doors in walls].
- I. Section [08 44 00 - Curtain Wall and Glazed Assemblies: mullion and stabilization co-ordination].
- J. Section [22 11 16 - Domestic water Piping: hot and cold water supply, faucets and drains at [every] roof level].
- K. Section [26 00 00 - Electrical: climbing monorail power supply].
- L. Section [26 20 00 - Low Voltage Electrical Transmission: three phase 208 volts 60 Hertz service at [every] roof level].
- M. Section [26 25 00 - Enclosed Bus Assemblies: climbing monorail busbar].
- N. Section [01 78 00 - Closeout Submittals].

#### 1.04 References

- A. AISC 360-05 "Load and Resistance Factor Design Specification for Structural Steel Buildings".
- B. AISI SG-02KIT, with 2001 Supplement "Specification for Design of Cold-Formed Steel Structural Members".
- C. Aluminum Association AA ADM-1-Aluminum

Design Manual, 2000 and ANSI/AWS D1.2/D1.2M:2003 Structural Welding Code - Aluminum.

- D. ANSI/AWS D1.1/D1.1M:2008 Structural Welding Code - Steel.
- E. ANSI/IWCA I-14.1-2001 Window Cleaning Safety Standard (International Window Cleaning Association).

#### 1.05 Design Requirements

- A. Design window cleaning/suspended maintenance system to suit building and in accordance with plans, specifications, standards, and regulations/codes contained in section 1.04 and 1.08.

- B. Locate outrigger bases/anchorage to suit suspension equipment which will be used on the building with respect to items such as reach, rigging, spacing, roof edge condition and similar items.

- C. Design all anchor components to provide adequate attachment to the building and suited to current window cleaning/suspended maintenance practices. Ensure compatibility with industry standard equipment.

- D. Ensure all anchor components conform to proper engineering principles and have been designed by a Professional Engineer qualified in the design of window cleaning/suspended maintenance equipment, its application and safety requirements.

- E. Design system fall arrest safety anchors and equipment supports to comply with the following structural requirements:
  - 1. Supports for Suspended Platforms: outrigger beams are used for suspending a powered platform from storage and rigging/working locations on the building. These supports and the structure to which they are attached are typically designed to 1000 lbs (4.45 kN) vertical service load plus impact with a factor of safety as per AISC requirements and/or ACI or other applicable construction codes, and to 4 times the rated load against fracture or detachment (i.e. 4 to 1 stability factor).

#### 1.06 Shop Drawings and Engineering Certification

- A. Submit shop drawings showing complete layout and configuration of complete window cleaning/suspended maintenance system, including all components and accessories. Clearly indicate design and fabrication details, window "drops", hardware, and installation details.

- B. Shop drawings to include installation and rigging instructions and all necessary Restrictive and Non-Restrictive Working Usage Notes and General Safety Notes.

- C. Shop drawings to be reviewed by a professional engineer, and upon request, complete with calculations or test reports.

#### 1.07 Qualifications

- A. Manufacturer: Work of this Section to be exe-

cuted by manufacturer specializing in the design, fabrication and installation of window cleaning /suspended maintenance systems having a minimum of 5 years documented experience.

- B. Loading and safety assurance: Work of this Section to meet the requirements of governing codes and jurisdiction and to comply with properly engineered loading and safety criteria for the intended use.

- C. Insurance: Manufacturer to carry specific liability insurance (products and completed operations) in the amount of \$2,000,000.00 to protect against product/system failure.

- D. Welding to be executed by certified welders in accordance with AWS requirements.

#### 1.08 Regulatory Requirements

*SPEC NOTE: Re 1.08.A. Specify for all States other than New York and California.*

- A. Comply with the following OSHA regulations:
  - 1. 1910, Subpart D (Walking and Working Surfaces).
  - 2. Appendix C to 1910 (Personal Fall Arrest Systems).
  - 3. "OSHA Ruling on Window Cleaning by Bosun's Chair" Memorandum to Regional Administrators from P. K. Clark, Director, Directorate of Compliance Programs.
  - 4. 1910, Subpart F (Powered Platforms).

*SPEC NOTE: Re 1.08.B and 1.08.C. Specify for New York State or California only as applicable.*

- B. Comply with the following New York State regulations:
  - 1. Department of Labor Advisory Standard 101 - Construction, Operation and Maintenance of Suspended Scaffolds Used for Window Cleaning and Light Maintenance.
  - 2. Advisory Standard 111 - Hoisting Machines Used for Suspended Scaffolds.
  - 3. Department of Labor Industrial Code Rule 21 - Protection of Persons Employed at Window Cleaning - Structural Requirements, Equipment and Procedures.

- C. Comply with the following California State regulation:
  - 1. 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).

#### 1.09 Maintenance Data

- A. Submit 1 copy of system Equipment Manual & Inspection Log Book, with "Initial Inspection - Certification for Use" and "Inspection Sign-Off" forms completed.

- B. Submit 2 copies of a reduced plastic laminated as-built shop drawing showing equipment locations and details. This drawing is to be posted near exits onto the roof.

## PART 2 - PRODUCTS

### 2.01 Manufacturer

- A. This specification is based on systems currently being manufactured by PRO-BEL Group Ltd., Toll free: 1-800-461-0575. Telephone: 905-427-0616, Fax: 905-427-2545, info@pro-bel.ca.

- B. Other manufactured products meeting this specification may be substituted provided that manufacturers show proof of product insurance. Equipment details to be approved by the architect and/or consultant. Companies, such as miscellaneous metal fabricators, who are not normally engaged in the design and manufacture of window cleaning/suspended maintenance equipment are not permitted to bid.

### Equipment

### 2.02

*SPEC NOTE: List type and quantity as required.*

- [ \_\_\_\_\_ ]  
 A. [ \_\_\_\_\_ ]  
 B. [ \_\_\_\_\_ ]  
 C. [ \_\_\_\_\_ ]

### Materials

### 2.03

*SPEC NOTE: Delete items not required.*

- A. Outrigger beams: [aluminum I-beams] [galvanized steel I-beams] [galvanized hollow steel sections] with non-corrosive, prominently displayed data plate clearly stating Maximum Service Capacity of beam, Manufacturer's Name, Serial No. and Manufacturing Date; and designed to carry minimum vertical service load of 1000 lbs (4.5 kN); of engineered length and size to suit application complete with [shackle] [friction U-bar] [trolley] on outboard end. Beams equipped with rolling trolleys or friction trolleys to have stops to ensure trolley cannot become detached from beam.

*SPEC NOTE: Some very long outrigger beams are designed specifically for bosun's chair with descent control equipment. For this restrictive application, vertical service load will be less than 1000 lbs (4.5 kN). Consult with Pro-Bel for recommendations.*

- B. Safety U-bars: [Type 304 stainless steel with yield strength of 35 Ksi (240 MPa)] [mild steel, Type 300W with yield strength of 44 Ksi (300 MPa), hot-dip galvanized to ASTM A123/A 123M-2000]. U-bar to be not less than 3/4" (19 mm) diameter material with 1-1/2" (38 mm) eye opening.

- C. Outrigger base/roof anchor hollow steel section (HSS) piers: mild steel as above with yield strength of 50 Ksi (350 MPa), [hot-dip galvanized to ASTM A123/A 123M-2000] [with Pro-Bel Protex 3/32" (2.4 mm) thickness, black colored two-component TPU polyurethane/polyurea coating system]. Wall thickness and securement to suit application.

- D. Swivel-type beam bases: round hollow section (HSS) piers of mild steel, Type 350W with yield strength of 50 Ksi (350 MPa), [hot-dip galvanized to ASTM A123/A 123M-2000] [Pro-Bel Protex coated]; capable of easily rotating; with connecting pins. U-bar as above.

- E. Beam dolly: [galvanized steel] [aluminum] with pneumatic type rubber wheels, sized to suit beam.

- F. Tethers: all pins and loose pieces to be secured using 1/8" (3 mm) stainless steel cable complete with easily inserted lead connectors to avoid loss.

- G. Base plate and all other sections: [galvanized] [Pro-Bel Protex coated] mild steel as above with yield strength of 44 Ksi (300 MPa). Thickness and securement to suit application.

*SPEC NOTE: Re 2.03,H. Specify aluminum flashing for BUR or modified bitumen roofs only (membrane above or below insulation). For single ply roofs, flashing to be in accordance with membrane manufacturer's instructions. Specify conformable mastic tape and heat-shrink rubber collar flashing for EPB Series roof anchors (BUR or modified bitumen roofs).*

- H. Seamless spun aluminum flashing (for steel pier anchors): Type 6061-T6 alloy to ASTM B221-2000 with deck flange flashed in to NRCA or CRCA recommendations. Seal top of aluminum flashing with conformable mastic tape and torch applied heat-shrink rubber collar flashing.

- I. Securement and miscellaneous bolts, nuts and washers: mild steel, Type 300W with yield strength of 44 Ksi (300 MPa), hot dipped galvanized to ASTM A123/A 123M-2000 or Type 304 stainless steel with yield strength of 35 Ksi (240 MPa).

### 2.04 Fabrication

- A. General:  
 1. Fabricate work true to dimension, square, plumb, level and free from distortion or defects detrimental to appearance and performance.  
 2. Grind off surplus welding material and ensure exposed internal and external corners have smooth lines.

## PART 3 - EXECUTION

### 3.01 Examination

- A. Examine surfaces and areas upon which the work of this Section depends. Report to the Contractor in writing, defects of work prepared by other trades and other unsatisfactory site conditions which would cause defective installation of products, or cause latent defects in workmanship and function.

- B. Verify site dimensions.

- C. Commencement of work will imply acceptance of prepared work.

### 3.02 Installation

- A. Install equipment in accordance with approved shop drawings and manufacturer's recommendations.

*SPEC NOTE: Re 3.02,B. In Roof Section [07500], specify all roof mounted outrigger beam bases and roof anchors to be properly flashed in compatible with roofing where applicable.*

- B. Co-ordinate installation with work of related trades.

- C. Install all work true, level, tightly fitted and flush with adjacent surfaces as required.

- D. Where applicable, deform threads of tail end of anchor studs after nuts have been tightened to prevent accidental removal or vandalism.

- E. Structural steel to receive outrigger base/anchors to have adequate bearing surface as indicated on shop drawings and/or to ensure 100% weld.

*SPEC NOTE: Re 3.02,F. Specify for furnish only projects if required.*

- F. Manufacturer to assist and/or supervise installation of window cleaning/suspended maintenance equipment installed by others.

### 3.03 Final Adjusting and Inspection

- A. Adjust and leave equipment in proper working order.

- B. Complete "Initial Inspection - Certification for Use" form included in Equipment Manual & Inspection Log Book.

### 3.04 Testing

- A. All anchorage systems relying upon chemical adhesive fasteners to be 100% tested on site using load cell test apparatus in accordance with manufacturer's recommendations.

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