



SYSTEM & EQUIPMENT INTRODUCTION

| | |
|--|-----------------|
| General Overview..... | Page G-3 |
| Pro-Bel Systems - Introduction..... | G-4 |
| Basic Uses..... | G-4 |
| Product Description..... | G-4 |
| Limitations..... | G-5 |
| Primary Suspension Equipment..... | G-6 |
| <i>Suspended Bosun's Chair</i> | G-6 |
| <i>Non-Permanent Suspended Single Work Cage</i> | G-7 |
| <i>Non-Permanent Suspended Platform</i> | G-8 |
| ■ <i>Suspended Permanent Powered Platform</i> | G-9 |
| <i>Roof Car Systems</i> | G-10 |
| Primary Suspension Supports..... | G-11 |
| <i>Direct Rigging Systems</i> | G-11 |
| ■ <i>Davit Systems</i> | G-12 |
| ■ <i>Outrigger Beam Systems</i> | G-13 |
| ■ <i>Monorail Systems</i> | G-14 |
| ■ <i>Rigging Sleeve Systems</i> | G-15 |
| Fall Arrest & Restraint Systems..... | G-16 |
| ■ <i>Safety & Tie-Back Anchors</i> | G-16 |
| ■ <i>Horizontal Cable Lifeline Systems</i> | G-17 |
| ■ <i>Horizontal Trolley Rail Lifeline System</i> | G-18 |
| Pro-Bel Features..... | G-19 |
| Standards/Codes/Regulations..... | G-19 |
| Liability..... | G-20 |
| Building/Labor Codes..... | G-21 |
| Related Work By Others..... | G-22 |
| Building Design Considerations..... | G-23 |
| Planning..... | G-23 |
| Retrofitting..... | G-23 |
| Fall Arrest Systems..... | G-23 |
| Minimum Requirement..... | G-23 |
| Engineer Certification..... | G-24 |
| Anchor Design..... | G-24 |
| Anchor Locations..... | G-25 |
| Parapets..... | G-26 |
| Working Drawing Options..... | G-26 |
| ■ Stabilization..... | G-27 |
| Rescue..... | G-29 |
| Inspection And Maintenance..... | G-29 |
| Additional Product Data..... | G-30 |
| Installation..... | G-30 |
| Roofing Consideration..... | G-30 |
| Availability & Cost..... | G-30 |
| Warranty..... | G-30 |
| Technical Consultation..... | G-30 |
| Related Data..... | G-30 |
| Other Products..... | G-30 |
| Pro-Bel Group Ltd..... | G-31 |



Cover photo and those on pages G-2 and G-3 show that today's architectural trends present unique challenges for the design and implementation of window cleaning/suspended maintenance systems.

An obvious challenge facing workers in the high rise, window cleaning/suspended maintenance industry is the added problem and danger associated with height. It is imperative that personnel be in the business of safety and not just maintenance.

Suspended access is a highly specialized area requiring a practical working knowledge of professional window cleaning methods, structural engineering, safety

regulations, building codes and the correlation between primary equipment and fall protection requirements.

The concept of fall protection is a relatively new industry, however, worker safety is a serious concern with OSHA inspection authorities. Unfamiliarity with safety issues on the part of the designer can often lead to stop work orders, citations, fines, and subsequent court action as well as multi-million dollar third party lawsuits.

Standards for fall protection specifying Fall Arrest Equipment were issued by OSHA in 1990 as part of a revised Powered Platform final rule. Similar standards for fall arrest are pending for Construction, General Industry, and other specific industries, however, OSHA is relying on the Powered Platform appendix rules to cover other industry presently.

For all buildings three stories and higher, workers performing maintenance using suspended access equipment require a properly designed fall arrest system that is separate and independent from the primary rigging system.

The ANSI/IWCA I-14.1 Window Cleaning Safety Standard, initiated and developed by the International Window Cleaning Association (Section 4.1.1) requires that "all buildings where window cleaning is performed that employ suspended equipment shall be equipped with roof anchorages or other approved devices which will provide for the safe use of the equipment in conformance with the provisions of this Standard."

It is common practice for workers engaged in the suspended maintenance of buildings, for example window cleaners, to be provided with auxiliary safety lines for use in emergency situations, such as those which occur when a suspended platform or bosun's chair fails. However, many buildings are not provided with suitable attachment points or anchors for alignment of these auxiliary safety lines. Instead, the lines are often attached to any convenient member around which a rope can be tied that the worker might find available. Clearly, many of these members are not capable of supporting a worker in the event of the worker falling and when put to the test, give way or fail.

In addition to the lack of adequate safety anchors, other factors having an effect on worker safety include:

- The complexity of low, medium and high rise construction i.e. set-backs, unconventional roof lines, slopes, cornices, sun shades, proliferation of glazed atriums, and other exotica.
- Inadequate inspection and maintenance of existing window cleaning equipment.

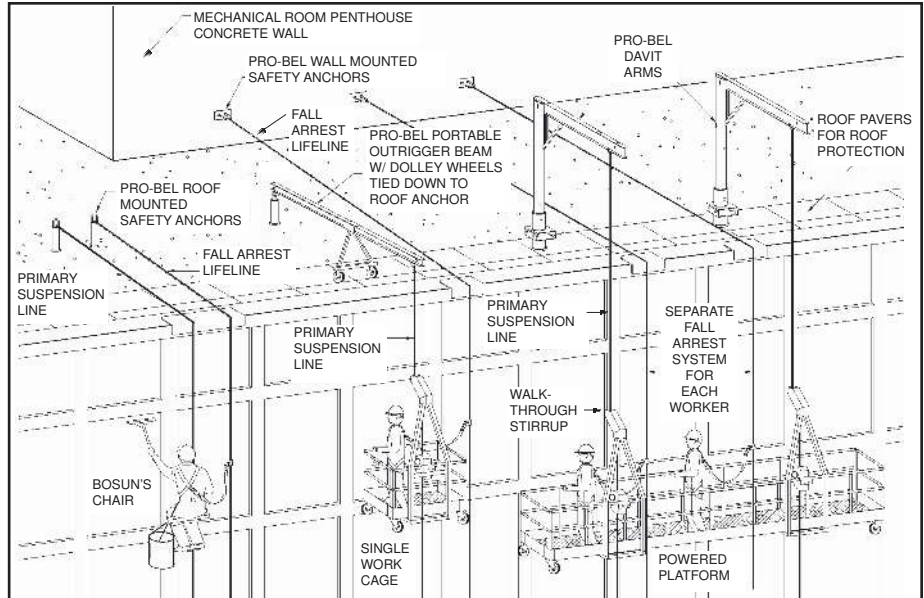
Unless the building has been designed for the provision of suitable anchorage points for the suspended access equipment being employed, including separate fall protection, eventually conditions will combine to produce a disastrous fall.



BASIC USES

Generally, Pro-Bel window cleaning/suspended access equipment and fall protection systems are recommended for all buildings three stories and higher where windows or building facades are accessed and maintained from the roof using suspended bosun's chair, single work cage, or platform. In addition to window cleaning applications, Pro-Bel products are recommended for:

- The facade maintenance of most buildings, which require at least tie-back and lifeline anchors (used interchangeably for the tie-back of conventional equipment, securing of lifelines and the direct rigging of descent controlled bosun's chair);
- Instances of where conventional equipment supplied by the maintenance contractor is not practical (unsuitable setup, takes too long to rig, unsafe, etc).
- Overhangs, where it is difficult to reach facades (can be serviced using monorails and/or rigging sleeves);
- Sloped roofs, which create unique access requirements (can be serviced using a combination of horizontal cable/rail travel restraint system and primary equipment e.g. anchors, davits, and/or outriggers);
- Roofing or any roof maintenance where workers are working without the protection of a regulation 42" (1067 mm) high guard rail or parapet;
- Terraces (anchorage can be recessed below terrace surface);
- Atriums, where access to and suspension from the highest point of the atrium is required. Monorails, gantries and/or rigging sleeves are typically used.
- Construction, restoration, cleaning, glass replacement, sandblasting, caulking, painting, color coating, and other construction operations.
- Fall protection for ladder work where personnel (using full body harness and lanyard) are working at a height of 10'-0" (3 m) or more above ground or on a roof or other elevated work area;



Typical rigging and fall arrest requirement scenarios using Pro-Bel safety lifeline and tie-back anchors.

- Interior or exterior industrial applications e.g. servicing security cameras, lighting, flagpole, overhead crane, wherever maintenance personnel are exposed to falls from elevation;
- New construction or retrofit.

Pro-Bel engineered systems are designed to suit the work practices of professional window cleaners and others working at height while meeting the mandatory fall arrest requirements of OSHA.

PRODUCT DESCRIPTION

Pro-Bel window cleaning/suspended maintenance equipment and fall protection systems are designed for use with all types of suspended equipment including:

Descent controlled bosun's chair supplied and used by professional window cleaners/external maintenance personnel.

Temporary platforms including single work cages (conventional* equipment) typically brought to the site by maintenance contractors.

*Conventional equipment is considered contractor supplied systems or equipment such as outrigger beams with counterweights, parapet wall clamps, cornice hooks and similar devices which must be tied back to permanently installed safety anchors.

Pro-Bel provides architects, roof designers and building owners with complete systems from concept to the manufacture, furnishing and installation of the following:

Fall Arrest/Restraint Systems

- Safety & Tie-back Anchors
- Horizontal Cable Lifeline Systems
- Horizontal Rail Lifeline Systems

Primary Suspension Supports

- Direct-to-Safety-Anchor Rigging Systems (see Safety & Tie-Back Anchors literature)
- Davit Systems
- Outrigger Beam Systems
- Monorail & Gantry Systems
- Rigging Sleeve Systems

Primary Suspension Equipment

- Permanent Powered Platforms, Single Work Cages, Gantries and Track Mounted Roof Car Systems



Indicates additional product literature is available with more detailed information.



Pro-Bel provides a free design service, thereby obtaining an intimate knowledge of the project in order for architects to specify the most appropriate equipment.



Pro-Bel roof rigged davits with modular powered platform system.



Pro-Bel safety anchors, in addition to securing worker's lifelines, are a practical means of suspending a bosun's chair equipped with a descent control device.

LIMITATIONS

Highrise safety is primarily a design issue, not an equipment selection issue alone. There is not a building that cannot (and should not) be properly and safely rigged. However, before detailing any equipment, architects and other roof designers need to be advised as to how the building will be rigged. This must be done on a project-to-project basis. See "Technical Consultation" on page G-30.

The selection of suspended access equipment is a performance oriented and highly specialized area requiring expertise in rigging methods, safety issues, OSHA Standards/State Codes, and structural engineering including testing and certification, all supported by specific liability insurance (products and completed operations) covering failure of primary suspension equipment and safety anchors. Companies such as miscellaneous metal fabricators, who are not normally engaged in the design and manufacture of window cleaning/suspended maintenance equipment should not be permitted to bid on projects, for both safety and liability reasons.



Pro-Bel modular powered platform system suspended via a roof rigged davit assembly.

SUSPENDED BOSUN'S CHAIR With Descent Control Device



Bosun's chair with descent control is one of the most common types of equipment employed by the window cleaning trade.

Description

The descent controlled bosun's chair is one of the most common and popular types of equipment employed for exterior building maintenance. The main advantage is that the chair is lightweight and simple to rig. Chairs are considered conventional equipment supplied by the window cleaning or other type contractor. A descent control device is primarily intended to allow downward movement only.

Direct Rigging (Direct-to-Safety-Anchor)

Pro-Bel safety anchors provide an effective, practical means for directly securing a bosun's chair equipped with a descent control device. The chair is rigged directly to wall or roof anchors in line with the point of suspension, and the primary synthetic rope suspension lines are normally protected at the roof edge using contractor supplied carpet or other anti-abrasion protection devices. Alternatively, contractor supplied equipment such as outrigger beams with counterweights, parapet wall clamps or cornice hooks can be used to suspend the chair. These devices must be tied back to permanently installed safety anchors. ■ Refer to Pro-Bel Safety & Tie-Back Anchors literature for more detailed information.

Note: When the roof edge is not capable of supporting the applied loads, primary suspension support equipment such as outriggers supported on blocks or beam dollies, or davits, must be considered. A separate independent wall or roof anchor is required to secure the worker's lifeline.

OSHA Ruling on Descent Control Devices

Descent control devices employed for window cleaning or other exterior maintenance may be used in accordance with an OSHA Memorandum dated March 12, 1991 (Patricia K. Clark — Director, Directorate of Compliance Programs). OSHA expects employers whose employees use descent control devices to implement the following procedures and precautions:

- Training of employees prior to use.
- Inspection each day before use.
- Proper rigging, including sound anchorages and tie-backs in all cases.
- Use of a separate fall arrest system which will quickly stop the employee's fall.
- All rigging lines to be capable of sustaining a minimum tensile load of 5000 lbs (22.2 kN). Provisions for rescue.
- Ropes are effectively padded where they
- contact surfaces which might cut or weaken the rope.
- Provisions are made for stabilization for descents in excess of 130'-0" (39.6 m) at the specific work location i.e. window.

Note: On October 25, 2001 the American National Standards Institute (ANSI) approved the International Window Cleaning Association (IWCA) I-14.1 Window Cleaning Safety standard for publication as ANSI/IWCA I-14.1-2001. This standard addresses the safe use of descent control equipment i.e. rope descent systems (RDS). Descents shall not exceed

300'-0" (91 m) above grade unless the windows cannot be safely and practically accessed by other means.

Exceptions to Federal OSHA

OSHA regulations may vary with states e.g. New York and California. New York does not allow the use of descent control equipment at all, except for block and tackle controlled bosun's chair up to 75'-0" (23 m) height, and California limits descent controlled bosun's chair use to 130'-0" (39.6 m) height on existing buildings providing an OPOS (Operating Procedure Outline Sheet) has been developed, and to 75'-0" (23 m) for block and tackle on other type manual chairs. New installations must be designed using suspended platform equipment only.

Use (Descent Control Devices)

Normally for descents of any height. However, for descents in excess of 130'-0" (39.6 m) OSHA requires provision for proper anchorages and local stabilization e.g. suction cups, hooks or gripping devices.

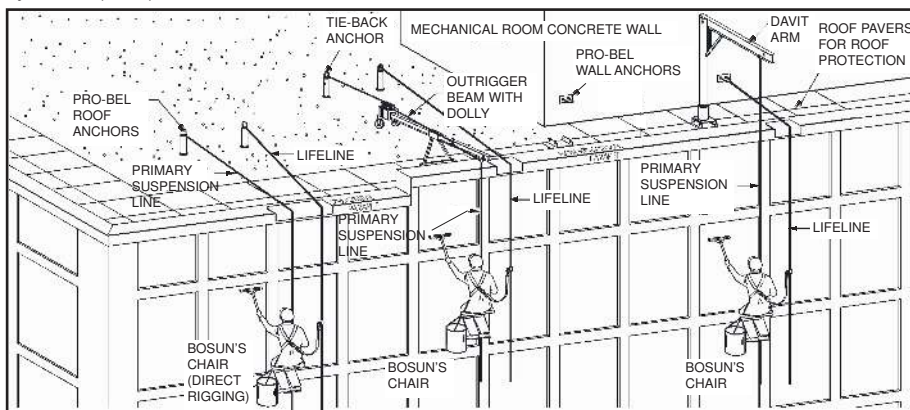
Primary Suspension Support Options

Contractor Supplied Equipment

Outrigger beams with counterweights, parapet wall clamps or cornice hooks tied back to permanently installed anchors. See "Limitations" as per Non-Permanent Suspended Single Work Cage, page G-7.

Permanent Equipment

- Direct rigging systems (direct-to-safety-anchor)
- Davit systems
- Portable outrigger beam systems (inboard end pinned to safety anchor)
- Monorails
- Rigging Sleeves



If the parapet wall is structurally sufficient, a bosun's chair can be practically and effectively secured to a safety anchor. This is known as direct rigging. When the parapet is not capable of supporting the applied loads, primary suspension support equipment such as outrigger beam with dolly, or davits, must be considered. See Primary Suspension Support Options on this page.

NON-PERMANENT SUSPENDED SINGLE WORK CAGE (Transportable)



Motorized single work cages often replace bosun's chair where both descent and ascent capabilities are required.

Description

Work cages, typically 3'-0" (1 m) in length are often used in place of bosun's chair where both descent and ascent capability is desired. They are usually equipped with power motor climbers similar to those used for platforms. Some are equipped with platform extensions for a wider work area. Accessories include ground casters to facilitate horizontal movement, face or side bumpers, and rollers to protect the building face.

Work cages (conventional equipment) are normally rented or supplied by the window cleaning or other type maintenance contractor and are typically ground rigged. Roof rigging is possible provided the building is equipped with roof-rig type davit arms.

Steel cable primary suspension lines are attached to support equipment on the

roof. A separate worker fall arrest system is required, consisting of a synthetic rope lifeline tied off to its own independent rooftop safety anchor.

Use

Normally for buildings of any height and/or confined areas.

Primary Suspension Support Options

Non-Permanent Equipment

Contractor supplied equipment e.g. outrigger beams with counterweights; parapet wall clamps. To be tied back to permanently installed safety anchors. ■ **Refer to Safety & Tie-back Anchors literature for more detailed information.**

Permanent Equipment

- Davit Systems
- Portable outrigger beam systems (inboard end pinned to safety anchor)
- Monorails
- Direct rigging to soffit anchors
- Rigging sleeves

Limitations

Building designers must recognize the intent and limitations of window cleaning contractor supplied (conventional) equipment such as the transportable outrigger beams and parapet wall clamps used to suspend single work cages (and bosun's chairs).

Conventional (non-permanent) parapet wall clamps, when used with a single work cage (or bosun's chair), are designed to be suspended directly from a structurally adequate parapet wall. The wall must be capable of supporting the applied loads.

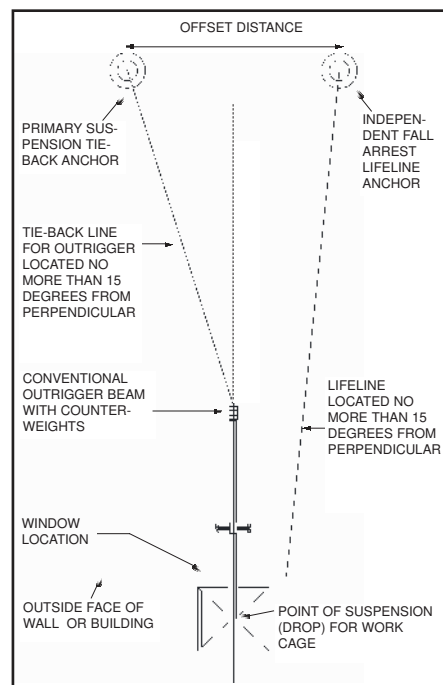
Conventional (non-permanent) outrigger beams employing counterweights when used with a single work cage (or bosun's chair), typically rest on a low, structurally adequate parapet wall capable of supporting the applied loads. Alternatively, a non-structural parapet wall can be cleared by supporting the beams via blocks or by using a beam dolly, or a davit system must be considered. Outrigger

beams are typically 10'-0" to 15'-0" (3 m to 4.6 m) long and have a reach of 3'-0" (915 mm) or less beyond the edge of the roof. They require sufficient space on the roof to accommodate the inboard portion of the beam which must be tied back to an anchor. ■ **See Pro-Bel Outrigger Beam Systems or Davit Systems literature.**



Typical wall mount anchors for tie-back, direct rigging, or lifeline anchoring.

SEE PRO-BEL SAFETY & TIE-BACK ANCHORS LITERATURE FOR MORE INFORMATION AND ANCHOR SPACING CHART



Plan View of Roof Showing Sample Anchor Layout For Single Work Cage

NON-PERMANENT SUSPENDED PLATFORM (Transportable)



Transportable platforms are available in fixed length and modular systems and are usually supplied by the window cleaning/suspended maintenance contractor.

Description

Transportable suspended platforms (conventional equipment) are normally rented or supplied by the suspended maintenance contractor and often consist of a standard one piece platform usually manufactured of aluminum. Available in lengths from 8'-0" to 39'-0" (2.4 m to 11.9 m) long, with 20'-0" to 24'-0" (6 m to 7.3 m) being the most popular.

Some platforms are modular and employ various combinations of shorter platform sections which are designed to be connected together and provide greater flexibility.

Accessories include: ground casters to facilitate horizontal movement; face or side bumpers; rollers to protect the building face; and walk-through type stirrups to extend platform beyond suspension points.

Steel cable primary suspension lines are attached to supports on the roof. Non-permanent platforms are typically ground rigged. Roof rigging is possible provided the building is equipped with roof-rig type

davit arms. A separate fall arrest system is required for each worker, consisting of a synthetic rope lifeline tied off to its own independent rooftop safety anchor.

Use

Generally, non-permanent platforms can be used for ascent or descent of any height or where it is not practical to use bosun's chair or single work cage, and where other conditions dictate.

Exceptions

Non-permanent powered platforms can only be used in New York state for window cleaning on buildings that are under 75'-0" (23 m) in height. The state of California restricts the height to 130'-0" (39.6 m).

Primary Suspension Support Options Non-Permanent Equipment

Contractor supplied equipment e.g. outrigger beams with counterweights; parapet wall clamps. To be tied back to permanently installed safety anchors. ■ **Refer to Pro-Bel Safety & Tie-Back Anchors literature for more detailed information.**

Permanent Equipment

- Davit systems
- Portable outrigger beam systems (inboard end pinned to safety anchor)
- Monorails
- Direct rigging to soffit anchors
- Rigging sleeves

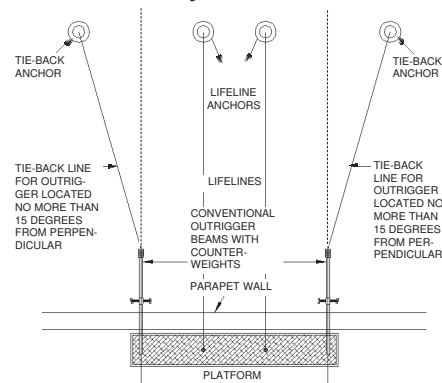
Limitations

Building designers must recognize the intent and limitations of window cleaning contractor supplied (conventional) equipment.

Conventional (non-permanent) parapet wall clamps, when used with a temporary platform, are designed to be suspended directly from a structurally adequate parapet wall. The wall must be capable of supporting the applied loads and clamps must be tied back to an anchor.

Conventional (non-permanent) outrigger beams employing counterweights when used with a non-permanent platform, typically rest on a low, structurally adequate parapet wall capable of supporting the applied loads. Alternatively, a non-structural parapet wall can be cleared by supporting the beams via blocks, using a beam dolly, or a davit system must be considered. Outrigger beams are typically 10'-0" to 15'-0" (3 m to 4.6 m) long and have a reach of 3'-0" (915 mm) or less beyond the edge of the roof. They require sufficient space on the roof to accommodate the inboard portion of the beam which must be tied back to an anchor.

■ **See Pro-Bel Outrigger Beam Systems or Davit Systems literature.**



Plan View of Roof Showing Sample Anchor Layout For Non-Permanent Suspended Platform

SUSPENDED PERMANENT POWERED PLATFORM (Permanent Installation)



This Pro-Bel permanent powered platform employs Pro-Bel 14'-0" (4.3 m) long span davit booms to clear roof terraces and cornice at lower level. The Millennium building, New York, NY.

Description

From an economic standpoint, the objective is to use a conventional maintenance contractor supplied temporary platform whenever possible. However, there are specific instances when permanent platforms are or can be considered mandatory. These include:

- When building/labor codes dictate e.g. New York and California, over certain building heights.
- When conventional ground rigged platforms are impractical due to wind hazard, stability problems, weight of suspension lines, and similar issues generally related to buildings over 300'-0" (90 m) in height.
- Overseas applications e.g. Asia, Pacific Rim countries, the Middle East, Eastern Europe and similar locations where temporary platforms are not typically employed or accepted.

Permanent platforms are or can be equipped with added safety features over and above that required for non-permanent platforms in compliance with OSHA 1910.66, Subpart F e.g. tall stirrup design which provides a means of suspension to restrict platform inboard to outboard roll, screened in platform, stabilizer tie-in devices, fire extinguisher, building face rollers, casters, power cable bin, and primary cable wire winders. An emergency action plan is also required.

■ See Pro-Bel Permanent Powered Platforms literature for building electrical supply requirements.

Electrical power outlets are to be located at each roof level no more than 100'-0" (30 m) from window cleaning/suspended equipment locations. The power requirements at designated outlets are to be capable of providing 208 volts, 3 phase, 60 Hertz, 30 amperes at each receptacle except for a permanent powered platform which requires 230 volts. The outlets should not experience more than 3% voltage drop under full load.

Permanent platforms are also equipped with added electrical safety features e.g. 3 phase reversal and phase failure, upper limit control device, lower limit control device, slack wire rope device, overload limiting device, and lateral leveling.

Normally a modular-type platform, permanent platforms are usually manufactured of aluminum and are available in



Pro-Bel modular powered platform system suspended from roof rigged davits.

connectable sections designed to suit building platform "drops". Accessories include: building face rollers to protect the building face; special adjustable roller or caster systems for use on sloping glass surfaces; and walk-through type stirrups to extend platform beyond suspension points and to accommodate a detachable single work cage.

Steel cable primary suspension lines are attached to primary suspension supports on the roof. 'T' Type platforms employ two cable suspension with separate fall arrest lifelines tied off to their own independent rooftop safety anchors. 'F' Type platforms employ four cable suspension with fall arrest lanyards secured to the platform (no separate hanging lifelines).

'T' Type platforms are more commonly used for window cleaning on buildings under 130'-0" (39.6 m). 'F' Type platforms are more commonly used over 130'-0" (39.6 m) due to concerns for weight and stabilization of hanging lines i.e. wind hazard.

Use

Generally, permanent powered platforms with motors mounted on platform can be used for ascent or descent of any building height up to 490'-0" (150 m). Over this height, it is recommended motors be mounted to equipment at roof level.

Mandatory in New York State for buildings of 75'-0" (23 m) height and higher, and mandatory in California State for buildings of 130'-0" (39.6 m) height and higher.

Interior or exterior

Primary Suspension Support Options

Powered platform installations permanently dedicated to exterior or interior building maintenance are intended to be used in conjunction with any of the following permanently installed support equipment:

- Davit systems, including rolling davit track systems, and roof cars
- Permanent outrigger systems
- Monorails
- Rigging sleeves



Refer to Permanent Powered Platforms literature for more information.

ROOF CAR SYSTEMS

DESCRIPTION

Dedicated to a specific building and owner purchased, Pro-Bel roof car systems and similar equipment e.g. rubber tire and long span boom machines, represent a generation of suspended maintenance equipment above that of other primary rigging equipment. A roof car, normally mounted at the highest elevation of the building, travels along I-Beam tracks, pipe rails, or concrete corridors/runways.

Roof cars are engineered to accommodate long span booms making it possible to extend the platform beyond terraces or roofs at lower levels. This feature can reduce or eliminate the need for additional roof cars, davits, or other primary equipment at lower levels.

Another consideration in "super-skyscraper" applications is the length of the control cable required to operate the hoisting mechanism. To eliminate the need for a control cable between the platform and the roof car, Pro-Bel employs a remote controlled hoisting system or control cable interwoven with any one of the four platform suspension cables to raise and lower the platform.

USE

Permanent powered platforms rigged with conventional permanent support equipment such as davits, outrigger beams, mono-rails, etc. are impractical on modern skyscrapers. Many of these buildings require roof cars in order to accommodate multi-level rigging, long span reaches, high parapets and other complicated building geometries.

A motorized roof car system also provides complete horizontal movement via a roof mounted track system or a rubber tire machine. These systems significantly reduce the setup time between stage drops.

Generally there are two types of roof car designs:

1. *With traction hoists and wire winders on the platform*

This design is suited to buildings under 490'-0" (150 m) in height, however the platform is typically small e.g. maximum 10'-0" (3 m), to accommodate the added weight of the suspension lines and power cord. The benefits of this type of roof car include being able to transfer the platform to other roofs for use with conventional supports, e.g. davits, outriggers, monorails, etc., and platform occupants can lower the platform to the ground using a descent control feature in the event of a power failure. See Pro-Bel Permanent Powered Platforms literature.

2. *With drum hoists at roof level on the roof car*

This design is suited to buildings over 490'-0" (150 m) in height requiring a platform longer than 10'-0" (3 m). The benefits of this type of roof car include eliminating the added weight of the sus-

pension cables which are now coiled at roof level using drum type hoists. Also, to eliminate the added weight of the power cord on the platform, a control cable can be interwoven in any one of the suspension cables or a radio-type remote control can be used to raise and lower the platform. A limitation of this

type roof car is that with the main controls at roof level, in the event of a power failure a communication and training system is necessary to permit a worker on the roof to activate the descent control apparatus allowing the platform to safely descend to the ground.



Roof car with traction hoists and wire winders on platform. Platform is 10'-0" (3 m) long.



Roof car with traction hoists and wire winders on roof car. Platform is 40'-0" (12.2 m) long.

DIRECT RIGGING SYSTEMS (Direct-to-Safety-Anchor)

Description

Pro-Bel safety anchors are an effective, practical means of directly securing bosun's chair with decent control equipment, the most popular method of window cleaning today. They are also commonly used to secure lifelines and to tie back primary suspension equipment such as conventional (contractor supplied) outriggers and parapet wall clamps.

Note: Pro-Bel tie-back/lifeline anchors and direct rigging anchors are the same and are used interchangeably. Refer to Pro-Bel Safety & Tie-Back Anchors literature for complete product data.

The chair suspension line is rigged directly to an anchor in line with the point of suspension. A separate independent anchor on the roof is required to secure the worker's fall arrest lifeline.

Safety Anchor Types

There are literally dozens of Pro-Bel anchor products available. Each has been engineered to satisfy a particular job requirement. They can be categorized as follows:

PB Series Wall Anchors

PBE Series Wall Anchors

PB Series Roof Anchors

PBE Series Roof Anchors

Use

Primary suspension support for bosun's chair employing descent control equipment.

For all types of wall construction.

For all types of roof construction regardless of composition or complexity.



Refer to Pro-Bel Safety & Tie-Back Anchors literature for more detailed information.



Two window cleaners are shown direct rigging to separate and independent roof anchors.



Typical Pro-Bel wall anchor through-bolted into concrete mechanical room wall. Can be adapted to suit any wall type. See page G-23 for cast-in-place detail.



Single ply roof showing typical Pro-Bel roof anchor. Reliable flashing/sealing techniques are employed to satisfy virtually any roof membrane condition.



Typical Pro-Bel roof anchor secured to roof structure using any one of a variety of methods e.g. cast-in-place, bolt-through, welding, or chemical adhesive (retrofit). See page G-23 for through-bolt-detail.



Due to stringent government standards, anchor placement requirements i.e. in line with the point of suspension and free fall distance, anchors must often be placed on the roof.

DAVIT SYSTEMS

Description

As with outrigger beams, Pro-Bel davits, are used singularly or in pairs, and provide an efficient means for suspending bosun's chairs, single work cages or platforms. Available in aluminum or steel, with aluminum being the most popular due to weight and ease of handling. Davits are very popular on buildings with various terrace levels. Each worker's life-line must be secured to a separate independent safety anchor.

DAVIT TYPES & RIGGING METHODS

Portable Davits: dedicated to a specific building and capable of being moved manually from work location to work location within the dedicated area.

Fixed Davits: designed to remain at a fixed location. Normally used for difficult to access areas where extra long reach is required.

Rolling Davits: designed to traverse on roof or wall mounted track using manually operated or electric powered rolling carriage. Can be ground rigged or roof rigged.

Ground Rigged Davits: A low davit designed to just clear the parapet. Preferred method of rigging with window cleaners. If using a platform, it can only be rigged on the ground i.e. cannot be rigged on the roof and then swung over the parapet.

Roof Rigged Davits: A davit used to raise the suspended working platform above the building face being serviced. The platform can also be rigged on the roof and then swung over the parapet, or rigged on the ground if desired. Normally the davit arms are 7'-0" (2134 mm) higher than the parapet wall to allow for roof rigging and equipped with transport wheels and winches for ease of use.

Use

Suitable for any building height (unlimited height) depending on type of davit selected and where adequate structural support is provided. Can be mounted on roof, terrace or parapet wall depending upon application.

Roof design conditions may dictate use e.g. no space for outrigger beam suspension.



Refer to Pro-Bel Davit Systems literature for more detailed information.



Pro-Bel rolling davit is designed for areas with restricted inboard space, access or rigging options.



Pro-Bel davit with rotating head for ease of movement under load.



Pro-Bel portable, ground rigged davit assembly with recessed base is typically used where a flush mounted deck appearance is required or desirable between maintenance operations. Note deck cover plate leaning against rail.

OUTRIGGER BEAM SYSTEMS

Description

Pro-Bel aluminum or steel outrigger beams, used singularly or in pairs, provide a practical means of suspending bosun's chairs, single work cages or platforms.

Each worker's lifeline must be secured to a separate independent safety anchor.

OUTRIGGER BEAM TYPES

Depending on factors such as roof space, roof loads, parapet height or strength, roof type or other factors, non-permanent "conventional" outrigger beams with counterweights normally brought to the site by the suspended maintenance contractor may not be suitable. In this case Pro-Bel manufactures and offers a range of engineered, structurally secured outrigger beam systems designed to suit all roof conditions.

Portable Outrigger Beams: these beams are designed and dedicated to a specific building or roof area and capable of being moved from work location to work location within the dedicated area. They are attached (pinned) to permanently installed bases or anchors during maintenance operations and placed in storage when not in use.

Fixed Outrigger Beams: these beams are permanently installed equipment and are designed to remain at a fixed location. Typically for long spans over 10'-0" (3 m).

Use

Suitable for roofs with sufficient inboard distance and are typically for ground rigged equipment.

Long span beams are ideal for accessing difficult-to-reach areas e.g. beyond sloped roofs, terraces, and sunscreens. Additional inboard roof distance is required.

Roof design conditions with minimal inboard distance or lack of structural supports may dictate the use of a davit system at roof edge or parapet.



Pro-Bel portable swivel-type outrigger beam with dolly is designed to suit a specific roof area and can be relocated within the dedicated work zone. Portable systems must be pinned to permanently installed bases or anchors during maintenance operations.



Pro-Bel fixed outrigger beam systems are designed to remain in place. Sliding beam, as shown above is ideal where inboard roof space is not restricted. Sliding beams typically span over 10'-0" (3 m) beyond the fulcrum and are available in aluminum or steel.



Refer to Pro-Bel Outrigger Beam Systems literature for more detailed information.



Refer to Pro-Bel Monorail Systems literature for more detailed information.

MONORAIL SYSTEMS

Description

Monorail systems are often used to access difficult-to-reach or otherwise inaccessible exterior or interior glass areas. Typically a Pro-Bel monorail system consists of an aluminum rail section which houses a traversing trolley. Secured to the building structure at 10'-0" to 12'-0" (3 m to 3.7 m) centers, monorails are normally used for platform work and single work cage, however, they are also ideal for bosun's chair or direct lanyard application. For platform, four trolleys are required (two for the primary suspension and two for worker's lifelines). For a cage, two trolleys are required (one for primary suspension and one for worker lifeline).

Rails, which can be straight or radiused, may be left exposed or concealed in soffit or ceiling spaces. Whatever the application, the platform is "slid" along the monorail.

Typically, workers access monorails via a localized window, hatch, rigging sleeve or ladder. They then suspend their lines from the monorail and return to the first floor or lower level to ground rig their platform. One of the most overlooked items by design professionals is the provision for localized access *and* fall protection for workers to approach monorails safely.

Trolley Types

Pro-Bel monorail systems incorporate various types of trolleys e.g. manual, manual chain drive, motorized, battery operated, and climbing.

Use

Monorail systems are ideal for the underside of building overhangs, sloped glazing/skylighting, all types of atrium glass, domes, and similar applications wherever continuous horizontal movement is required.



Workers adjust new monorail which houses four stainless steel rolling trolleys (two for platform and two for lifelines). Ideal for underside of building overhangs and can be left exposed or concealed in soffit or ceiling spaces. This rail is powder coated to match soffit.



Monorail can also be roof mounted (as shown) or wall mounted to suit application.



Pipe or I-beam monorail is ideal for interior and exterior rolling gantry systems. Gantry can be manual or motorized for horizontal travel.



Perimeter skylight monorail system is used to service interior glass atrium and interior lighting system. Monorail corner-turning hubs are utilized to facilitate automatic turning at corners.

RIGGING SLEEVE SYSTEMS

Description

Rigging sleeves have solved many a window cleaning access problem by providing pathways through roofs, floors, and walls or other vertical elements for suspension lines where access would otherwise be difficult, unsafe, or impossible.

Typically, workers access rigging sleeves located at upper levels via the roof, mechanical room floor, or soffit. They then suspend their lines through the sleeves and return to the first floor or lower level to ground rig their platform.

Available in many model variations, rigging sleeves are designed to satisfy virtually any access requirement. Example applications include:

- Roof mounted rigging sleeves complete with rigging bars and removable cap.
- Wall mounted rigging sleeves complete with push/pull transportable outrigger sleeve.
- Floor mounted rigging sleeves complete with flush type removable rigging caps.



Photo shows wall sleeve application. When not in service, rigging sleeves retract to interior of building. Wall is stucco finished masonry. See close-up photo at right.



Curved rigging sleeves projecting from soffit (circled areas) are used to provide suspension points for platform and worker lifelines for window cleaning of non-balcony windows. Grand Bay Residences, Key Biscayne, Florida.



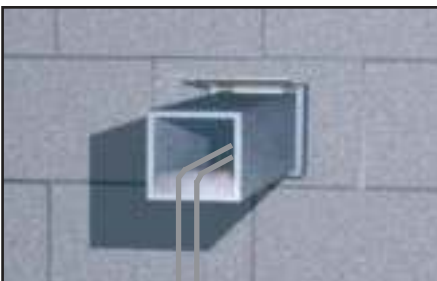
Curved Horizontal Rigging Sleeve Illustration

Use

For safe, convenient access of primary suspension lines or lifelines *through* roof, floor, wall or other building elements.

Ideal for accessing sloped roofs, overhangs, skylights or otherwise inaccessible areas.

Recommended when all other conventional means of performing window cleaning/maintenance cannot be used.



Refer to Pro-Bel Rigging Sleeve Systems literature for more detailed information.



Refer to Pro-Bel Safety & Tie-Back Anchors literature for more detailed information.

SAFETY & TIE-BACK ANCHORS

Description

A fundamental concept in the use of suspended access equipment such as conventional outrigger beams and parapet wall clamps is that there must be two independent means of support for each worker using the equipment.

The first means of support is the access equipment itself tied back to an anchor. The second is usually provided by a fall arrest system consisting of a full body harness, lifeline and lifeline anchor.

In addition, anchors which are used for tie-backs or for securing lifelines are also an effective, practical means for directly securing a bosun's chair with descent control equipment – the most popular method of window cleaning today (direct rigging. See page G-11).

SAFETY ANCHOR TYPES

There are literally dozens of Pro-Bel anchor products available. Each has been engineered to satisfy a particular job requirement. They can be categorized as PB and PBE Series Wall and Roof Anchors which are available with securements such as:

- Cast-in-place
- Bolt through
- Bolt around
- Weldment
- Chemical epoxy adhesive

Use

Tie-back anchors for suspension equipment (provides structural attachment between building and support equipment to prevent accidental movement).

Direct rigging anchors (provides structural attachment between building and bosun's chair suspension lines).

Fall arrest anchors (provides structural attachment between building and workers' personal fall protection system).

Lifelines anchors are required when working within 6'-0" (1.8 m) of roof edges or skylights unprotected by a 42" (1067 mm) high guardrail, or in the case of skylights, protective screens (ANSI/IWCA I-14.1-2001, section 3.8 Fall Protection, and OSHA 1926.502).

For all types of roof or wall construction regardless of composition or complexity.



Bosun's chair is the equipment of choice among window cleaners. Pro-Bel safety anchors provide a practical means for securing lifelines or suspension equipment such as a bosun's chair with descent control.



Above are examples of typical Pro-Bel wall anchor (left) and roof anchor (right) which can be used for both the securement of lifelines and for the tie-back of suspension equipment e.g. conventional outriggers and parapet wall clamps, or for the direct securement of a bosun's chair (direct rigging).

HORIZONTAL CABLE LIFELINE SYSTEMS

Description

When workers require horizontal mobility over an extended distance while operating close to a vertical drop, single point anchors along an entire work zone may not be feasible or desirable due to the danger of swing fall hazards. The solution is a fully engineered horizontal lifeline cable system.

A horizontal lifeline is a permanently installed, multi-span anchored cable requiring more substantial end anchors or supports. The lifeline cable serves as an attachment point for travel restraint or fall protection lanyards.

Horizontal lifelines are a highly restricted fall protection system requiring extremely careful engineering. These systems when used in high rise applications are normally intended for restraint or the direct attachment of a worker's lanyard. They are not designed for direct rigging (attachment of primary suspension equipment), or for securing tie-back lines. This is due to the potential for excessive loading i.e. equipment failure or misuse. Horizontal cables provide safe access to secondary rigging and safety anchoring systems, if desired.

Pro-Bel offer two types of horizontal cable lifeline systems, as follows:

1. "Hands-Free" Horizontal Lifeline
2. Double Lanyard (DL) Horizontal Lifeline



Metal roof maintenance and electrical/mechanical roof inspection performed safely while tied to horizontal lifeline cable.



Refer to Pro-Bel Horizontal Cable Lifeline Systems literature for more detailed information.



When workers require extended horizontal movement while operating close to a vertical drop, Pro-Bel recommends a horizontal cable lifeline system.

Use

For horizontal, sloped or vertical mobility over extended distances while working close to a vertical drop e.g. within 6'-0" (1.8 m) of roof edge, skylight, or any high, narrow, level roof area or walkway not protected by a 42" (1067 mm) high guardrail (ANSI/IWCA I-14.1-2001 and OSHA 1926.502).

As an alternative to single anchor points when independent anchors do not provide the required degree of safety.

As a complement to conventional vertical lifeline anchorages in confined spaces.

Industrial applications wherever maintenance personnel are exposed to falls from elevation e.g. rooftop servicing or inspection of lighting, gutter drains, mechanical/electrical operations, large equipment servicing, work over crane rail, airplane maintenance, and similar applications.

Suitable for exterior or interior use.



Worker above uses horizontal cable to safely access recessed windows as well as custom, ledge mounted Pro-Bel safety anchors for access to next "drop" using a bosun's chair. See photo below.



Four window cleaners working same facade, suspended from separate and independent ledge-mounted anchors.

HORIZONTAL TROLLEY RAIL LIFELINE SYSTEMS

Description

When architectural building features require worker's lanyards, lifelines and primary equipment to move horizontally over an extended distance, single point anchors along an entire work zone may not be feasible or desirable. The solution is a fully engineered horizontal trolley rail lifeline system.

A horizontal rail lifeline is a permanently installed, multi-span anchored rail which serves as an attachment point for lanyards, lifelines, direct rigging (attachment of primary suspension equipment), and for securing tie-back lines.

Trolley rails differ from horizontal cable lifeline systems in that trolley rails are considered a non-restrictive, more heavy duty fall protection system whereas cable systems are highly restricted, lighter duty and subject to amplified loads.

Pro-Bel offers several types of trolley rail systems. Each has been engineered to satisfy a particular job requirement. They can be categorized as follows:

1. *Aluminum Horizontal Trolley Rails*
2. *Steel Horizontal Trolley Rails*



Overhead trolley rail (soffit application).



Although designed primarily for travel restraint/fall arrest, trolley rails can also be used for direct rigging of primary suspension equipment. e.g. bosun's chair, cage, platform or outrigger beam dolly.

Use

Designed primarily for horizontal applications.

For horizontal mobility over extended distances while working close to a vertical drop e.g. within 6'-0" (1.8 m) of roof edge, skylight, or any high, narrow, level roof area or walkway not protected by a 42" (1067 mm) high guardrail (ANSI/IWCA I-14.1-2001, section 3.8 Fall Protection, and OSHA 1926.502).

For interior or exterior applications.

Ideal for long restricted spaces or tight quarters, for attaching lanyard or lifeline, or direct rigging of suspended equipment.

As an alternative to single anchor points when independent anchors do not provide the required degree of safety.

As a complement to conventional vertical lifeline anchorages in or around confined spaces.



In this roof terrace application, Pro-Bel trolley rail at left is used to restrict travel of window cleaner due to low parapet which is less than 42" (1067 mm) guardrail height, as well as for primary rigging of bosun's chair. Pro-Bel safety anchors beneath insulated air duct are used to secure lifeline when worker lowers himself over parapet.



Refer to Pro-Bel Horizontal Trolley Rail Systems literature for more detailed information.

PRO-BEL FEATURES

Standards Conformance: All Pro-Bel equipment conforms to OSHA and ASME/ANSI safety requirements for window cleaning, and various materials standards.

Engineer certified; OSHA and ANSI/IWCA I-14.1 requires that safety anchoring devices and primary suspension support equipment be designed by or under the direction of a registered professional engineer experienced in such design. Pro-Bel systems meet this criteria and equipment performance is based on data derived from testing and/or engineering calculations.*

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

Compatible with roofing; an important consideration in the design of Pro-Bel anchor systems and primary suspension support equipment 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 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 equipment and installations automatically carry \$5,000,000.00 coverage against product/system failure (over 8,000 projects successfully completed to date).

Free design service; the selection of window cleaning/suspended maintenance equipment is a performance oriented and highly specialized area requiring an in-depth knowledge of rigging methods, safety issues and OSHA Standards/State codes. Pro-Bel provides a FREE DESIGN SERVICE to ensure that Pro-Bel products/systems are properly specified.

*Copy of test reports available upon request.



Pro-Bel products are manufactured in Pro-Bel's 48,000 square foot (4 459 m²) facility thereby providing 100% quality assurance.

STANDARDS/CODES/REGULATIONS

All Pro-Bel safety anchors and equipment conforms to:

United States

1. Federal OSHA standards 1910.28 Subpart D (Walking - Working Surfaces); 1910.66, Subpart F (Powered Platforms for building maintenance); Appendix C to 1910.66, Personal Fall Arrest System (Section I - Mandatory); and 1926.50 Subpart M (Fall Protection).
2. U.S. Department of Labor (OSHA) Memorandum (March 12, 1991) to Regional Administrators for Descent Control Devices, by Patricia K. Clark Director, Directorate of Compliance Programs.
3. California OSHA Code of Regulations, Title 8 - Industrial Regulations, Article 5 Window Cleaning, Article 6 (Powered Platforms for Exterior Building Maintenance), Appendix C to Article 6 (Personal Fall Arrest System), Articles 23 and 24 Suspended Scaffolds and Fall Protection (Construction), and Section 3212 (d), Roofs (Guardrails).
4. New York State Regulations:
 - a. Department of Labor Advisory Standard 101 - Construction, Operation and Maintenance of Suspended Scaffolds Used for Window Cleaning and Light Maintenance.
 - b. Advisory Standard 111 - Hoisting Machines Used for Suspended Scaffolds.
 - c. Department of Labor Industrial Code Rule 21 - Protection of Persons Employed at Window Cleaning - Structural Requirements, Equipment and Procedures.
5. ASME A120.1-2008 Safety Requirements for Powered Platforms for Building Maintenance.
6. ANSI/IWCA I-14.1-2001 Window Cleaning Safety Standard (International Window Cleaning Association).
7. AISI 360-05/AISI SG-02KIT with 2001 Supplement No. 1 "Load and Resistance Factor design Specification for Structural Steel

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

8. ANSI/AWS D1.1/D1.1M:2008 "Structural Welding Code—Steel".

9. Aluminum Association AA ADM-1-Aluminum Design Manual, and ANSI/AWS D1.2/D1.2M:2003 "Structural Welding Code - Aluminum".

Canada

1. CAN/CSA-Z271-98 Safety Code for Suspended Elevating Platforms and CAN/CSA - Z91-02 (R2008) Safety Code for Window Cleaning Operations.
2. Ontario Occupational Health and Safety Act Window Cleaning Regulation 859/90 as amended by 523/92, and 213/91 as amended by 631/94 (Construction Projects).
3. Ontario Building Code 2006, 4.1.10.8. Anchor Systems on Building Exterior — to be provided where any portion of the roof is more than 8 m (26'-3") above adjacent ground level, for both maintenance and window cleaning operations.
4. Workers' Compensation Board of British Columbia Industrial Health & Safety Regulations, Section 8, Places of Employment - General Requirements, and Section 74, Window Cleaning General Requirements.
5. Nova Scotia Department of Labour Occupational Health and Safety Act, Schedule "A" Fall Protection and Scaffolding Regulations.

International

1. European Standard EN 1808:1999 (Safety requirements on Suspended Access Equipment - Design calculations, Stability criteria, Construction - Tests)
2. Health and Safety at Work etc. Act 1974, Chapter 37 (U.K.).

BUILDING CODES VS OSHA AND ANSI/IWCA I-14.1

Building codes are not specific enough to cover all of the issues or aspects outlined in OSHA standards relating to window cleaning/suspended maintenance. Building codes do not address fall protection for workers such as window cleaners working at height. Also, the subject of fall protection is a relatively new standard being enforced by OSHA.

Of the three building codes in the U.S. (ICBO, SBBCI and BOCA), only BOCA requires fall protection anchors for buildings over 50'-0" (15240 mm) or four stories in height in which the windows are cleaned from the outside.

However building codes have not caught up with OSHA in the area of window cleaning/suspended maintenance and the issues of fall protection.

OSHA will enforce the issue of fall protection using the General Industry and Duty clause Sec. 5(a)(1) of the Occupational Safety and Health Act of 1970. OSHA will support that enforcement by citing fall protection requirements using any one of the variety of labor standards contained in CFR 29 relating to fall arrest equipment.

For bosun's chair, which is not specifically covered in OSHA, enforcement will be supported via an OSHA ruling on window cleaning (refer to Memorandum to Regional Administrators from Patricia K. Clark, Director, Directorate of Compliance Programs March 12, 1991 regarding the use of descent control equipment by employees performing building exterior cleaning, inspection and maintenance).

OSHA CFR 29 labor references governing fall protection include:

- 1910.28, Subpart D - Walking-Working Surfaces
- 1910.66, Subpart F - Powered Platforms
- 1910.66, Appendix C - Personal Fall Arrest System
- 1926.500, Subpart M - Fall Protection

Ultimately, the new ANSI/IWCA I-14.1-2001 Window Cleaning Safety Standard prepared jointly by the American National Standards Institute and the International Window Cleaning Association provides the best guidance and liability protection for architects and building owners with regard to building and equipment design requirements.

ANSI/IWCA I-14.1 references governing fall protection include:

3.9 Anchorages

"Building owners and window cleaning contractors shall not allow suspended work to be performed unless it has been determined that the building has provided, identified and certified anchorages."

4.1.1 Building Requirements

"All buildings where window cleaning is performed that employ suspended equipment shall be equipped with roof anchorages or other approved devices which will provide for the safe use of the equipment in conformance with the provisions of this standard."

Only the architect/engineer is in a position to protect the building owner against liability in the area of fall protection as anchorages are part of the built environment. Otherwise the owner is left with a building that does not comply with the OSHA Code of Federal Regulations, the overriding authority governing fall protection. **Ultimately, designers must comply with all codes and laws for the state in which the project is located.**

Furthermore, while the ANSI/IWCA I-14.1 Window Cleaning Safety Standard is designed for reference by regulatory government agencies or to serve these agencies as a guide in the formation of safety rules and regulations, the Standard is also for use by registered professional engineers and architects and by manufacturers of window cleaning equipment and devices. Always reference the ANSI/IWCA I-14.1 in construction specifications.



Planning of anchors should be incorporated during construction and designed to suit professional window cleaning and other building maintenance professions.



Pro-Bel safety anchors may be used for securing lifelines, as a tie-back for primary rigging equipment or to directly rig (secure) a bosun's chair. Anchors protect workers' lives in case the suspension equipment fails, or in the event a worker momentarily loses control.

ARCHITECT'S RESPONSIBILITY

The mandate of OSHA is to provide safe working conditions. To achieve its mandate, OSHA places the responsibility for fall protection on building owners/employers, and by implication the owner's agents including architects, designers, engineering consultants, roof consultants, design-builders, product manufacturers, and contractors. When it comes to worker safety, everyone is in a potential liability position. *In the event of an accident, documentation of safety anchorage point planning is the trail by which everyone's efforts will be measured.*

Design professionals need to recognize that the building owner is considered the controlling employer and has the necessary means to provide a safe workplace. This responsibility is regulated through the enforcement of the OSHA General Industry and Duty Clause, Section 5.(a)(1) of the Occupational Health and Safety Act, 1970, as follows:

1. Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.

All Pro-Bel window cleaning/suspended maintenance system designs ensure that the rooftop is free from recognized hazards.

BUILDING OWNER'S RESPONSIBILITY

Once a building leaves the guardianship of the architect or other design professional and contractor, the safety of workers performing maintenance at elevation becomes the responsibility of the building owner and/or employer. Effective January 1990, owners/employers are subject to more aggressive enforcement by OSHA inspection authorities in the form of higher fines and criminal actions against violators.

In the event of a fall from elevation, for example by a window cleaner, tougher OSHA inspections will seek to clarify

"what steps were taken to protect the worker from injury or death — and what additional steps could have been taken?"

The owner's best defense is the documentation showing compliance with the ANSI/IWCA I-14.1 Window Cleaning Safety Standard i.e. section 1.6.2 (Assurances) which states that "Building owners and/or their operating agents shall provide window cleaning contractors with written assurance that the installation or structure has been inspected, tested and maintained in accordance with the requirements of the I-14.1 "Standard."

SHARED RESPONSIBILITY

There is a shared responsibility between the building owner/employer and the suspended maintenance contractor. OSHA and the ANSI/IWCA I-14.1 Standard acknowledges that the building owner/employer is the controlling employer and must assure the contractor that the system has been installed in accordance with engineered drawings, test data (when required) and equipment specifications.



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



In this window washing accident, one end of the platform broke loose and one window cleaner fell to his death while a second man was saved by his independently anchored rope lifeline.

Related work performed "by others" in connection with suspended access equipment installations, depending on system selected, might include the following:

General Contractor

- Installation of embedded items;
- Installation of welded items;
- Unloading and hoisting of equipment to roof;
- Access to all roof areas.

Note: To minimize embedment errors and to facilitate concrete forming, all Pro-Bel cast-in-place products or equipment has been painstakingly fabricated with the following features:

- Simple, easy-to-follow critical forming details and instructions;
- Forming guide nuts tack-welded to steel anchor rods to ensure correct anchor depth. Nailing plates where required to keep anchor rods in place during pour;
- "Caged" multiple anchor rods to keep anchors square and level e.g. davit base cages;
- Rubber-coated anchor ends to protect threads against soiling from concrete spatter (rubber is peeled away just prior to attaching equipment and nuts).



Pro-Bel davit cage cast into concrete slab by General Contractor.

Roofing Contractor

Flashing-in of Pro-Bel spun aluminum safety anchor flashings to NRCA (National Roofing Contractor's Association) or CRCA (Canadian Roofing Contractors Association) recommendations or roofing membrane manufacturer's instructions, as applicable.

Note: To protect against roof leaks and to minimize roof maintenance, all Pro-Bel products or equipment has been fabricated without using ring gaskets, rubber grommets, worm gear clamps, pitch pans or other flashing devices that require extraordinary maintenance.



This retrofit application shows roofer restoring watertight integrity of roof using seamless spun aluminum flashing and roof patch following installation of a Pro-Bel PBE Series roof anchor.

Caulking Contractor

Continuous bead of caulking around the exterior wall anchor plates and/or box flashings e.g. clear silicone rubber to ASTM C-920 or CAN2 19.13-M87.

Mechanical Contractor

Fresh hot and cold water supply, faucets and drain in vicinity of every roof level, or at least main roof level e.g. in mechanical room.

Electrical Contractor

The power requirements at designated

outlets are to be capable of providing 208 volts, 3 phase, 60 Hertz, 30 amperes at each receptacle except for a permanent powered platform which requires 230 volts. Consideration to be given to including a power booster to maintain 230 volts.

Independent protected main line power and weatherproof Hubbell twist-lock receptacle (HBL2620SW, NEMA No. L6-30R for rental powered platforms, and HBL2720SW, NEMA No. L15-30R for permanent 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.

Weatherproof power supply outlets with strain relief anchors i.e. Pro-Bel anchors.

Such outlets should be readily accessible and located at the level at which the scaffold is boarded or at the approximate level of the scaffold suspension point.



Typical wall type electrical outlet showing strain relief device being secured to Pro-Bel wall anchor.



Provide faucet for water at roof.

BUILDING DESIGN CONSIDERATIONS

Many professional designers would prefer to simply specify Pro-Bel window cleaning equipment from a catalog. However, the selection of window cleaning equipment cannot be treated as a catalog item. To be efficient, economical and practical, it is imperative that designers appreciate the importance of planning a properly designed system necessary to suit professional rigging methods while conforming to applicable OSHA standards.

PLANNING

Probably the most overlooked component with regard to the use of personal fall protection or equipment tie-back systems is planning for suitable anchorage points. Such planning should ideally be done before the structure or building is constructed so that anchorage points can be incorporated during construction for use later for window cleaning or other facade building maintenance. If properly planned, these anchorage points may be used during construction as well.

RETROFITTING

With an extensive engineering and construction background, Pro-Bel can evaluate all types of roof systems, structural framing, walls, glazing and similar building elements in order to provide a design solution for any building.

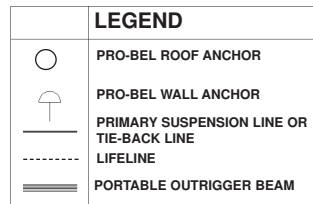
Many existing buildings are not provided with suitable anchorages or safety anchors for securement of worker lifelines or the tie-back of primary equipment i.e. cage or platform. These buildings must be identified and retrofitted if tragic accidents are to be avoided.

FALL ARREST SYSTEMS

A fundamental concept in the use of suspended access equipment is that there must be two independent means of support for each worker using the equipment. The first means of support is the access equipment itself i.e. platform, bosun's chair, etc. The second is usually provided by a fall arrest system consisting of a:

- full body harness;
- lanyard with shock absorber;
- mechanical rope grabbing device;
- synthetic rope lifeline;
- lifeline anchor.

Another fundamental concept in the use of a fall arrest system is that it should be fully rigged, in place, properly adjusted and worn by all workers while they are getting on and off suspended access equipment and during the entire time they are on the equipment. Failure to adhere to this basic concept has resulted in many fatalities.

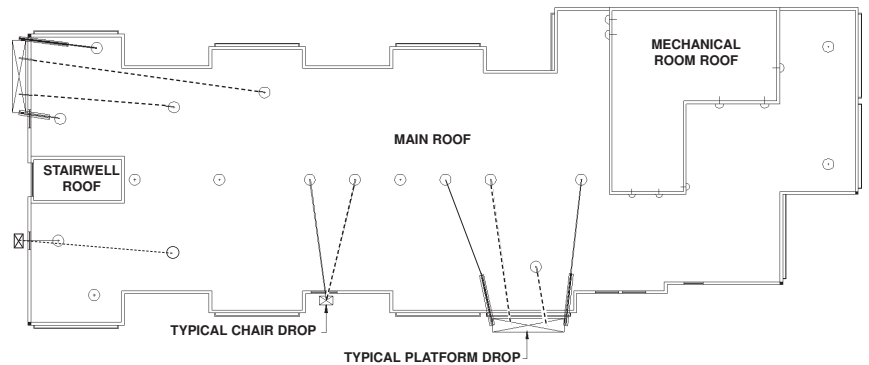


MINIMUM REQUIREMENT

OSHA and the ANSI/IWCA I-14.1 Window Cleaning Safety Standard state that all buildings three stories and higher where windows or building facades are accessed and maintained from the roof using suspended bosun's chair or platform require at least safety anchors for fall protection. Anchors protect workers lives in case the suspension equipment fails, or in the event a worker momentarily loses control.



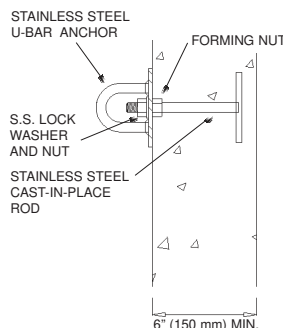
Anchors are also used to secure workers approaching the roof edge when parapet wall is less than 42" (1067 mm) guardrail height.



ROOF PLAN/ANCHOR LAYOUT SHOWING TYPICAL CHAIR AND PLATFORM "DROPS"

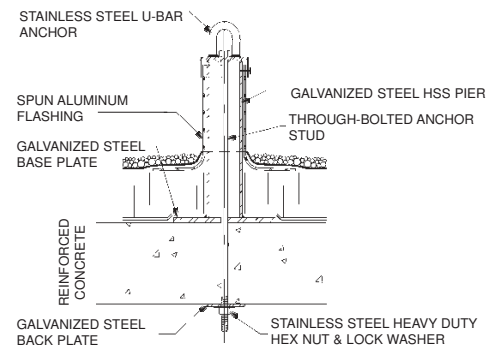
A **tie-back anchor** is a device secured to the building structure to which primary suspension equipment i.e. outrigger beam or parapet wall clamp, is tied back to prevent accidental movement.

A **Safety (lifeline) Anchor** is a device secured to the building structure to which a worker's lifeline is tied and is intended to support a worker in the event of a fall.



SECTION DETAIL – TYPICAL PRO-BEL CAST-IN-PLACE WALL ANCHOR (PB69-S)

NOTE:
Anchors are designed to a maximum fall arresting force of typically 1800 lbs (8.0 kN) when wearing a body harness with a safety factor of 2 without any permanent deformation and to 5000 lbs (22.24 kN) against fracture or detachment.



SECTION DETAIL – TYPICAL PRO-BEL BOLT-THROUGH ROOF ANCHOR (PB73-SDC1)

ENGINEER CERTIFICATION

Suspended access equipment must meet the structural performance criteria outlined in OSHA and ANSI/IWCA I-14.1 and be designed under the direction of a registered professional engineer experienced in such design. Pro-Bel systems meet this criteria and equipment performance is based on data derived from testing and/or engineering calculations. All anchorage systems relying upon chemical adhesive anchors must be 100% tested on site.

Since most safety anchors are used interchangeably for either tying off suspended platforms or fall protection lifelines, they should all be designed for the most serious loading condition, which is the impact due to the arrest of a fall.

Anchors are designed to a maximum fall arresting force of typically 1800 lbs (8.0 kN) when wearing a body harness with a safety factor of 2 without any permanent deformation and to 5000 lbs (22.24 kN) against fracture or detachment.

Pro-Bel Structural Design Data

Pro-Bel systems fall arrest safety anchors and equipment supports comply with the following structural requirements:

1. Fall Arrest Safety Anchors

Fall arrest safety anchors are designed to a typical maximum fall arresting force of 1800 lbs (8.0 kN) against fracture or detachment.

2. 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. 4 to 1 stability factor).

3. Horizontal Cable Systems

"Hands-Free" System: End Supports, corner supports, and intermediate supports to which a horizontal lifeline is



Load tester being used to verify strength of Pro-Bel roof anchor. Opposite end of cable is secured to wall anchor or other suitable structure.

attached and the structure to which they are attached are designed to resist 2 times the reactions (obtained by analysis) generated by the horizontal lifeline system. The applied loads take into consideration that workers are wearing a 900 lb (4.0 kN) shock absorber built into their lanyard and harness.

Double Lanyard System: End supports and corner supports of the DL horizontal cable lifeline and the structure to which they are attached are designed to resist 2 times the reactions (obtained by analysis) generated by the horizontal lifeline system incorporating a 900 lb (4.0 kN) shock absorber.

ANCHOR DESIGN

Prior to the advent of anchors specifically



Standing seam sloped metal roof showing end tensioner and roof anchor terminal of Pro-Bel Horizontal Cable Lifeline System.

designed for lifelines or equipment tie-backs, lines were secured to structural supports such as beams or columns located on the roof. Tie-offs to beams or columns can reduce lifeline strength by as much as 70% due to the cutting action of the steel edges (OSHA 1910.66, Subpart F). Tying off in such a way where the line passes over or around rough or sharp surfaces reduces strength drastically. Such tie-offs should be avoided. Other structurally adequate but problematic anchorages might include:

- eye-bolts;
- the base of large HVAC units;
- stub columns on roofs;
- large pipes 12" (305 mm) in diameter or greater;
- large masonry chimneys;
- roof structure such as mechanical rooms;
- other structures.

See "Suitable Anchorages" on next page.

Eye-Bolt Anchorages

Eye-bolt anchors have often been provided on roofs or walls of highrise buildings for the attachment of safety lines. Lifelines or tie-backs employing eye bolts have a tendency to malfunction in a fall arrest situation. The strength of an eye bolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at right angles to this axis (in the direction of its shear strength). Other problems associated with fabricated eye bolts include: potential weld deficiencies (100% weld is not possible); difficulty of concrete forming and form removal i.e. non-flush application which allows space between the form and the eye, thus affecting strength.

Conversely, Pro-Bel safety anchors show surprising resistance to lateral and shear stresses; far more than that shown by conventional eyebolts, as determined by structural testing via an independent testing agency.* Pro-Bel patented, U-bar anchors are designed to facilitate concrete forming and are flush mounted to provide maximum strength.

* Copy of test report available upon request.

Other Problem Anchorages

Lifelines should never be tied back to portable equipment e.g. counterweights, cornice hooks, or parapet wall clamps.

Other poor anchorages include:

- vent pipes (stink pipes)
- roof access hatches or A/C units
- small pipes or ducts
- metal chimneys
- T.V. antennas
- stair or balcony railings
- terrace benches or other outdoor furniture

Clearly, many of these members are not designed or suitable for supporting a worker in the event of a fall.

In addition, the difficulty with many of these anchorages including the aforementioned tie-offs and eye bolts is the tendency for lifelines or tie-back lines to run at angles contrary to OSHA regulations.

Suitable Anchorages (OSHA and ANSI/IWCA I-14.1 Requirements)

OSHA and I-14.1 requirements state that anchorages to which personal fall arrest equipment is attached shall be capable of supporting at least 5,000 pounds (22.2 kN) or shall be designed, installed, and used as part of a complete personal fall arrest system which maintains a safety factor of at least two, under the supervision of a qualified person.

OSHA further states that lifelines shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the worker in case of a fall, and that equipment tie-backs shall be secured to a structurally sound portion of the building (OSHA 1910.28, Subpart D).

Obstruction Considerations

The location of the tie-off (anchorage) should also consider the hazard of obstructions in the potential fall path of the employee. Tie-offs which minimize the possibility of exaggerated swinging should be considered (OSHA 1910.66, Subpart F).

Ultimately, in the event of an accident, it

is imperative that the building owner/ employer is able to show that anchorages were *designed for fall protection*. Anchor point planning, including proper placement, engineer certification, test data, and specific liability insurance against failure, is the professional designer's, building owner's or employer's first line of defense.

Other Fall Causes

In addition to inferior anchorages, the reasons for workers falling while performing maintenance include:

- powered platform failure (cable breaking or slipping, burning due to contact with high voltage lines);
- suspension ropes being cut due to rubbing against sharp surfaces;
- workers not wearing safety harnesses;
- snagged safety lines;
- malfunctioning descent control devices;
- outriggers not properly weighted;
- structurally inadequate parapets;
- improperly rigged horizontal line;
- performing ladder work without fall protection;
- using homemade equipment;
- tying back to portable (non-permanent) equipment;
- tying back to horizontal lines or slings.



Lifelines should never be tied back to rooftop items other than a properly designed and engineered rooftop anchor. Clearly, objects such as a vent pipe, a/c unit, process piping and metal ladder as shown above are not suitable for supporting a worker in the event of a fall.

ANCHOR LOCATIONS

Pro-Bel safety anchors are located on the roof of the building and are generally secured to any or all of the following acceptable vertical or horizontal elements: mechanical room curb walls; parapet walls minimum 42" (1067 mm) high; roof mounted structural elements e.g. rooftop equipment structural support beams or columns, penthouse enclosures, cooling tower columns, and similar structures; roof decks (to concrete slab, precast deck, structural steel, and similar structures); finished roof top terraces.

Ideally locations for Pro-Bel safety anchors are in direct line with the anticipated "drops" and are suited to both bosun's chair and suspended platform. A "drop" for a chair is typically a 6'-0" (1.8 m) wide area, and 20'-0" to 28'-0" (6 m to 8.5 m) for a platform (evenly divided around roof perimeter). Two anchors are required for bosun's chair (1 primary and 1 lifeline) and 4 anchors are required for a platform (2 primary and 2 lifeline). Prior to locating safety anchor points on the roof, it is important to determine what areas of the building face will need to be accessed by bosun's chair and suspended platform.

Anchors which are provided for bosun's chair work can be used for the tie-back of suspended scaffolds, and vice versa.

Note: It is imperative that design professionals understand the relative complexity of designing window washing systems with regard to RIGGING METHODS, SAFETY & OSHA STANDARDS/STATE CODES.

See individual product literature for layout data for specific equipment.

PARAPETS

Window cleaners/suspended maintenance workers often use parapet wall clamps and outrigger beams with counterweights to suspend their rigging lines beyond the building face. The parapet wall must be strong enough to support the applied loads. Special attention should be given to prevent damage to the parapet and the potential dangers to workers as a result of the parapet wall being overloaded.

Alternatively, to prevent damage or overturning of equipment, a means of support *above* the parapet wall could be provided; either a portable davit arm or a portable outrigger beam dolly is recommended. In rare cases lines can be passed *through* the parapet wall. ■ **Refer to Pro-Bel Rigging Sleeve Systems literature for more information.**

If parapet walls are 42" (1067 mm) guardrail height or higher and structurally adequate i.e. typically reinforced concrete, they can be considered a suitable anchorage for tie-back and lifeline anchors. If parapet walls are less than 42" (1067 mm) guardrail height, they should not be used for either tie-back or lifeline anchors.

Cast-in-Place Concrete Walls

Typically reinforced concrete parapets are used to secure both primary equipment and lifelines provided the wall is approved by a professional engineer who is aware of loads to be placed on the wall.

Precast Concrete Walls

Precast walls are not normally acceptable for the use of parapet wall clamps or installation of lifeline anchors unless the precast wall panel securement clips are designed to take the applied loads.

Masonry Walls

Brick parapet walls or brick face parapet walls with concrete block back-up are not normally acceptable for the use of parapet wall clamps or installation of lifeline anchors unless reinforced.

Unreinforced Walls

Walls employing lightly constructed fram-

ing such as timber or sheet metal covered with plywood or light facing materials are not acceptable for suspending primary equipment or securing lifelines.

Excessive Height Over 42" (1067 mm)

Where structurally adequate parapet walls exceed 42" (1067 mm) in height, provision for ladders, scaffolding or a permanent catwalk is required for safe access when davits, parapet wall clamps or lifeline anchors are employed at the top of parapets.

Line Stops

Where conditions dictate, line stops (typically attached to a parapet) can be employed to:

- prevent inadvertent swing hazard or to facilitate re-direction of bosun's chair lines e.g. while rigging over a sloped parapet wall.
- prevent excessive swing hazard of lifelines in case of accident, while using bosun's chair or stage i.e. during fall arrest.

SECTION DETAIL
EXAMPLE ROPE GUIDE/
LINE STOP (SURFACE
MOUNTED TYPE SHOWN IN
PHOTO BELOW)



WORKING DRAWING OPTIONS

Once the architect/designer has reviewed the various equipment options, securements, details, and layout recommended by Pro-Bel, the equipment may be shown on the roof plan using either one of two options:

1. Show actual locations of equipment and selected details based on Pro-Bel design concept. When Pro-Bel equipment design requires related structural steel, it is advisable to show actual equipment locations and securement of related structural steel on roof plan. This option however implies that the architect/designer is responsible for the layout and design.
2. Show selected details and state the number required of each detail based on Pro-Bel design concept, without showing actual equipment locations. This option will still provide related trades with enough information to eliminate confusion or extras at later date, leaving final design the responsibility of Pro-Bel.



Parapet wall must be strong enough to support applied loads of suspension ropes, wall clamps/hooks or outrigger beams with counterweights. Alternatively, a portable davit arm or outrigger beam dolly can be used to clear the parapet.

STABILIZATION

The stabilization of platform, cage or bosun's chair equipment is a system designed to keep the equipment in contact with the building facade, to prevent movement. Without stabilization, worker safety could be in jeopardy due to wind action or building faces could become damaged due to equipment impact.

Continuous Stabilization:

On the exterior of the building, provision for tie-in guides is supplied by the curtain wall manufacturer to provide a positive and continuous means of engagement between the platform and the building during full vertical travel of the platform.

Tie-in guides/mullion tracks are normally used for stabilizing a powered platform. The guides start at the highest elevation and extend to the ground. The tie-in guides/mullion tracks are placed in vertical rows in line with the point of suspension. It is recommended tracks be coped out or designed so that platform trolleys or "shoes" can be inserted at both the top and bottom of the building.

Trolleys (guide rollers) or "shoes," attached to the platform and supplied by the window cleaning equipment manufacturer, engage the tie-in guides (mullion tracks) provided by the curtain wall manufacturer.

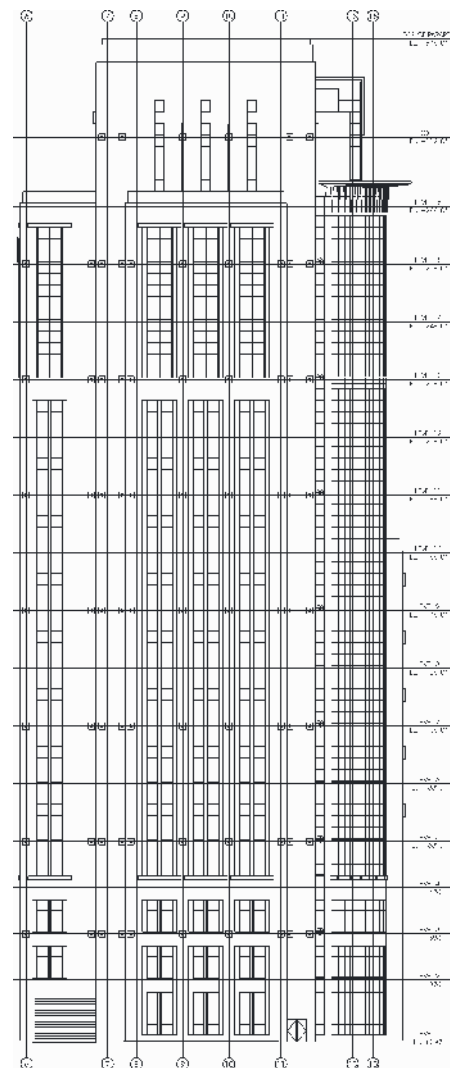
Note: careful co-ordination is required between these two manufacturers to ensure smooth, trouble-free platform operation i.e. track alignment and properly fitted trolleys or "shoes."

Intermittent Stabilization:

Tie-in guides such as buttons or detent pins are located in vertical rows in line with suspension cables starting at the highest elevation possible. The maximum vertical interval between tie-in guides is to be three floors or 50 feet (15.3 m), whichever is less. Note: New York specifies three floors or 40'-0" (12.2 m) whichever is less.

As a platform moves down, past the elevation of a tie-in guide (button or detent pin), each of the platform's two occupants secure a stabilization tie between a suspension rope and a tie-in guide. Each stabilized tie is to be adjustable or of fixed length to provide continuous contact between the platform's facade rollers and the building facade. This process will be repeated as each stabilization point button or detent pin is reached.

The design load for stabilization components such as tie-in guides/buttons/detent pins are designed for a working load of 300 lbs (1.33 kN) per AISC requirements and/or other applicable codes and to 600 lbs (2.67 kN) against fracture or detachment.



ELEVATION: PRO-BEL INTERMITTENT STABILIZATION TIE-IN GUIDE LAYOUT



Maintenance personnel will attach a stabilizer tie to buttons located under sun shades on this building.

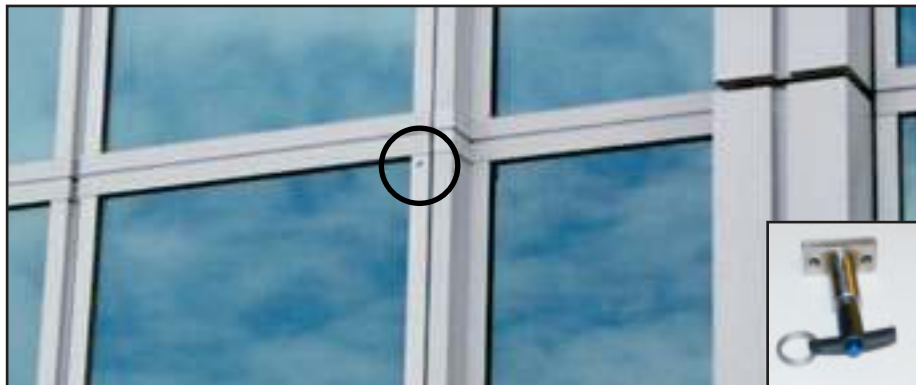


Photo shows partial curtain wall facade. Black dot in aluminum mullion is location of hole for detent pin. This type of tie-in guide, although unobtrusive, is more difficult for maintenance personnel to locate and is usually employed where a flush appearance is critical.



Refer to Pro-Bel Stabilization Systems literature for more detailed information.

Pro-Bel Stabilization Recommendations

Permanent Installations (P.I.)

When buildings require a permanent powered platform, it is mandatory that mullion tracks, buttons, or detent pins be employed for platform stabilization for buildings or "drops" that exceed 130'-0" (39.6 m) in height.

Mullion tracks provide rigging flexibility for both roof rigging and ground rigging applications.

High rise buildings with multi-tiered roofs or roof areas too small to accomplish a transfer of a platform i.e. no davits, no parapet, narrow roof area, etc. would require mullion tracks at the upper elevations.

Installations that employ buttons or detent pins are normally designed to suit roof rigging.

Non-Permanent Platforms

Temporary platforms (scaffolds) supplied by the window cleaning or maintenance contractor are required to be securely lashed to the building or structure (OSHA 1910.28, Subpart D). OSHA does not specify how the lashing is to be achieved, however building mullion tracks, face buttons or detent pins are normally considered on buildings or "drops" that exceed 130'-0" (39.6 m).

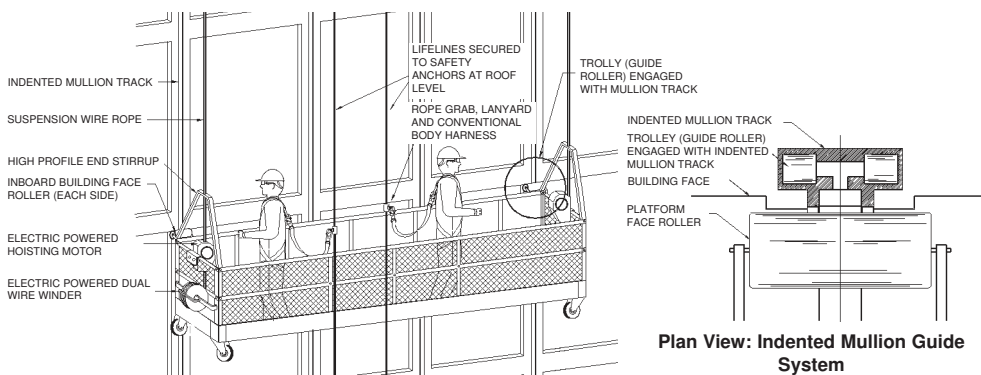
Consideration should be given to installing davits which would allow for roof rigging of the platform to provide an intermittent method of stabilization comparable to a permanent powered platform. Alternatively on buildings over 130'-0" (39.6 m) buttons or detent pins should be installed at every floor. Each project must be assessed on an individual basis.

Bosun's Chair with Descent Control

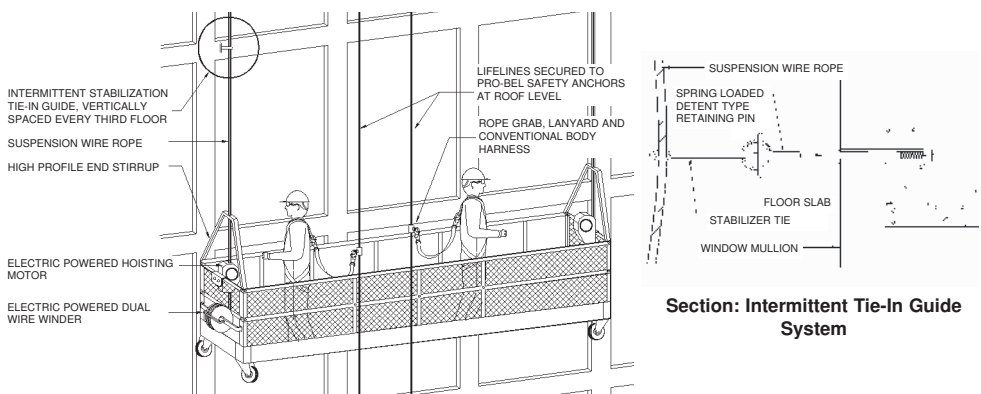
Bosun's chair stabilization is not presently covered by OSHA 1910.28, Subpart D. Instead the OSHA ruling for stabilization is covered in a separate memorandum to Regional Administrators from Patricia K. Clark, Director, Directorate of Compliance Programs, Department of Labor (March 12, 1991). Provision for local stabilization for descents in excess of 130'-0" (39.6 m) is required and normally suction cups are employed. Although suction cups are the popular choice of window cleaners, other methods of stabilization include the use of 'C' clamps and vice grips.



Extreme right and left hand side of photo shows how platform is stabilized against wind using cable, down rigged lines anchored to a Pro-Bel anchor at ground level and davit arm at roof level. Nylon webbing stabilizer ties secure the platform to down rigged lines—a custom, restrictive solution designed with a slip rope grab to control amplified loads.



TYPICAL PRO-BEL POWERED PLATFORM SYSTEM WITH INDENTED MULLION TRACK GUIDES



TYPICAL PRO-BEL POWERED PLATFORM SYSTEM WITH INTERMITTENT TIE-IN GUIDES

RESCUE, INSPECTION AND MAINTENANCE

RESCUE CONSIDERATIONS



Window cleaner is rescued after hanging from 23 storey building for 20 minutes after platform cable breaks. Rooftop safety anchors save the day.

The governing standard for the rescue of workers performing suspended maintenance, regardless of the type of equipment employed, is contained in OSHA 1910.66, Subpart F (Powered Platforms, etc.) which addresses the building owner/employer and reads as follows:

Emergency planning. *A written emergency action plan shall be developed and implemented for each kind of working platform operation. This plan shall explain the emergency procedures which are to be followed in the event of a power failure, equipment failure or other emergencies which may be encountered. The plan shall also explain that employees inform themselves about the building emergency escape routes, procedures and alarm systems before operating a platform. Upon initial assignment and whenever the plan is changed the employer shall review with each employee those parts of the plan which the employee must know to protect himself or herself in the event of an emergency.*

There is a shared responsibility between the building owner/employer and the window cleaning/suspended maintenance contractor. Building owners of all installations, new and existing, shall inform the employer (maintenance contractor) in writing that the installation has been inspected, tested and maintained in compliance with OSHA 1910.66 and International Window Cleaning Association ANSI/ IWCA I-14.1 Window Cleaning Safety Standard requirements. And it is incumbent upon the contractor to submit written certification that employees have been trained in the operation of and can demonstrate competency in the use of window cleaning equipment. It is also the responsibility of the employer (building manager) and maintenance contractor to plan for the prompt rescue of maintenance workers in the event of a fall.

INSPECTION & MAINTENANCE

Window cleaning equipment that is supplied and installed must be inspected annually as a minimum requirement. OSHA addresses the annual inspections through the enforcement of the General Industry and Duty clause, Section 5(a)(1) of the OSHA Act and related equipment outlined in 1910.66, Subpart F - Powered Platforms and Appendix C to 1910.66, Personal Fall Arrest Systems. See "Owner's Responsibility" on page G-21 for additional information.

OSHA Inspection Requirements

All suspended maintenance systems shall be inspected and tested (as required) prior to initial use to determine that all safety and operating equipment is functioning as required. A similar inspection shall be performed following any major alteration made to the existing installation.

All safety equipment and related components shall undergo periodic inspections by a competent person at intervals specified by the manufacturer/supplier, but not to exceed twelve (12) months, to determine that they are in safe operating condition. Parts subject to wear such as wire ropes, bearings, gears and governors shall be inspected and/or tested to determine that they have not worn to such an

extent as to affect the safe operation of the installation.

The building owner shall keep a certification record of each inspection and test required. The certification record shall include the date of the inspection, the signature of the person who performed the inspection, and the number, or other identifier, of the building support structure and equipment which was inspected. This certification record shall be kept readily available for review by the Assistant Secretary of Labor or the Assistant Secretary's representative and by the maintenance contractor.

Pro-Bel Inspection Services

Pro-Bel offers owners/employers two inspection options. Inspections may be carried out using a Pro-Bel inspector or an independent engineer. Regardless of option selected, Pro-Bel must provide a 'Certification For Use' sign-off document at a minimal fee. Pro-Bel maintains up-to-date inspection records of all Pro-Bel manufactured equipment/installations. All inspection data is recorded in the building owner's/employer's Equipment Manual & Inspection Log Book. The Log Book, containing the necessary information to comply with all relevant State and Federal safety standards, will reduce both the design professional's and owner's legal exposure in the event of an accident. Special Note: Pro-Bel customers automatically receive \$2,000,000.00 liability insurance coverage providing the foregoing conditions are met.

Posting of Engineered Drawings

It is recommended that the building owner post a copy of the Pro-Bel engineer approved shop drawing showing equipment layout and details of the window cleaning/suspended maintenance system. The drawing should be located adjacent to the roof entrance for ease of review by window cleaners, inspection authorities and Pro-Bel if necessary. A copy of this drawing must also be provided for the maintenance contractor/personnel prior to commencing work.

INSTALLATION

Due to liability issues, Pro-Bel window cleaning equipment is installed either under "Sole Responsibility Contracts" or furnish only with installation by others utilizing a strictly controlled sign-off and certification procedure.



Pro-Bel's many transport trucks with sleepers allow installation crews to work throughout North America.

Roofing Consideration

An important consideration in the design of Pro-Bel anchor products 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.

ALTERNATIVE FINISH TO GALVANIZING

Pro-Bel Protex, a superior finish to galvanizing, provides greater impact and abrasion resistance for Pro-Bel products susceptible to banging about or scratching during use (corrosion issue) See Pro-Bel Protex Technical Data Sheet # R-2.

AVAILABILITY & COST

Pro-Bel window cleaning/suspended maintenance safety systems are available 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" following.

WARRANTY

Warranty is in accordance with standard Pro-Bel terms and conditions of sale. Copy of Warranty available upon request.

TECHNICAL CONSULTATION

Pro-Bel Group Ltd. provides a complete technical consultation service, available to Architects, Consultants, Engineers, Contractors, Property Managers and Building Owners (see Special Note below). Without obligation, Pro-Bel will provide interested parties with a proposed window cleaning/suspended maintenance design concept to OSHA requirements, including anchor and equipment locations, securement, roofing details, and specifications.

Simply provide the following information:

- Roof plans (architectural and structural).
- Building elevations.
- Typical floor plan.
- 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 design concepts as required with respect to suspended access equipment.

In addition, Pro-Bel Group Ltd. will provide budget pricing for the concept. Budget pricing is contingent upon acceptance between Pro-Bel and Architect/Owner for proposed system design.

Special Note: To be efficient, economical and practical, it is imperative that architects and engineers understand the relative complexity of designing window cleaning systems with regard to the following three areas: RIGGING METHODS - SAFETY - OSHA STANDARDS/ STATE CODES.

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 myriad 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 and engineers with a FREE DESIGN SERVICE, and to ensure that Pro-Bel Window Cleaning/Suspended Maintenance Systems are properly specified and installed.

RELATED DATA

Separate literature for all Pro-Bel products or complete technical manual (including 3-Part Format guide specifications) is available to qualified prospects.

OTHER PRODUCTS



Pro-Bel aluminum gantry systems, designed so that personnel can work over glass, are available to suit any atria roof access requirement.



Pro-Bel motorized material hoists solve problem of lifting mechanical or other type equipment (A/C units, replacement motors, window cleaning equipment etc.) onto roof.

Currently, Pro-Bel Group Ltd. is celebrating over 8000 building projects utilizing Pro-Bel Window Cleaning/Suspended Maintenance Equipment and Fall Protection Systems.

Pro-Bel has acquired a reputation as a highly qualified authority for any organization contemplating a specialized approach to suspended access equipment requirements. Building owners and design professionals can have confidence that when they select a Pro-Bel system, they are choosing a system designed and manufactured by industry experts while obtaining single source compatibility and single source responsibility. With a track record for safety second to none, it is especially appropriate to highlight the history of our company.

Unique among manufacturers of suspended access equipment, Pro-Bel's purpose from inception has been protecting window cleaners against falls from elevation. Falls are the number one cause of occupational deaths* in America (**Best's Safety Directory, 1995*), excluding motor vehicle accidents. We are indeed one of the largest companies in North America, and to our knowledge the world, that consistently has made high rise fall protection its primary business, designing to the work practices of professional window cleaners. We believe this singular focus

is the key to our past success and will continue to serve us well for the future.

From 1978 to 1989, Marc Lebel, President of today's firm, owned and operated a high rise window cleaning company called Pro-Bel Services. During this period, window cleaning contractors used suspension equipment ranging from block and tackle, descent controlled bosun's chair to manually operated and motorized stages — but virtually all without the benefit of auxiliary safety line anchoring points for workers in case of equipment failure or emergency.

An unrelenting number of falls led Mr. Lebel to conclude they were the result of workers being unable to secure independent lifelines to properly engineered and situated rooftop anchors. Thus, it was during the 1980's Mr. Lebel developed and patented a line of rooftop safety anchors designed specifically for window cleaner's fall protection, thereby giving birth to the safest method of rigging that existed prior to this time.

It was also during this period that Pro-Bel Group Ltd. was formed, and expert technical staff, including standards/codes specialists, evolved. Simultaneously, Mr. Lebel, in tandem with the International Window Cleaning Association (IWCA), gave a presentation in 1990 at the OSHA

public hearings in Washington, D.C. relating to 29 CFR Part 1910 Proposed Rulemaking (window cleaning standards, anchors, chairwork).

Today, in addition to marketing an extensive product line of suspended access and fall protection equipment, Pro-Bel staff continue to sit on standards writing committees such as ANSI/IWCA I-14.1-2001 Window Cleaning Safety Standard and ASME A120.1-2008 Safety Requirements for Powered Platforms for Building Maintenance. In Canada, Mr. Lebel helped develop consensus standards CAN/CSA-Z91-M90 (Safety Code for Window Cleaning Operations), CAN/CSA-Z271-98 (Safety Code for Suspended Powered Platforms), as well as labor legislation.

Pro-Bel's greatest competitive advantage lies in an extensive knowledge of rigging practices and expertise with OSHA and other standards. This time tested experience is reflected in the quality and diversity of Pro-Bel systems featuring safety, ease of use, practicality, and economy.

Pro-Bel takes pride in our heritage of leadership and looks ahead enthusiastically to even greater success in an ever-changing building environment.



Pro-Bel Group Ltd. occupy their own 48,000 square foot (4459 m²) building in Toronto (Head Office).

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 myriad 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, general contractors, 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.

Pro-Bel's purpose from inception has been to protect window cleaners against falls from elevation. Pro-Bel is currently celebrating over 8000 projects successfully completed world wide.

SERVING CANADA, THE UNITED STATES AND THROUGHOUT THE WORLD

TO FIND ADDITIONAL PRO-BEL LOCATIONS IN YOUR AREA PLEASE VISIT OUR WEBSITE...

www.pro-belgroup.com

Pro-Bel Group Ltd.
(Florida)
2501 NW 34th Place, Unit 23
Pompano Beach, FL 33069
954-457-5080 - local
866-377-6235 - toll free
954-457-9010 - fax
info@pro-belgroup.com

Pro-Bel Group Ltd.
(Chicago)
2850 West Fulton Street
Chicago, IL 60612
773-638-6714 - local
773-638-6715 - fax
info@pro-belgroup.com

Pro-Bel Group Ltd.
(Pennsylvania)
421 Guilford Avenue
PO BOX 556
Chambersburg, PA 17201
(717) 263-7400 - local
(717) 263-7414 - fax
info@pro-belgroup.com

Pro-Bel
(China)
36 Guangqumennei St.
Beijing, 100036, China
(+86.10.6718 6272 - local
(+86.10.6713 8186 - fax
(+86.139 1146 0532 - cell
www.pro-bel.com.cn

Pro-Bel Enterprises Ltd.
(India)
#26, Chamundi Mansions
22nd Main, 2nd Phase
JP Nagar Bangalore
560078
(080) 2658-7856 - local