DAVIT SYSTEMS

PRO-BEL

Safety Systems Engineered for Life





SUSPENDED EQUIPMENT & FALL PROTECTION EXPERTS

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Window Cleaning/
Suspended Maintenance
Equipment & Fall
Protection Systems

DESCRIPTION
Davits, used singularly or in pairs, provide an efficient and practical means for suspending bosun's chairs, single work cages or platforms.

Davits are commonly used on multi-level buildings and where it is necessary to clear non-structural parapets, sloped glazing, and decorative cornice moldings. Davits provide greater flexibility in roof rigged applications i.e. clearing high parapets or storing platform on roof.

Available in aluminum or steel, with aluminum being the most popular due to weight and ease of handling.

Steel masts are primarily used for long reach davit arms complete with reinforced aluminum booms. These heavy long reach arms are often recommended to be permanently left in place.

Davit systems are very popular on buildings with various terrace levels. Davit bases can be recessed below the pavers if an inverted roofing system is used. The davit base can be concealed with a paver cap.

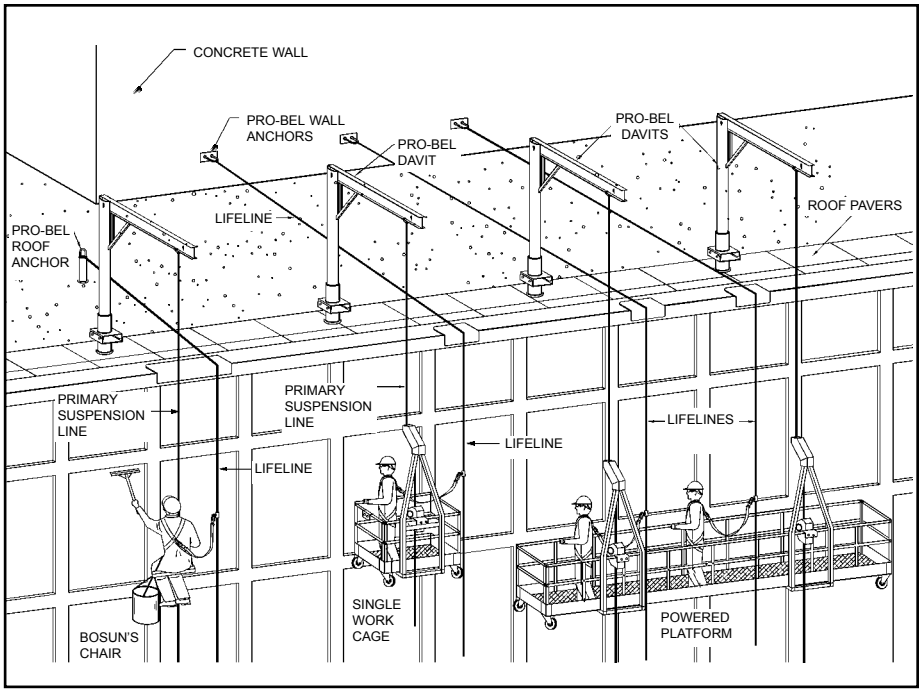
Davit bases are completely installed around the perimeter of the roof top. The davit arms themselves are dedicated to a specific building and most often dedicated to a specific roof level.

Each worker's lifeline must be tied back to a separate independent safety anchor, unless a four point suspension platform is used. **See Permanent Powered Platforms literature.**

USE
Suitable for any building height depending on type of davit selected and where adequate structural support is provided.

Roof, terrace or parapet wall mounted depending upon application. Roof design conditions may dictate use e.g. limited space for outrigger beam suspension or inadequate structural support at roof edge or parapet for davit.

To access difficult-to-reach areas e.g. beyond sloped roofs, terraces, sunscreens and railings.



Typical rigging and fall arrest requirement scenarios using Pro-Bel davits and safety anchors.


Davit bases (next to parapet) require separate and independent lifeline anchors (foreground).


Concrete pier mounted davit bases shown in this photo are concealed in planter boxes.

DAVIT TYPES AND RIGGING METHODS
Depending on factors such as roof loads, parapet height, roof type or other considerations, a range of Pro-Bel davit designs are offered. There are literally dozens of Pro-Bel davit products available. Each has been engineered to satisfy a particular job requirement. They can be categorized as follows:

Portable Davits are dedicated to a specific building and can be moved manually from work location to work location within the dedicated area. A 6'-0" (1830 mm) reach is standard with 8'-0" (2440 mm) also common. Typically roof or parapet wall mounted.

Fixed Davits are designed to remain at a fixed location. Heavy duty boom provides for reaches of greater than 8'-6" (2591 mm).

Rolling Davits are designed to traverse on roof or wall mounted track using manually operated or electric powered rolling carriage. Suitable for confined space, where safe relocation of davit arms is impractical or when davit reach is beyond 8'-6" (2591 mm). A roof car should be considered when a reach greater than 12'-0" (3658 mm) is desired and/or the building is 35 to 50 storeys in height. See Powered Roof Cars literature.

Each of these catagories of davit arms can be designed to suit ground rigging or roof rigging.

Ground Rigged Davits are designed to rig the platform on the ground only i.e. the platform (stage) cannot be rigged on the roof and then swung over the parapet. Ground rigged davit masts are typically short and easy to handle. Ground rigging is the preferred method of rigging with window cleaners i.e. the platform is set up and moved from drop location to drop location at ground level.

Roof Rigged Davits are designed to rig the platform on the roof. Since the platform must be swung over the parapet, roof rigged davits must also be designed for ease of rotation under load. Pro-Bel davit masts are equipped with aluminum rollers with bronze bushings or bearings for this purpose, as well as an optional locking device used to lock the arm in the service position. In addition, Pro-Bel roof rigged davits are designed with a winch and locking device to safely raise and lower the tall davit mast which is typically 7'-0" (2135 mm) or more above the height of the parapet in order to facilitate the inboard outboard movement of the platform. Due to the weight of the arm they are equipped with transport wheels.

Portable 21'-0" (6.4 m) long reach davit arm is employed for sloped glass and designed to suit bosun's chair equipped with descent control equipment.

General: Davits to be demountable, portable, capable of being easily and quickly broken down into pieces weighing no more then 80 lbs (36.3 kg) for ease of carrying.

A modular davit component weighing more than 80 lbs (36.3 kg) is to be provided with a means for its transport, which shall keep the center of gravity of the davit at or below 36" (915 mm) above the safe surface during transport.

Assembled davit arms that require more than 80 lbs (36.3 kg) lifting force are to be equipped with a mechical means for raising and lowering the arms.

Davit bases secured to the building structure using chemical adhesive anchor bolts are to be tested on site as well as tied back to Pro-Bel U-bar safety anchors for added safety.

Portable ground rigged davit arm with low profile steel mast.

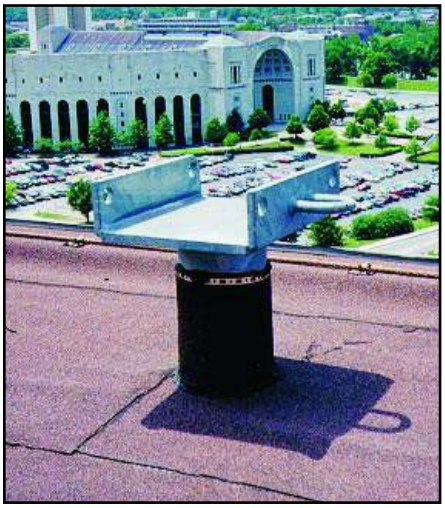
Ground rigged davit assemblies with permanent rotating heads and portable booms.

DAVIT BASE TYPES

Pro-Bel davit bases have been designed for all types of roof or wall construction regardless of composition or complexity and can be catagorized as follows:

200 Series Davit Base

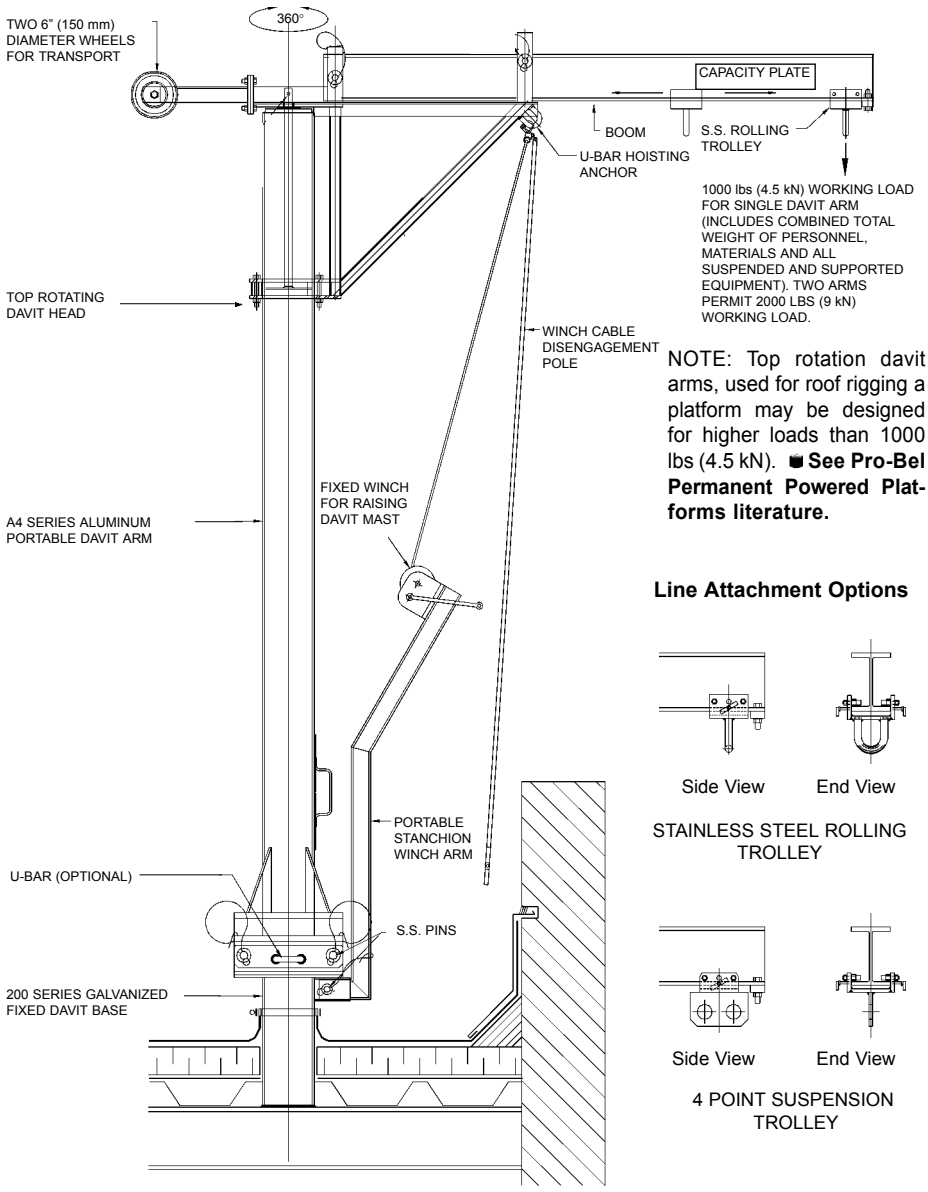
The 200 series davit bases are the most commonly used type. The low profile design suits all Pro-Bel top and bottom rotation davit arms. For heavy duty applications, this base is reinforced with gusset plates under the base plate.



Pro-Bel 200 series steel pier davit base.

Pro-Bel 200 series metal clad concrete pier davit base.

TYPICAL ROOF RIGGED DAVIT DETAIL



NOTE: Top rotation davit arms, used for roof rigging a platform may be designed for higher loads than 1000 lbs (4.5 kN). **See Pro-Bel Permanent Powered Platforms literature.**

Line Attachment Options

Side View End View

STAINLESS STEEL ROLLING TROLLEY

Side View End View

4 POINT SUSPENSION TROLLEY

PRO-BEL 200 Series DAVIT BASE WELDED TO STEEL STRUCTURE COMPLETE WITH A4 SERIES ALUMINUM PORTABLE ROOF RIGGED DAVIT ARM (with Transport Wheels and Winch).

The PBD-200 Series Davit Bases are recommended for use in new or existing construction. Ideal for conventional or protected membrane single ply roofs. Employ flashing boot and draw clamp with single ply, or split flashing with BUR. Roof pavers/hard surface is recommended to facilitate movement of mast and boom assembly from base to base. Davit arm assembly varies to suit rigging method and reach. Securement method to suit roof structure.

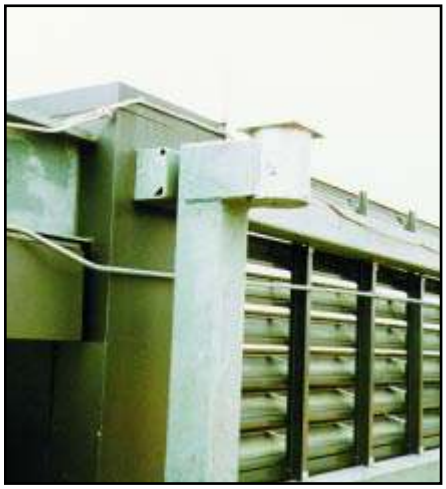
Note: Illustrations are only a few of the many model variations of davit systems available. Davits can be engineered to satisfy virtually any access requirement.

300 Series Davit Base

The 300 series davit base is considered a transition davit base which means that a portable davit adapter is required to accommodate a Pro-Bel davit arm. The 300 series base permits the use of a spun aluminum flashing sealed at the top with a heat-shrink rubber collar flashing.

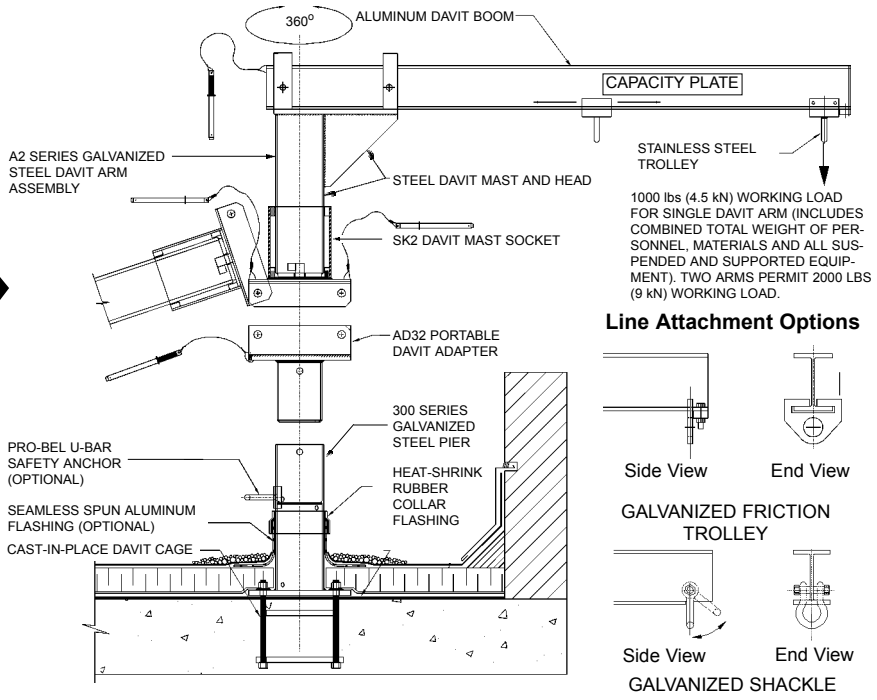
Recommended for use with low profile ground rigged davit arms. The 300 series base is ideal for conventional (membrane above insulation) or protected membrane roof applications. Securement methods include cast-in-place, weldment, bolt-through, bolt-around and epoxy adhesive securement i.e. to suit roof structure.

This Pro-Bel 18" (457 mm) tall 300 series davit base has been installed using epoxy adhesive anchor studs. Each stud has been tested to a capacity of 10,000 lbs (44.4 kN) to ensure proper securement.

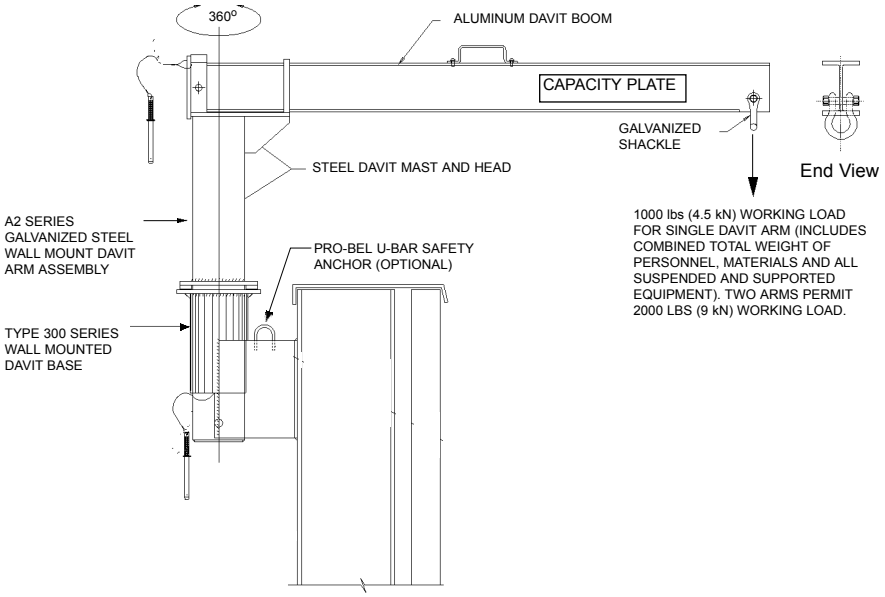


This photo shows a 300 series wall mounted davit base. All davit base designs are suited to wall mount applications.

TYPICAL GROUND RIGGED DAVIT DETAILS



PRO-BEL 300 SERIES CAST-IN-PLACE DAVIT BASE COMPLETE WITH A2 SERIES PORTABLE GROUND RIGGED DAVIT ARM



PRO-BEL 300 SERIES WALL MOUNT DAVIT BASE COMPLETE WITH A2 SERIES PORTABLE GROUND RIGGED DAVIT ARM

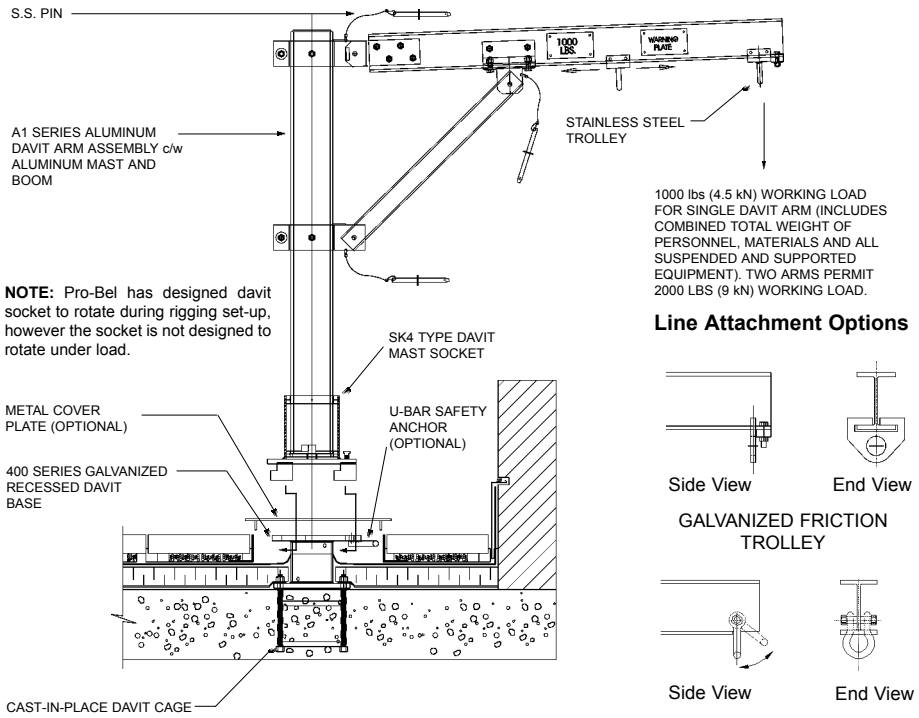
Recommended for use in new or existing construction, where adequate parapet wall strength is provided. Ideal for applications where roof deck cannot support loads or for very high parapet walls (special consideration should be given to safely accessing the davit). Davit arm assembly varies to suit rigging method and reach. Securement method to suit wall structure.

400 Series Recessed Davit Bases

Recommended for use in new or existing construction where flush deck appearance is desired i.e. promenade decks, terraces, elevated plazas, podiums, and similar applications.

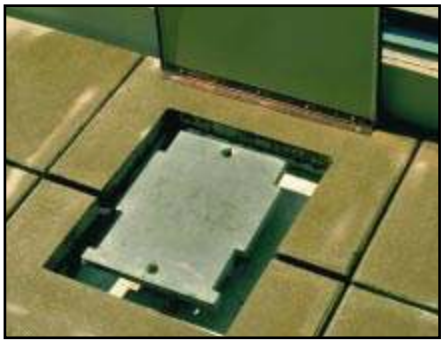
Use with inverted roofing system is ideal in order to provide adequate depth between the roofing membrane and roof pavers. Flush mounted cover plate conceals davit base when not in use. Davit arm assembly varies to suit rigging method and reach.

400 series recessed davit bases are designed with securement methods to suit all roof structures. The roofing detail determines if this type of base can be used.



PRO-BEL 400 SERIES RECESSED DECK MOUNT DAVIT BASE (Shown Exploded) COMPLETE WITH A1 SERIES PORTABLE GROUND RIGGED DAVIT ARM.

Recessed portable ground rigged davit. See assembly sequence at right.



1. Concealed galvanized steel base is accessed by removing fitted metal cover plate.

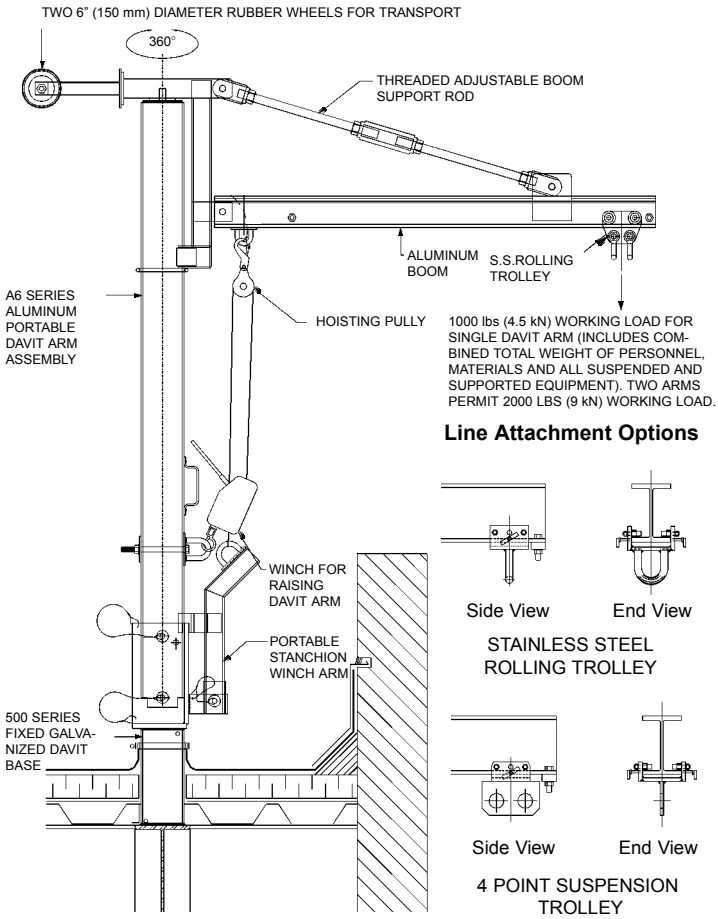
2. Galvanized mast socket is secured to base via lugs and spring-loaded locking devices.

3. Aluminum mast is set into socket and twist locked into place.

4. Aluminum boom is mechanically fitted to mast and secured with stainless steel connecting pins.

500 Series Davit Base

500 series davit bases are normally used with 6'-0" (1829 mm) reach davit arms. This davit base design is only suited to top rotation A-4 and A-6 davit arms.



PRO-BEL 500 SERIES WELDMENT DAVIT BASE COMPLETE WITH A6 SERIES PORTABLE ROOF RIGGED DAVIT ARM

The 500 series heavy duty davit base employs flashing boot with single ply, or split flashing with BUR. Suitable for conventional or protected membrane single ply roof.

ASSEMBLY SEQUENCE FOR PORTABLE ROOF RIGGED DAVIT (With Transport Wheels and Winch)

Aluminum mast and boom assembly is rolled onto permanent galvanized base (davit assemblies are normally stored outdoors on the roof).

Mast and boom assembly is raised into position using the winch.

The platform is hoisted into the air using electric hoisting motors mounted on each end stirrup and the platform is pushed out over the parapet via the rotating davit heads.

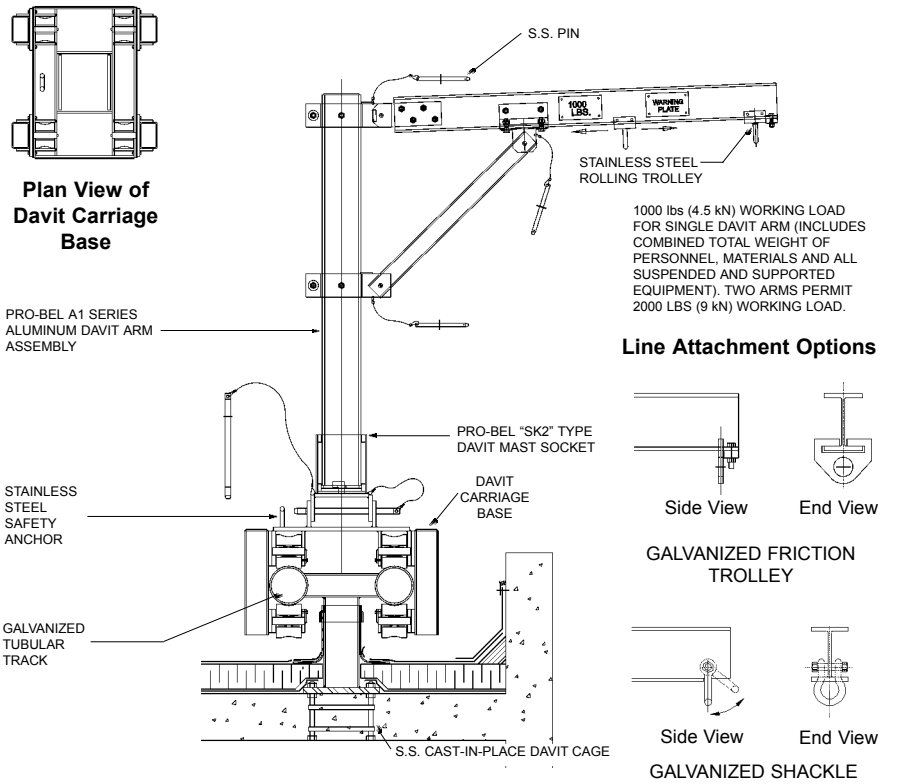
Rolling davits are designed for roofs with restricted access or long reach rigging options. Worker is shown manually positioning davit. Motorized models are also available. Worker's lanyard is clipped to body harness with other end secured to U-bar safety anchor welded to rolling carriage. 25 Sheppard Ave., Toronto, Ontario.

Motorized rolling davit system utilizing I-beam tracks.

Motorized rolling davit system utilizing tubular wall mount tracks.

2000 Series Track Mounted Davits

Pro-Bel offers a full range of unique track mounted davit systems which are used where inboard space is limited for roof rigging and ground access is restricted for ground rigging i.e. when it is necessary to rig over a skylight or glass atrium. Track mount assemblies are also considered when the davit arm assembly is too large/heavy to maneuver from base to base and horizontal travel is required. Concrete pier mounted and wall mounted tracks are shown in these photos. Various I-beam and tube designs are available to suit roof or wall structure.



PRO-BEL ROUND TUBE TRACK MOUNTED PORTABLE ROLLING DAVIT SYSTEM COMPLETE WITH A1 SERIES GROUND RIGGED DAVIT ARM

Parapet wall mounted motorized davit system, George's Quay Development, Dublin, Ireland.

Square tubular wall mounted track supporting a motorized davit system. Islip Courthouse, Islip, New York.

FEATURES

All corrosion resistant materials; davit components are hot dip galvanized steel and/or aluminum, and stainless steel.

Standards conformance; all davits comply with OSHA and ASME/ANSI/IWCA safety requirements for window cleaning and various material standards.

Easily relocated; portable davit arms and masts are quickly dismantled into components weighing a maximum of 80 lbs. (36.3 kg) and equipped with convenient handles for carrying. When individual davit components (mast, boom and socket) exceed 80 lbs. (36.3 kg) a transport dolly is included. A raising winch may also be required to raise and lower the assembly as a single unit.

Safe assembly; davit arms are designed to ensure safe assembly by providing a pivoting, locking socket or davit mast design to facilitate insertion or removal of davit arm inboard of the building face.

Engineer Certified; OSHA requires that davit arms and bases be designed by or under the direction of a registered professional engineer experienced in such design. Pro-Bel davit performance is based on data derived from independent testing and/or engineering calculations. Davits are rated for a minimum 1,000 lb. (4.5 kN) or as specified on the drawings.

Compatible with roofing; an important consideration in the design of Pro-Bel davit systems 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.

Sole responsibility; Pro-Bel provides complete davit products/systems from concept to the supply and installation of same, including annual inspection.

Specific liability insurance; all Pro-Bel davit installations automatically carry $5,000,000.00 + coverage against product/system failure (over 5000 projects successfully completed to date).

This Pro-Bel roof rigged davit system suspends a permanent powered platform system. Bose Corporation, Boston, MA.

Pro-Bel long span roof rigged davit arms are used to hoist a platform from its storage location on a cooling tower roof and then swung across a wide metal catwalk and parapet over the side of the building. U.S. Courthouse & Federal Building, Sacramento, California.

Note Re: Alternative Finish to Galvanizing. For all anchor bases and supports, Pro-Bel offer a superior protective coating – Protex – in lieu of galvanizing if desired. Pro-Bel Protex is a 3/32" (2.4 mm) thickness, black colored, two component spray on, flexible 100% solids thermoplastic (TPU) polyurethane/polyurea system. Protex provides exceptional impact and abrasion resistance and is factory applied via high pressure impingement mix polyurethane dispensing equipment. See Pro-Bel Protex Technical Data Sheet # R-2 for complete information.

MATERIALS/FABRICATION
(as applicable)

Davit booms: Equipped with stainless steel rolling trolley, friction trolley or galvanized shackle on outboard end; prominently displayed, non-corrosive data plate on boom clearly stating Maximum Service Capacity of davit, Pro-Bel Enterprises Limited Name, Serial Number and Date of Manufacture.

Davit masts: round tubular aluminum or steel section capable of rotating through 360 degrees; equipped with connecting pins having retaining end gravity locks, friction locks or cotter pins.

Davit bases: round, hollow steel section (HSS) piers of mild steel to Type 350W with yield strength of 50 Ksi (350 MPa) hot dip galvanized to ASTM A123/A 123M-2002.

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.

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

Seamless spun aluminum flashing (for 300 Series bases): Type 6061-T6 alloy to ASTM B221-2000 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 300 series bases): torch applied heat-shrink rubber collar flashing.

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

DESIGN CONSIDERATIONS

Davit base location for platform; recommended location is approximately 2'-0" (610 mm) away from inside face of parapet to provide for proper roofing detail (room to install flashing, etc.) and evenly spaced around perimeter of building to suit the various stage drops. Roof pavers/hard roof surface is recommended to facilitate movement of davit arm from base to base. Two independent worker lifeline anchors are required for each pair of davit bases.

This photo shows Pro-Bel installers maintaining the manual chain driven trolley during the roof rigging process. U.C. Davis Medical Center, Sacramento, California.

Long 14'-0" (4.3 m) span davit booms are employed to clear roof terraces, projections and lower levels. The Millennium building, New York, NY.

Working down face of building using Pro-Bel long span davit boom and bosun's chair. Bull Corporate Centre, Toronto, Ontario.

Pro-Bel permanent davit arm is used to clear high parapet rail and is suited to both single work cage and permanent powered platform. UC Davis Medical Center, Sacramento, California.

This long span aluminum davit boom was designed to circumvent a projecting sun porch.

Structural load data; davit arms, bases and the structure to which they are attached are typically designed to a capacity of 1000 lbs (4.45 kN) 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.

Davit height for platform; top of davit boom and trolley must be min. 7'-0" (2135 mm) above parapet to allow platform to be swung over parapet. Roof rigged davits require ease of 360 degree rotation under load.

Stabilization; to prevent unwanted platform movement, the use of tie-in guides such as internal or external mullion guide tracks or buttons/detent pins are mandatory for permanent powered platforms (owner purchased). For temporary platforms (supplied by maintenance contractor), stabilization is optional with restrictions, however, stabilization is recommended to protect building faces and buttons/detent pins are the most economical and practical form of tie-in method. Refer to Pro-Bel Stabilization Systems literature.

Davits vs outriggers; the advantages of using davits include: single point loads vs two for outrigger beams; can be both roof and ground rigged vs ground rigged only for beams; fewer roofing problems than with outriggers.

Roof protection: Paver walkways, minimum 2 rows 24" (610 mm) wide are recommended on the approach side of davit locations to protect the roof surface during the raising, lowering and movement of davit arms. If using a roof rigged platform, additional pavers should be installed at corners or other locations for added protection against platform movement. Note: When roof protection is not supplied, a restrictive note should be added to the design drawing stating that the maintenance contractor take extra care and precautions to protect the roofing membrane which may include working with temporary plywood protection where warranted.

DAVIT 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 locations. Typically, davit bases are anchored to concrete structural roof slabs, the steel superstructure, or similar elements.

6. Review the Design Considerations on page D-10 to assist in making a "rigging" decision.

7. 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 typically a 6'-0" (1830 mm) wide area and a cage is 8'-0" (2440 mm). In determining davit base placement consider the range of motion that can be obtained from a rotating davit arm. The davit arm 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 a davit arm.

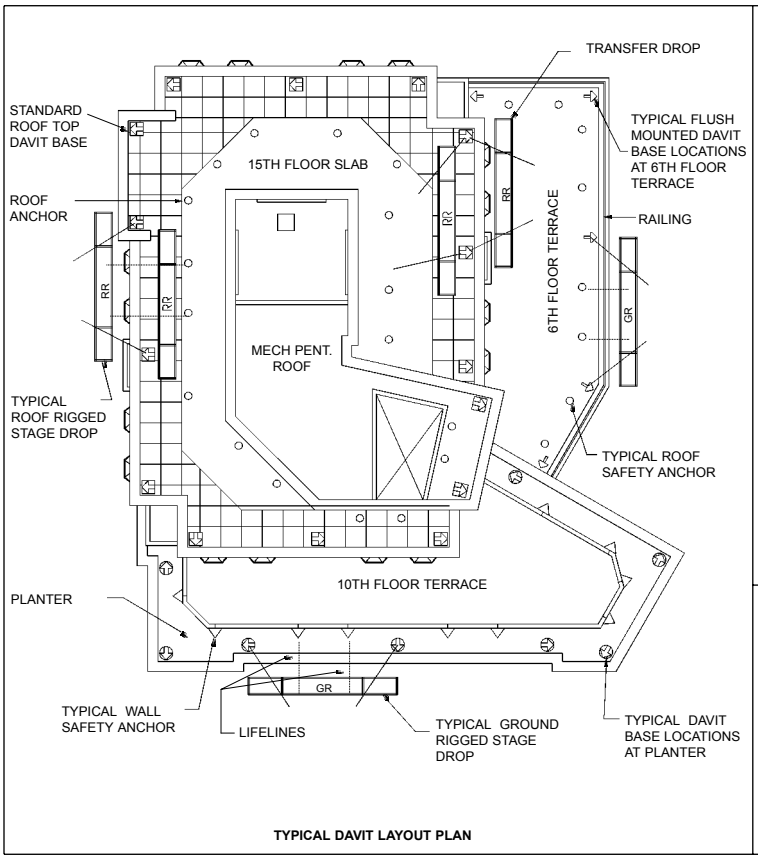
8. If it is more practical to clean windows or perform maintenance using a platform as in the case of continuous windows or curtain wall, davits should be located to suit various platform lengths of 10'-0" to 30'-0" (3050 mm to 9145 mm). A "drop" for a platform is approximately 20'-0" (7000 mm), evenly divided around roof perimeter.

9. Locate davit bases approximately 2'-0" (610 mm) away from inside face of parapet to allow for proper roofing detail (room to install flashing, etc.).

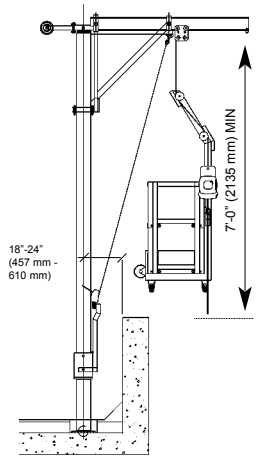
10. a. Regardless of access equipment used with davits, separate lifeline anchors are required for each worker using the equipment.

b. Lifeline anchors should be separate and independent from the davit arm. In some cases if a 6'-0" (1830 mm) vertical free fall can be maintained, lifeline anchors may be secured to davit bases and/or on the roof as outlined in the Pro-Bel Safety & Tie-Back Anchors literature.

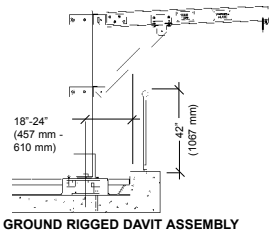
11. If a permanent powered platform is required or desired, davits should be located to suit building configuration with as few platform lengths as possible. Permanent powered platforms are modular, however dissassembly of sectional platforms can be time prohibitive and impractical. The designer should also add additional davits in order to transfer the permanent powered platform from one roof level to the next.



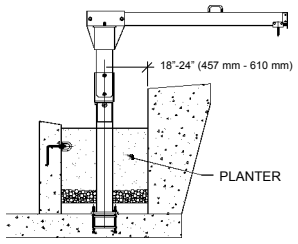
TYPICAL DAVIT LAYOUT PLAN



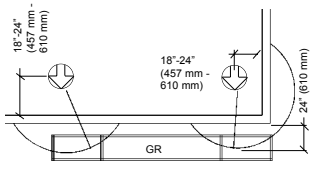
ROOF RIGGED DAVIT ASSEMBLY



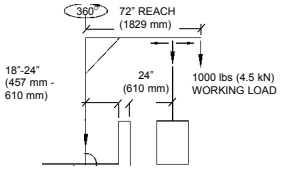
GROUND RIGGED DAVIT ASSEMBLY [RECESSED BASE] - TERRACE LOCATION



GROUND RIGGED DAVIT ASSEMBLY AT PLANTER



TYPICAL CORNER - RIGGING LAYOUT



TYPICAL DAVIT LOADING DIAGRAM

OTHER USES
Generally, Pro-Bel window cleaning/suspended maintenance davit systems are economical or practical for all new or retrofit buildings where an extended reach is required beyond the scope of conventional contractor supplied outrigger beams and parapet wall clamps.

In addition to window cleaning applications, Pro-Bel davit systems are recommended for work such as:

- construction, or general exterior suspended maintenance which may include restoration, cleaning, sandblasting, caulking, or pointing;
- hoisting of materials to the roof of buildings where elevator access to the roof may be unsafe or impractical.

MAINTENANCE NOTE
There is a shared responsibility between the building owner/employer and the window cleaning/suspended maintenance contractor. OSHA and ANSI/IWCA I-14.1 acknowledges that the building owner/employer is the controlling employer and must assure the contractor that the davit system has been installed in accordance with engineered drawings, test data (when required), and equipment specifications. The building owner/employer shall provide written assurance that the installation has been annually inspected and maintained to ensure that all equipment is safe and operating as required.

Refer to Pro-Bel "Digest for Building Owners, Property Managers, and General Contractors" literature for more detailed information.

Annual maintenance and inspection is required in order to comply with OSHA and ANSI/IWCA I-14.1 requirements.

AVAILABILITY & COST
Pro-Bel window cleaning/suspended maintenance davit systems are distributed throughout the United States, Canada and internationally.

Budget pricing is provided on a project-to-project basis for both materials and installation, or materials only. See "Technical Consultation" at right.

FREE DESIGN SERVICE
The selection of window cleaning equipment is a performance oriented and highly specialized area. Also the issues of fall protection and fall arrest are serious concerns with OSHA inspection authorities. Interpreting the many OSHA standards, including the separate requirements of various states, and proposed changes, is a daunting task at best.

Each building is different, requiring an individual technical approach and a time commitment beyond the scope of most professional offices. Even with a high degree of knowledge and the best of intentions, the planning process can go askew. It is for these reasons that Pro-Bel provides architects, building owners and engineers with a FREE DESIGN SERVICE, and to ensure that Pro-Bel Window Cleaning/ Suspended Maintenance Systems are properly specified and installed.

TECHNICAL CONSULTATION
Pro-Bel Enterprises Limited provides a complete technical consultation service, available to architects, consultants, engineers, contractors, and building owners. Without obligation, Pro-Bel will provide interested parties with a proposed window cleaning/suspended maintenance design concept to OSHA and ANSI/IWCA I-14.1 requirements, including equipment locations, securement, roofing details and specifications.

Simply provide the following information:

- roof plans (architectural and structural)
- building elevations
- typical floor plans
- section drawings showing parapet walls or roof edge condition and mechanical room walls; and
- any other drawings pertinent to window cleaning/suspended maintenance requirements

Pro-Bel will review drawings and provide one or more concepts as required with respect to equipment, methods and similar options.

In addition, Pro-Bel Enterprises Limited will provide budget pricing for window cleaning/suspended maintenance systems contingent upon design acceptance between Pro-Bel and architect/owner for the proposed project.

Close-up photo showing top of Pro-Bel Tall Davit. Equipped with two gear chains - one to facilitate davit arm rotation and one to facilitate movement of rolling trolley inboard or outboard under load.

SPECIFICATION

SPEC NOTE: This basic guide specification (Section 11010 - Window Washing Systems) is devoted exclusively to davits 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 outrigger beams, 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. Unloading and hoisting of equipment to roof Section [01500]
B. Cast-in-place concrete, including installation of embedded items Section [03300]
C. Precast concrete Section [03400]
D. Structural Steel Section [05120]
E. Open Web Steel Joists Section [05210]
F. Metal Deck Section [05310]
G. Catwalks Section [05516]
H. Roofing Section [07500]
I. Flashing Section [07600]
J. Sealants Section [07900]
K. Rigging access doors in walls Section [08111]
L. Continuous track stabilization on exterior of building Section [08800]
M. Installation of intermittent stabilization on exterior of building Section [03450]
N. Hot & Cold water supply, faucets and drain at [every] roof level Section [15400]
O. Three phase 208 volts, 60 Hertz service at [every] roof level Section [16050]

SPEC NOTE: Re 1.03,P. Specify independent protected main line power and weatherproof Hubbell Twist-Lock 208 volts, 3 phase, 60 Hertz, 30 amperes receptacle (HBL2620SW, NEMA No. L6-30R for rental powered platforms). Power to be located no more than 100'-0" (30 m) from window cleaning/suspended maintenance equipment location. Outlets to experience no more than 3% voltage drop under full load. Pro-Bel wall or roof anchors may be employed for strain relief. Contact Pro-Bel for requirements.

P. Weatherproof power supply outlets with strain relief anchors Section [16132]

1.04 References

A. AISC S342L-1993, with Supplement No.1 "Load and Resistance Factor Design Specification for Structural Steel Buildings".

B. AISI SG-971-1996, with 2000 Supplement "Specification for Design of Cold-Formed Steel Structural Members".

C. Aluminum Association AA ADM-1-Aluminum Design Manual and AWS D1.2-97 Structural Welding Code - Aluminum.

D. AWS D1.1-2000 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 maintnance system to suit building and in accordance with plans, specifications, standards, and regulations/codes contained in section 1.04 and 1.08.

B. Locate davit bases 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: davits, rigging sleeves and monorails 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. a 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 executed 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 $5,000,000.00 + to protect against product/system failure.

D. Welding to be executed by welders certified 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).

SPEC NOTE: See Master Specification (Section 12 of manual for specific California State requirement clauses.

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.

SPEC NOTE: See Master Specification (Section 12 of manual) for specific California State Requirement clauses.

PART 2 - PRODUCTS

2.01 Manufacturer

A. This specification is based on systems currently being manufactured by PRO-BEL ENTERPRISES 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.

2.02 Equipment

SPEC NOTE: List type and quantity as required.

A. [_____]

B. [_____]

C. [_____]

2.03 Materials

Spec Note: Delete items not required.

A. Davit booms: Aluminum sections of engineered length and size to suit application, equipped with: carrying handles; [stainless steel rolling trolley] [stainless steel friction trolley] [galvanized fixed shackle] on outboard end; prominently displayed, non-corrosive data plate clearly stating Maximum Service Capacity of boom, Manufacturer's Name, Serial No. and Manufacturing Date; and designed to carry minimum vertical service load of 1,000 lbs (4.5 kN).

SPEC NOTE: Re 2.03,B. Specify erection winch assembly and transport wheels for roof rigged davits.

SPEC NOTE: Some very long davit arms 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. Davit masts: Round tubular [aluminum] [steel] section capable of rotating through 360°; carrying handles; connecting pins; [erection winch;] [transport wheels].

SPEC NOTE: Re 2.03,C. U-bar safety (lifeline) anchors secured to davit bases are optional. If lifeline anchors are required farther back on the roof, see Pro-Bel Safety & Tie-back Anchors literature.

C. Davit bases: Round, hollow steel section piers of mild steel, Type 350W with yield strength of 50 Ksi (350 MPa), [hot-dip galvanized to ASTM A123/A123M-2002], [with Pro-Bel Protex 3/32" (2.4 mm) thickness, black colored two-component TPU polyurethane/polyurea coating system], [with] [without] 3/4" (19 mm) diameter U-bar safety anchor, and securement to suit application.

SPEC NOTE: Pro-Bel Protex is a superior substitute to galvanizing and provides exceptional impact and abrasion resistance.

D. 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.

E. Plate and all other sections: [Galvanized] [Pro-Bel Protex coated] mild steel as per davit bases above with yield strength of 44 Ksi (300 MPa).

SPEC NOTE: Re 2.03,F. For 300 series bases 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.

F. Seamless spun aluminum flashing (for davit bases): Type 6061-T6 alloy to ASTM B221-2000 sized 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.

G. Miscellaneous bolts, nuts and washers: mild steel, Type 300W with yield strength of 44 Ksi (300 MPa), hot-dip galvanized to ASTM A123/A123M-2002 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.

B. Davit arms:

SPEC NOTE: Delete items not applicable.

1. Davits to be demountable, portable, capable of being easily and quickly broken down into pieces weighing no more than 80 lbs (36.3 kg) for ease of carrying.
2. A davit or part of a davit weighing more than 80 lbs (36.3 kg) to be provided with a means for its transport, which shall keep the center of gravity of the davit at or below 36" (915 mm) above the safe surface during transport.
3. Davits or davit components that require more than 80 lbs (36.3 kg) lifting effort to raise the arm into postion to be provided with a mechanical means for hoisting them into postion.

SPEC NOTE: For California State, substitute the following item 3. design criteria in lieu of item 3. above.

3. Davit or davit components which weigh more than 140 lbs (73 kg) to be provided with a mechanical means for hoisting them into postion.

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 davit bases to be properly flashed in compatible with roofing.

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

E. Deform threads of tail end of davit cage studs after nuts have been tightened to prevent accidental removal or vandalism.

SPEC NOTE: Re 3.02,D. 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.

Pro-Bel Enterprises Limited provides a complete technical consultation service, available to architects, consultants, engineers, contractors, and building owners. Without obligation, Pro-Bel will provide interested parties with a proposed window cleaning/suspended maintenance design concept to OSHA and ANSI/IWCA I-14.1-2001 requirements, including equipment locations, securement, roofing details and specifications.

Simply provide the following information:

- **Roof plans (architectural and structural).**
- **Building elevations.**
- **Typical floor plans.**
- **Building section drawings showing all parapet walls or roof edge conditions and mechanical room walls and similar details.**
- **Any other drawings and/or photographs pertinent to window cleaning/suspended maintenance requirements.**

Pro-Bel will review drawings and provide one or more concepts as required with respect to suspended access equipment.

Printed in Canada

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