IWCA Safety Certification Program

COURSE STUDY PROGRAM

For Window Cleaner Safety Certification

High Rise-Rope Descending System Operations

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High Rise-Rope Descending System Operations

When you see a window cleaner sitting on a small board hanging from a rope on a tall building, what do you think ?

At first, many feel that the worker is just plain crazy. Some confirm the amount of bravery that's required and assume the employee is paid a million dollars an hour. Ultimately, most realize that it's an occupation left well enough alone and a select group is certain that high rise window cleaners on ropes have a death wish.

How Safe Is It ?

In the grand scheme of things, performing window cleaning from a rope and chair system is still safer than driving a car, flying in a plane and even climbing a ladder. The occupation of window cleaner is not even listed in the top 100 most dangerous occupations in this country. Millions of descents (times a worker goes down the side of a building) are performed each year and the ratio of accidents to the amount of use is obviously not alarming.

Where Did It Come From ?

For many years, industry standards and regulations that have applied to window cleaning only addressed block and tackle systems for suspended operations. This equipment required the user to hoist themselves up the building before going down to clean. As time progressed, industry standards gradually included the use of powered equipment particularly, suspended scaffolds.

While standards and regulations may have recommended that all buildings incorporate some type of permanent equipment to allow safety for exterior building maintenance, the facts show that most buildings in this country are ill-equipped when it comes to adequate anchors or other types of permanent equipment.

This scenario caused the window cleaning industry to develop new means and methods which considered safety, transportability and practicality. Sometime in the late 1960's is when the concept of descending a building from the roof down to stop at every floor and clean a window was born. Window cleaning company owners realized the benefits of transporting and mobilizing a rope descent system versus the use of a suspended scaffold or a block and tackle system.

The fact that less components were required, less trips to the roof during setup and takedown, and that workers only needed to access a buildings windows instead of the entire façade helped reduce the amount of labor involved with a window cleaning operation. When one company in a city started using rope systems, others followed suit and quite rapidly. By the mid 1980's rope descent systems had become the most popular means of providing high rise window cleaning services in the United States. At the time, California and New York were the only two states that did not recognize the use of this equipment.

Almost simultaneously the use of rope descending systems had become just as popular for window cleaning in Canada, the United Kingdom, Australia and several European countries.

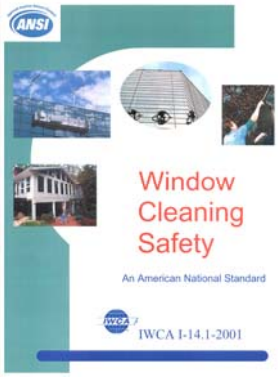
How Is It Regulated?

In the late 1980's the only standard devoted to window cleaning, the ANSI/ASME A39.1, discussed the topic of this "new" piece of window cleaning equipment. Several members made an effort to investigate the use of ropes and chairs and presented their findings to the entire committee. The A39 Committee found the report to be inconclusive and felt that basic safety parameters were missing when the equipment was considered for buildings that were not yet designed or constructed. Ultimately, the A39 Committee prohibited the use of "emergency descent systems" for window cleaning operations.

Not long after this, Federal OSHA saw the need to regulate rope and chair systems because of its extensive use. At first, OSHA was going to adopt the A39.1 Standard in the same manner they have adopted other ANSI Standards when developing new regulations. OSHA notified affected parties of their intentions.

The window cleaning industry became alarmed with the news that OSHA may adopt a safety standard which prohibited the singular most popular piece of access equipment in the country. Letters were sent, phone calls were made and OSHA felt the need to hold a public hearing to address this new piece of equipment. Ultimately, OSHA found rope descending systems to be a safe and viable means to clean a buildings windows. In 1991 a letter was distributed to all regional offices of OSHA explaining that a regulation would be promulgated. In the meantime, compliance officers were to enforce at least 8 simple safety precautions when the equipment was being used.

As time went on, users and regulatory agencies found the eight steps to be limited. The International Window Cleaning Association developed and published Safety Guidelines for Window Cleaning. In this small but effective pamphlet, window cleaners were given guidelines on the safe use of a variety of access equipment. The section on ropes and chairs had 25 safe practices to follow when the equipment was used. Because the State of California is self-regulated, they too set out to develop a section to their codes which encompassed "Controlled Descent Apparatus". The new addition to the States General Safety Orders Title 8 was recently published in August of 1998.



The ANSI/ASME A 39 Committee made several attempts to develop a section for their standard on the safe use of rope systems for window cleaning. Unfortunately, the committee could not achieve a consensus and ultimately was disbanded by the American Society of Mechanical Engineers. ASME then formed a new committee, the A41.1, to address the use of manual equipment for access to buildings. Simultaneously, the IWCA began the formation of a committee to address window cleaning safety. This committee will also consider the use of rope systems however, it will be specific to window cleaning. Recently, the IWCA applied to the American National Standards Institute to have this new committee accredited. On October 25, 2001, the American National Standards Institute approved the ANSI/IWCA I 14.1 Window Cleaning Safety Standard.

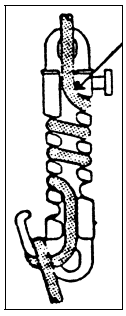
What is a rope descending system ?

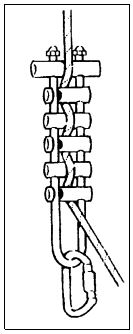
Quite similar to all transportable suspended access systems, a rope descending system (RDS) consists of components that when assembled allow a worker to access the façade of a building. As with any transportable

equipment, a RDS must consider the building as an integral part of the system mainly because the equipment is so easily transportable from one location to another.

When used correctly a RDS functions by allowing a worker to access the system on the roof, manuever outboard and slowly descend the workface with gravity as the power source. The rate of descent is controlled by the number of friction points that are placed onto the rope from the descending device. The amount of friction is substantial because in most cases, a descent is easily stopped by changing the direction of the working line by lifting it upward. To lock the system for an extended period, the user simply wraps the lifted working line around the top of the device which is usually pre-grooved for this purpose. There are some descending devices which automatically lock by using a tension spring to push the rope into a groove.

There are two basic types of descending devices which provide an adequate level of safety for the worker; the cylinder device and the rack and bar device. The cylinders were designed specifically for industrial applications while the rack and bar devices came from the sport and rescue industries.

Cylinder 

 Rack and Bar

The cylinder devices apply friction to the working or primary line in an elliptical fashion. As you can see by the illustration, the rope wraps around the cylinder several times and because it is a metal composite, quite a bit of friction is applied at each point the rope contacts the device. The rack and bar system applies the friction to the rope in a vertical fashion. The bars on a rack pivot in and out of position allowing the user to easily place the device onto a rope. The user has a choice of either aluminum or stainless steel bars. Each device and their sub-components are generally tested from 8000 to 10,000 lbs. at their respective factories.

ROPE

The type of descending rope being used is dependent upon the type of descending device. Cylinder type devices prefer rope that is loosely braided. The most common size of this type of rope is ½" in diameter. Solid braided nylon is often used and newer types of rope consist of a parallel core of synthetic strands surrounded by a woven outer cover or "sheath" of the same. These type of ropes are more forgiving to the elliptical effect placed upon them by the cylinder devices which means less backturning or "hockling" of the rope below the descending worker.

Because the rack and bar descenders come from the sport and rescue industries, they work best with the ropes most commonly used in these applications. Static kernmantle performs best when friction is applied in a vertical manner. The inner core of static kernmantle is generally parallel strands of synthetic fibers. This type of construction reduces the amount of stretch in a line considerably. The outer sheath of kernmantle is tightly woven strands which give the line a noticeable stiffness. The most common size of kernmantle used for descending is 7/16" although ½" is gaining in popularity.

The majority of rope used today by the building maintenance industries consists of nylon, polyester and or polypropylene fibers. These fibers greatly reduce damage from exposure to ultraviolet light (sunlight). They also are more resistant to abrasion and chemical abuse. Average tensile strength among these sizes and types of rope is generally over 6,500 lbs.

There are no set criteria as to what constitutes when a descending rope should be discarded. It is very rare that a rope just breaks without the help from a sharp building component or serious over abuse. Things to look for in a worn rope are excessive outer fraying, significant change in the diameter, chemical damage, cuts or abrasion and stiffness the whole way through.

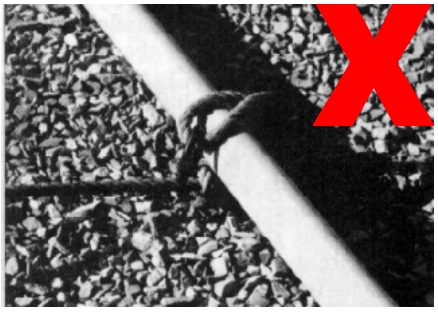
When on the roof of a building, a worker should lower their safety line, then their descending line. Once in place the worker can place the descending device onto the rope while standing on the roof. A seatboard which consists of a piece of wood and a 1 ½" nylon webbing strap is hooked to the descender with a locking d-ring or carabiner. Both of these components support well over 5000 lbs. Coupled with a backup safety system consisting of a rope, harness, lanyard and rope grab, the user is ready to descend to perform their work.

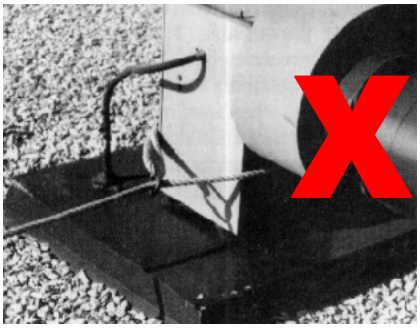
When it comes to using transportable equipment whether it is a rope descending system or swingstage, OSHA requires that all tiebacks, lifelines or main lines be secured to an anchor capable of supporting 5000 lbs.

When is the last time you saw something that even comes close to meeting this requirement on a roof you were rigging or planning to rig ?

The number one reason for fatalities in the exterior building maintenance industries is consistently due to falls from equipment that is poorly rigged. If it's not the primary rigging itself which fails, it is the secondary or backup fall arrest equipment.

Workers are regularly subjected to the real life game of jeopardy as they attempt to find adequate anchor points at each drop location on the roof of a building. The photographs show typical scenarios where workers relied on building components which are totally unacceptable however in their mind, were all that was available.





As you can see, danger thrives in the everyday world of exterior building maintenance. Experts agree that OSHA created more of a problem by requiring tie backs and lifelines be secured to adequate anchors without designating a specific responsibility for providing them. Although there are many ingenious and creative

contractors out there, the home made or job made rigging equipment they use is not a substitute for basic engineering principles, which are crucial to supporting this kind of equipment. By it's very nature and design, transportable equipment needs to rely on the building or structure it is being used on as an integral component of the system.

While there may be a slowly developing increased awareness by property owners and managers with regards to the installation of adequate anchorage points on their facilities, the majority of buildings in this country remain unequipped for the safe performance of exterior maintenance services.

This simple fact is one of the primary reasons rope descending equipment quickly developed into the system of choice for the professional window cleaning industry. Contractors felt much more confident when they only needed to rig a system which; a) only operated in the down direction and; b) applied one fifth of the loading of a suspended scaffolding and; c) consisted of less components and less rigging requirements. Secondary reasons are based upon efficiency issues since window cleaning only requires workers to access part of a buildings façade. And of course, once a company in town started using rope systems others followed suit to remain competitive.

Aside from these issues the simple truth remains. Numerous building maintenance industries have developed over the years with little attention to one of the most important safety requirements involved. Contractors across the country are physically unable to provide "anchors capable of sustaining 5000 lbs" on buildings where none exist. Transportable rigging equipment can be brought to a work site however, the need for tieback and independent lifelines remains. The fact of the matter is that property owners and managers need to realize their responsibilities in this area. It is their property and if they desire that contracted exterior maintenance be performed safely, they may have to do a little more to insure a safe workplace is provided.

Anchorage points may be also be an important component of a fall arrest or fall protection system on the roof of a building. Property management employees are at risk when performing routine maintenance on a roof that is not equipped for fall protection. This is one of the primary focus points in the new ANSI/IWCA I-14.1 Window Cleaning Safety Standard.

Rope Descending Systems

Employees shall be trained in the use and care of rope descent systems before they are permitted to use such equipment. Training shall include but not be limited to understanding the manufacturer's instructions, inspection of components, accepted rigging practices, identifying anchorages, descending, fall arrest requirements, rescue consideration and a full understanding of safe working conditions considering as a minimum, correct rigging, rope use, inspection and care and the effects of wind on suspended operations.

1. When such equipment is used for window cleaning applications, its design, use and maintenance shall conform to industry standards for rope descent systems and in accordance with the manufacturer's instructions. Only equipment designed in accordance with industry standards and intended for use in commercial applications shall be used.

Many of the components of an RDS must meet specific safety requirements. Be smart when selecting a system. Find out if the equipment meets industry standards with regards to being used in a commercial application. Don't use equipment that looks like something it's not.

2. Prior to assembling, the operator shall inspect the components of the rope descent system and all safety devices including ropes, harnesses, rope grabs, lanyards, descent devices, chairs and hardware for their general condition. Those components which have defects shall be immediately removed from service, tagged or marked with a label which states, "Dangerous, Do Not Use", then restored or destroyed. Improvised repairs are prohibited.

Make sure the synthetic rope and webbing is flexible and not stiff or hard. Check for tears, cuts or abrasions that may weaken the rope. Insure that metal hardware such as carabiners, buckles, and descending devices are free from cracks, splits or other damage. Be sure that your carabiners operate fully and LOCK.

3. Rope descent systems shall be stored in such a manner as to provide ease of access or inspection and to prevent danger of an accident when withdrawing the equipment for use. Components shall be stored at a location where they will be protected from the elements. Working surfaces shall be kept free from grease, oil or other slippery substances. Ropes shall be stored in a cool, dry, dark environment.

4. Anyone using a rope descent system, should have available at the jobsite at least one other co-worker equally proficient in the use of the system and rescue procedures. When performing descents over 130 feet (40 m), special attention shall be given to prevent against the danger associated with the following industry recognized hazards:
a) the potential of sudden climactic changes such as wind gusts, micro bursts or tunneling wind currents;
b) the ability of the RDS to function without the user having to apply excessive force;
c) the length of time workers are suspended;
d) the re-rigging and movement of main suspension and safety lines;
e) the ability to provide a prompt rescue in the event of an emergency.

It's very important to use the buddy system when performing RDS work. Sudden wind gusts or changes in the weather can be very dangerous. Have a plan to avoid that danger. In between long descents, take a break and move your legs. Do some stretching of your back and legs to stay loose.

Bring along an extra RDS to the job. This way if a co-worker does get stranded or needs assistance while suspended, someone can quickly set up this extra system for prompt rescue.

5. Prior to making a descent, the building exterior shall be visually inspected and where necessary, appropriate measures shall be taken to ensure that building features, such as sharp edges of parapets, window frames, open projected windows and cornices or overhangs cannot impair the structural integrity of the RDS or associated fall protection rigging. When used, padding shall be secured to prevent its dislodging from the surface to be protected. These measures shall be incorporated into the plan of service.

ALWAYS USE ROPE PROTECTION !!!! ***Most of the accidents with RDS involve the main lines being cut but a building object and careless workers. Use rope protectors and always have more on hand than you think you'll need for the job. It pays to have extra.***

6. Workers shall wear and completely assemble their personal fall arrest equipment prior to approaching the point of suspension. The worker shall be secured within the seatboard and fall arrest equipment prior to being suspended. Workers shall maintain their connection to a primary descent system and fall arrest system at all times when suspended. Disconnecting from either system while suspended is strictly prohibited.

WEAR YOUR HARNESS AND ATTACH YOUR GRAB ***before going over the side. It's also recommended that you have your seatboard on, before going over the side. The seatboard is only HALF of the Rope Descending System and if you don't have it on, you're not fully protected. Always stay connected to both main and backup systems.***

7. Rope shall be rigged through the descent device with the appropriate number of wraps or friction points so as to ensure a controlled rate of descent. The diameter and construction of the rope used shall correspond to the manufacturer's specified rope diameter. Descent devices shall be connected to a seatboard using a double acting carabiner of manual or auto locking design. The attachment point on the descent device shall be of one piece construction with no gates or openings.

8. While suspended, window cleaners shall not reach further than six (6) feet (1800 mm) in any direction as measured from the plum line of the suspension point on the bearing point on the building. Rapid descents, excessive swinging and sudden stops are prohibited.

Don't try to do big overhangs or multiple windows in one descent. This is not safe and the risk is definitely not worth it.

9. Operators of rope descent systems shall continuously monitor wind speeds and weather conditions throughout the course of operation. Rope descent systems shall not be used for window cleaning when wind speeds become excessive. On descents higher than 130 feet (40m), provisions shall be made for stabilization. Such provisions may include:
a) continuous;
b) intermittent;
c) work station. (suction cups)
Descents shall not exceed 300 feet (91m) above grade unless the windows cannot be safely and practicably accessed by other means.

10. Operators of rope descent systems shall continuously monitor the condition of all components of the system. Any components subject to constant friction and wear shall be inspected regularly. Manufacturer's instructions with regards to maximum allowable wear points shall be followed. Those components which

have defects shall be immediately removed from service, tagged or marked with a label which states, "Dangerous, Do Not Use", then restored or destroyed. Improvised repairs are prohibited.

11. Extreme care shall be taken when using descent equipment around electrical service or heat sources and turbulent areas such as air vents.

12. Prior to using a rope descent system for window cleaning, proper danger signs and barricades shall be in place in accordance with industry standards. Where it may be a danger to the public, window cleaning tools shall be secured by tool lanyards or other similar methods in order to prevent them from falling.

13. Working lines shall not be used longer than two (2) years from date first placed in service or three (3) years from date of manufacture.

14. The securing of a rope to an anchor with a knot is permitted providing the specific knot does not decrease the initial breaking strength of the rope below 5000 pounds (2268 kg) considering the operators intended deceleration and the reduction of tensile strength over the course of daily use.

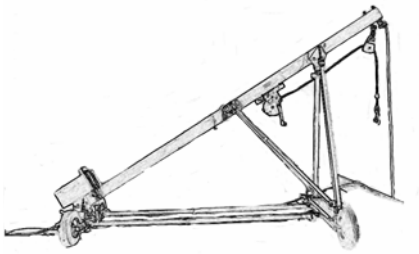
SEE PAGE 15 on how to tie and use the Figure 8 knot.

15. All ropes shall be protected from contact with any surface that may abrade, sever, weaken or damage it.

16. Ropes shall be inspected and a method shall be provided by the employer to identify the use of descent lines and lifelines. Rope shall be removed from service as recommended by the manufacturer or if one of the following conditions is evident or occurs: a) braids are cut; b) excessive abrasion has worn fibers; c) there is hardness or stiffness; d) dirt or grit has clogged the fibers; e) rust, tar or grease is present; f) line size has been reduced; g) subjected to a shock load; h) exposed to chemicals that affect their strength; i) exposed to excessive ultra violet degradation; or j) working lines that have been subjected to a rapid descent.

<u>Supporting Equipment</u>

1. Rope descent system may be suspended from equipment or anchorages permanently dedicated to the building or equipment that is transported from building to building, providing that the design of the support apparatus and the part of the structure where it is placed has been approved by a registered professional engineer for all loads that will be imposed in accordance with industry standards.



ANOTHER LEADING CAUSE OF RDS ACCIDENTS ***has always been related to workers attaching their work lines and or life lines to something on the roof that they guessed would hold them. When it comes to high rise and rope descending work, GUESSWORK is dangerous. Don't guess on anchor points, have the building verify what you're attaching lines to will hold you***.

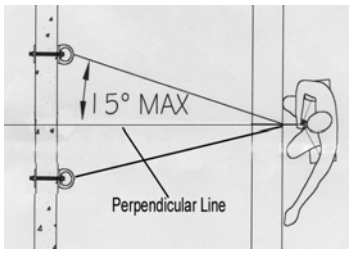
2. Portable support devices shall be inspected by a competent person before, during and after daily use. Operator shall as a minimum, check for cracks, bends, missing pins/bolts and other items that may affect the support capability of the device. Those components which have defects shall be immediately removed from service, tagged or marked with a label which states, "Dangerous, Do Not Use", then restored or destroyed. Improvised repairs are prohibited.

3. Portable support devices shall be assembled according to the manufacturer's instructions and specifications and shall provide a minimum 4 to 1 ratio against overturning. **See page 13**. Weights used to counterweight a transportable support device shall be non-flowable and secured to the device using means for positive engagement. Portable support devices shall be tied-back to a certified anchorage on the building with a rope equivalent in strength to the suspension rope.

ONLY USE WEIGHTS ***designed for a transportable outrigger. Sandbags or anything that could flow out or off the outrigger is*** **DANGEROUS.**

ALWAYS TIE YOUR PORTABLE ROOF RIGGING BACK !!!! ***and make it so that your tiebacks and safety lines are in a straight line.***

4. Every primary line, lifeline and tie-back line, shall be attached with minimal slack to an identified anchorage in line (within 15 degrees of perpendicular) [see photo] with the area being accessed. The anchorage shall comply with industry standards. Tie-back lines shall be constructed of wire rope or static fiber rope with minimal stretch characteristics whose breaking strength is greater than or equal to that of the primary suspension line.



5. A portable support device which uses the parapet wall for support is acceptable under the following conditions:
a) the support capability of the parapet has been approved by a registered professional engineer;
b) the support device meets the requirements of industry standards;
c) the location(s) on the parapet have been identified in the plan of service;
d) The use of portable outriggers with wheels at their fulcrum point that rest on the building parapet are prohibited.

6. Horizontal movement of a worker suspended from a transportable device is strictly prohibited unless:
a) it is designed to be rolled under load without disassembly and re-assembly;
b) it maintains an overturning stability of at least 4 to 1;
c) its tie-back anchorage and safety line anchorage are independent of each other and have been specifically designed for such movement and repositioning under load and;
d) a method is used to protect the suspension lines and lifelines from abrading horizontally against the roof edge, parapet wall or other building feature or appurtenance;
e) employees moving transportable devices shall be tied off with a personal fall protection system in accordance with industry standards.

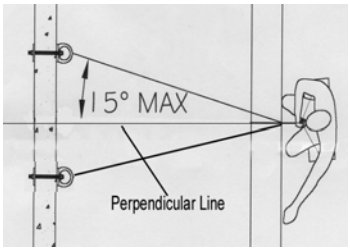
HORIZONTAL MOVEMENT OF A SUSPENDED WORKER IS DANGEROUS!!! ***In fact, for several years it has been the leading cause of window cleaning accidents. The only way it can be done safely is by at least following the guidelines above. If they cannot be followed, then it should*** **NOT BE DONE.**

7. Attaching lifelines or suspension lines to or through free standing or free hanging weights is strictly prohibited.

Fall Arrest Equipment

1. The components of an independent fall arrest system shall comply with the requirements found in industry standards. Components of the fall arrest that do not meet these requirements are strictly prohibited.

2. The lifeline of the system shall always be anchored in line (within 15 degrees of perpendicular) [see photo] with the suspended worker or platform.



3. Anchorage of the lifeline should be independent of any portable support device.

4. The lanyard and rope grab assembly shall limit a free fall of no more than 6 feet (1800 mm) and shall have shock absorbing characteristics.

5. Operators of a rope descent system shall wear a full body harness with the attachment in the upper torso located either in the front or back. In the case of an upper torso front attachment, the overall lanyard length shall not exceed 24 inches (610 mm). In the case of an upper torso rear attachment, the overall lanyard length shall not exceed 48 inches (1200 mm).

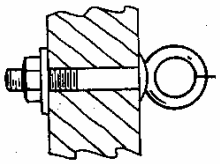
6. Fall arrest equipment shall remain engaged when the worker is exposed to a fall and during the entire length of the descent and shall not be removed until the worker has reached the ground or safe working level.

Safety Hazards Under Jurisdiction of Building Owner/Management

Fall Protection

Fall protection, perimeter guarding, personal fall arrest systems or a personal fall restraint system (as applicable) shall be provided for all work areas (with the exception of working from a ladder supported at grade or using a window cleaner's belt and window cleaner's belt anchors) that expose a worker to a fall hazard when approaching within 6 feet (1800 mm) of an unguarded edge or unguarded skylight. The means or methods used shall comply with the requirements found in industry standards.

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 complying with industry standards for: independent safety lines; tie-backs for outriggers, parapet clamps and cornice hooks; primary support anchorages for powered and manual boatswain's chairs; primary support anchorages for rope descent systems; horizontal (rope) lines or lifelines; and wherever else required.

FORMULA FOR DETERMINING HOW MANY COUNTERWEIGHTS ARE REQUIRED FOR A PORTABLE OUTRIGGER BEAM.

$$W = \frac{B \times C \times 4}{A}$$

W= Number of counterweights

A= Distance inboard from fulcrum (front end of beam where it rests) to the point on the beam where the counterweights hang.

B= Distance outboard from the fulcrum point to the suspension point

C= Load rating of the hoist

x 4= OSHA's requirement of a 4 to 1 safety factor against the load

Since C is typically around 250 pounds, the formula might look like this on an RDS portable rig.

12 foot beam, with 2 feet extended outboard from the fulcrum.

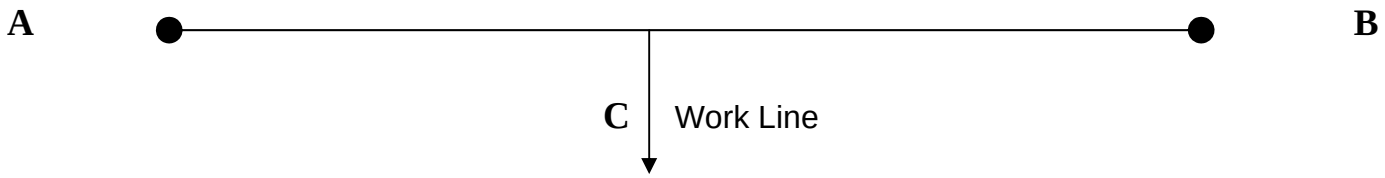
W=? A= 10 B= 2 C=250 x 4

(B) (C) (OSHA)

Therefore, $W = \frac{2 \times 250 \times 4}{10}$ W = 200 lbs. of counterweights per beam

(A)

Side Loading and Static Lines



Side Loading

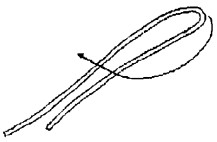
A rigging practice that has occurred for many years is the use of a horizontal or static line as pictured above. Window cleaners have often "stretched a line" from one anchor point to another and then attached their main working or descending line in an opposite and perpendicular direction.

This is a VERY DANGEROUS technique because of the effects of side loading. Side loading occurs because the line is stretched and anchored from point A to point B. Putting a load on the rope in this manner is fine, until another load is placed on the rope and in a different direction (C).

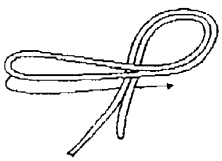
When a horizontal or static line is used in this manner, the force or load in pounds which is generated to points A and B is incredibly high. A horizontal line stretched completely straight with the loading of a 180 pound person will generate 5, 294 pounds to each anchor point.

This is why industry standards suggest that only licensed professional engineers design and install horizontal lines. It's best to understand that adding slack to the static line will significantly reduce the loading that will occur at the anchors. More important is knowing the ability of the anchorage points to hold such rigging. Because of the complexity of trying to determine what slack is acceptable or what a typical anchor will hold, it is best that a licensed engineer design and/or approve a horizontal line.

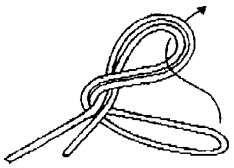
Tying the Figure 8 Knot to use as a termination for Descending Lines and Life Lines.



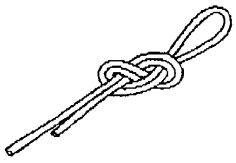
Step 1. Take the end of the rope and make a single loop at least 24" (2') in length.



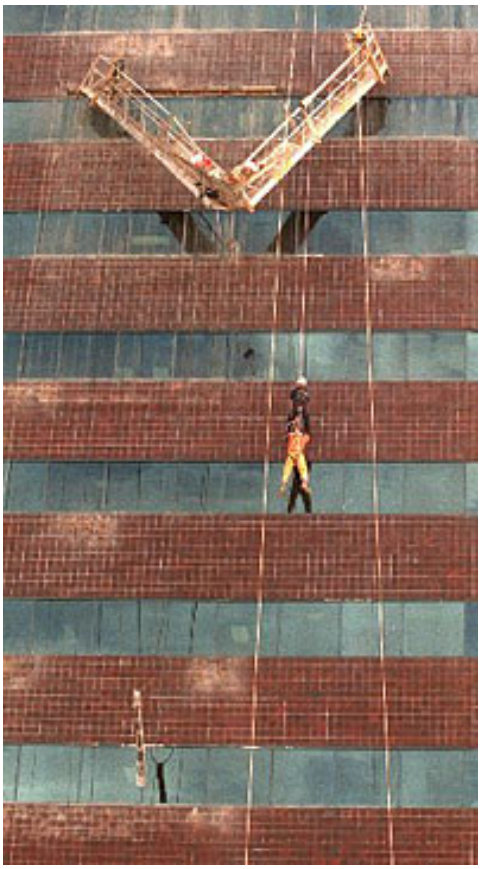
Step 2. Take the middle of that loop and make another loop in the rope that is at least 18" in length. Now you have a doubled loop in the end of the rope. Take the end of the loop and go over the top of the doubled rope.



Step 3. After going over the top, come around the bottom of the rope with the loop and then from over the top insert the end of the loop into the first loop. This will look like a figure 8. Pull this tight. It is recommended to insert a "thimble" into this loop for ease of using locking D rings and for protection of the rope.



<----------Insert a thimble here.



Fall Protection

Fall protection is of utmost importance to those engaged in professional window cleaning operations. In the past, there have been no guidelines for fall protection for general industry. The only existing regulation for some type of fall protection is found in OSHA CFR 1910.66 Appendix C, which covers fall arrest equipment as it relates to permanently installed powered platforms.

With the publication of the ANSI/IWCA I 14.1 Window Cleaning Safety Standard, window cleaners and property owners/managers now have at least a guideline on what equipment may protect workers from a fall from elevations.

Fall protection is divided into four subgroups. They are a) perimeter guarding; b) fall arrest; c) fall restraint and; d) warning line system. Excerpts from the ANSI/IWCA I 14.1 Window Cleaning Safety Standard are shown below.

Members of the industry hope that buildings will assess their roof or other areas where fall protection may be required and institute one of the following methods in order to create a safe place to work for window cleaning contractors. Remember, workers must stay at least 6 feet away from an unprotected fall hazard.

Perimeter Guarding

(a) Perimeter guarding shall consist of a parapet, guardrail or combination parapet guardrail system not less than 42 inches (1.1 m) above its adjacent surface and capable of withstanding a minimum lateral force of 50 pounds (23 kg) per linear foot between any two stanchions (applied at its uppermost elevation) or a minimum of 200 pounds (91 kg) of lateral force concentrated at any point along its length at its uppermost elevation. Parapets and guardrails which may be subjected to additional loading such as lifelines, power cables, etc., shall be designed to consider these added loads.

(b) Buildings with tall parapets, those exceeding 6 feet (1800 mm) in height, shall have either:
1) a catwalk;
2) an inboard mobile access tower; or
3) an engineered fall protection or fall arrest system.
Item (2) may be provided by the window-cleaning contractor. Perimeter guarding for permanent roof carriage installations shall be designed in accordance with applicable provisions of ASME A120.1. Parapets over 48 inches (1200 mm) in height present a falling hazard to the inboard roof surface as fall arrest systems only

perform when the fall is away from their anchorage or outboard. Care must be exercised to prevent such a fall.

Simply put, perimeter guarding is generally just a parapet wall that is at least 42 inches in height. It could also be a guardrail that's 42 inches high. There are cases where perimeter guarding is a little of both. Several feet of parapet wall with a metal guardrail on top of it creating the 42 inch barrier.

Personal Fall Arrest System

A personal fall arrest system describes those components that when assembled, stop the fall. In other words, the worker has already fallen. Fall arrest equipment will prevent them from falling further than 6 feet and typically consists of a lifeline, harness, lanyard and rope grab. Below are the requirements for such a system.

(a) All workers shall use a full body harness as a part of their complete fall arrest system and all components of that fall arrest system shall comply with ANSI Z359.1 with the following exceptions:

1) window cleaner's belts used during the cleaning of operable windows.
(b) In addition to complying with ANSI Z359.1, rope grabs used for fall arrest shall include by design, an anti panic stop feature.
(c) All components of the fall arrest system shall be compatible.
(d) Components of the fall arrest system subjected to an impact load shall be immediately removed from service and shall not be used again for employee protection.
(e) Lifelines shall be protected from contact with any surface that may abrade, sever, weaken or damage it. Ropes shall be inspected according industry standards and a means shall be provided by the employer to identify and log the use of lifelines. The securing of a rope to an anchor with a knot is permitted providing the specific knot does not decrease the initial breaking strength of the rope below 5000 pounds (2268 kg) considering the operators intended deceleration and the reduction of tensile strength over the course of daily use.

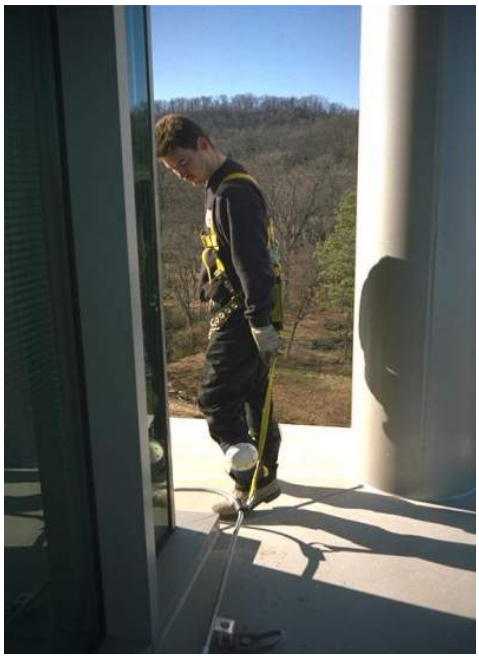
Rope shall be removed from service as recommended by the manufacturer or if one of the following conditions is evident or occurs:
1) braids are cut, or
2) excessive abrasion has worn fibers, or
3) there is hardness or stiffness, or
4) dirt or grit has clogged fibers, or
5) rust, tar or grease is present, or
6) line size has been reduced, or
7) subjected to a shock load, or
8) exposure to chemicals that affect their strength, or
9) exposure to excessive ultra violet degradation.

(f) Personal fall arrest systems shall not be attached to guardrail systems, nor shall they be attached to hoists.
(g) Personal fall arrest systems, when stopping a fall shall:
1) limit maximum arresting force on an employee to 1800 pounds (8 kN) when used with a body harness;

2) be rigged such that an employee can neither free fall more than 6 feet (1800 mm), nor contact any lower level;
3) bring an employee to a complete stop and limit maximum deceleration travel distance of an employee to 42 inches (1067 mm);
4) have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1800 mm), or the free fall distance permitted by the system, whichever is less.
(h) Anchorages used as a part of the personal fall arrest system shall comply with industry standards.

Personal Fall Restraint System

A fall restraint system describes that equipment that protects workers using the "dog on a leash" method. This enables workers to move on or around however, as they approach the fall hazard like the edge of the roof, the equipment prevents them from going near or being exposed to the hazard.



(a) Positioning devices shall be rigged such that an employee cannot free fall more than 24 inches (610 mm).

(b) Positioning devices shall be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall or 3,000 pounds (13.3 kN), whichever is greater.

(c) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(d) Connectors shall have a corrosion resistant finish and all surfaces and edges shall be smooth to prevent damage to interfacing parts of this system.

(d) Positioning devices shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service.

Warning Line System

A warning line system is typically a temporary barrier, much like a ground barricade, that is erected to keep workers from entering the "danger zone". In the case of a falling hazard, the danger zone is measured from the fall area to a safe surface and is usually 10 feet. In other words, workers must stay at least 10 feet away from an unprotected fall hazard when a warning line system is used.

(a) Warning line systems, used as a physical barrier to keep workers outside a fall hazard zone, shall comply with the following provisions:
1) shall be erected around all affected roof work areas at a distance of at least 10 feet (3 m) from the roof edge which is parallel to the warning line;
2) warning lines shall consist of ropes, chains or wires and supporting stanchions erected as follows:
A) the rope, chain or wire shall be flagged at not more than 6 foot (1800 mm) intervals with high-visibility material;

B) the rope, chain or wire shall be rigged and supported in such a way its lowest point (including sag) is no less than 34 inches (864 mm) from the walking/ working surface and its highest point is no more than 39 inches (1 m) from the walking/ working surface;

C) after being erected, with rope, wire or chain attached, stanchions shall be capable of resisting, without tipping over, a force of at least 16 pounds (7.25 kg) applied horizontally against the stanchion, 30 inches (762 mm) above the walking/ working surface, perpendicular to the warning line, and in direction of the floor, roof or platform edge;

D) the rope, wire or chain shall have a minimum tensile strength of 500 pounds (227 kg) and after being attached to the stanchions shall be capable of supporting without breaking, the loads applied to the stanchions as prescribed in para. 9.2.4 (2)(C) of this Section;

E) the line shall be attached at each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in adjacent sections before the stanchion tips over.

3) no employee shall be allowed in the area between a roof edge and a warning line unless the employee is equipped with a complete fall arrest system.

Emergency Rescue

The following section is a compilation of information and techniques that address the requirements of OSHA pertaining to the rescue and self-rescue capabilities of employees in the event of an emergency situation while working on suspended equipment.

Not one of the techniques for rescue described herein should be attempted until a qualified person trains workers. All rescue methods should only be used if other means have been ineffective and the safety of the workers is at risk.

What Can go Wrong ?

Transportable suspended equipment like Rope Descending Systems (RDS) requires quite a bit of initial set-up and rigging. There are many steps involved with the use of this equipment. This fact requires the users to know what they are doing, and they should take their time doing it.

What is a Rope Descending System?

A rope descending device is part of a system of components that when used, provide a method of exterior building access similar to suspended scaffolding with one major difference. A rope descending system (RDS) operates primarily in the down direction only. These systems incorporate the use of synthetic ropes as the working lines and the descent device travels down the rope itself. The rate of descent is controlled by the number of points of contact that are placed on the device by the rope. Some descent devices operate by wrapping the rope around a cylindrical shaft. Others use a vertical travel of the rope through metal bars that provide the necessary friction. Whichever device is used, it should be noted that the more points of contact between the rope and device, the slower the rate of descent. This should be remembered when applied to a rescue situation. All descent devices can be locked off so that the worker can safely remain suspended at a work station.

RDS has become popular in the window cleaning and building maintenance industries in the past 25 years. Federal OSHA has no existing regulations concerning this equipment but will be releasing a standard devoted to descent equipment in the near future. In the meantime, Federal OSHA has published a set of interim rulings which must be followed when using controlled descent equipment. They are as follows:

1. Training of employees in the use of the equipment before it is used.

2. Inspection of equipment each day before use.

3. Proper rigging, including sound anchorages and tiebacks in all cases, especially when non-permanent anchorages are used.

4. Use of a separate fall arrest system (which includes a harness, lanyard, rope-grab and a lifeline which is anchored independently of the friction device and it's support.

5. All lines installed, are capable of sustaining a minimal tensile strength of 5,000 pounds.

6. Provisions are made for rescue.

7. Ropes are effectively padded wherever building contact or other obstructions may cause abrasion.

8. Provisions are made for stabilization for descents in excess of 130 feet.

The above statements are the laws by which descent equipment must be used during a work operation. A rescue is not considered a work place environment; however, the above laws should apply when applicable. In particular, numbers 1, 3, 5 and 7. Number 4 may or may not be available depending on the type of rescue being performed.

Most of the manufacturers of descent equipment have recommendations on the safe and correct use of their equipment, and these too should be followed.

Why Perform a Rescue?

Again, the prompt rescue of employees who have just sustained a fall, or are left stranded on the side of the building is an opportunity to protect the health and well being of the employees. Any one who has not had proper training in the use of descent equipment, or rescue techniques should not do a rescue.

A tactical rescue team associated with a Fire Department can provide this assurance. These people undergo this type of training on a regular basis, in most cases.

Other reasons to consider a rescue is the fact stated earlier that a human body could endure only so long while suspended in a body harness. Removing a person from such a position would insure the safety of the individual. And the need for a prompt rescue may be lost while waiting for a Fire Departments Tactical Rescue team to arrive.

How to Perform a Rescue

If the main line of an RDS fails, the result is the worker being suspended in their body harnesses attached to a lifeline. This is the most serious of predicaments and should be attended to immediately.

The rescuer will need to lower a descending line for the suspended worker. The rescuer should set up their own rope descending system along side of the person being rescued. They should descend to the person and determine if the person can cooperate both physically and mentally.

If so, the rescuer will then place the descent device on the working line above the worker. They should then assist the worker in to the seatboard and attach it to the descent device. The worker now needs to disconnect

from their engaged lanyard, rope-grab. Once a rope grab is engaged, it is difficult to disengage because of the weight of the suspended worker. The tension applied to the rope grab will have to be relieved before the rope grab can be moved. One method of doing this is to place an overhand loop knot in the lifeline at a point where the suspended worker can place a foot in to it and stand up. This relieves the tension on the rope grab and it can be slid down to the worker. Since the worker is on a seatboard and descent line, this process can be performed quite comfortably. The main reason for the seatboard is the comfort of the person being rescued. An alternative to the seatboard is available and recommended. There are body harnesses which have rescue straps built into them. When used, these straps keep the user in an upright (sitting) position. After the worker has removed the tension from the rope grab, they will be in a sitting position and ready to descend to the ground, working both the rope grab on the lifeline and the descent device on the descending line. Again, if the worker is unsure of the descent device, the rescuer can operate this for them.

Rescuing an Unconscious or Injured Worker

If the worker is suspended in their fall protection equipment and has either been rendered unconscious, or sustained an injury, the rescuer must take means to perform the rescue as quickly and safely as possible without further injuring the worker. Obviously, the worker will not be able to cooperate.

The rescuer must set up their rope descending system. Since the injured worker is on the lifeline, no additional lines will be used for this type of rescue. It is important to remember that unconscious or injured people should be moved as little as possible until medical help arrives. The rescuer needs only a descent device, additional lanyard, and a sharp knife to rescue this worker. The rescuer now descends to the worker and places the descent device on the lifeline above the worker. Then the additional lanyard should be attached to the device and then to the ring on the back of the workers harness, where the lanyard from the rope grab is already attached. The descent device should be placed on the lifeline so that there is no slack in the lanyard because the lanyard which is holding the worker to the rope grab is going to be cut and the least amount of movement for the injured person should be considered. The descent devices will be locked off by the rescuer and the original lanyard can now be cut. Once this is done, the worker will be suspended by the lanyard, descent device. The rescuer now unlocks the descent device and controls the descent for both rescuer and worker.

DEFINITIONS

accept, accepted, acceptable- a practice, design or method recognized by the industry or the authority having jurisdiction.
access platform- a platform used to gain access to an area of the building.
anchorage- a secure point of attachment.
angulated roping- a suspension method where the upper point of suspension is closer to the building than the attachments on the suspended unit causing the suspended unit to bear against the face of the building.
approved- accepted as satisfactory by a duly constituted administrative or regulatory authority.
bearing point- is a location on the surface of a building where the suspension line contacts the building.
boatswain's chair- a seat for one person, suspended by a single line or tackle, which is designed to be raised and lowered by the user or his/her assistant.
body harness- a design of simple or compound straps that may be secured about the wearer in such a manner as to distribute the stopping forces over the thighs, buttocks, chest and shoulders, or any combination thereof, and with provisions for attaching a lanyard.
cable- a conductor or groups of conductors enclosed in a weather proof sheath, that may be used to supply electrical power and/or control current for equipment or to provide voice communication circuits.
certified- accepted by design, evaluation or inspection by a registered professional engineer or legal jurisdiction.
competent person- a person who by way of training or expertise is knowledgeable of applicable standards, is capable of identifying workplace hazardous or dangerous conditions relating to the specific operation, is designated by the employer and has the authority to take appropriate actions.
controlled descent apparatus/controlled descent equipment- see RDS.
davit- a device used for suspending a platform or seat board from work, storage or rigging locations on the building being serviced. Unlike an outrigger, a davit reacts its operating load into a single roof socket or carriage attachment.
drop- a vertical area or work zone accessed by the worker or piece of equipment during one descent.
drop line- a vertical line from a fixed anchorage, independent of the work surface, to which the lanyard is affixed.
fall hazard- greater than 48 inches (1200 mm).
fixture- attachments, anchors, anchorages, tie backs or support equipment permanently dedicated to a given site.
grade- the ground, the floor, the sidewalk or any other approximately level, solid surface of sufficient area and having sufficient structural strength to be considered a safe work place.
guy- (standing rope) a supporting rope which maintains a constant distance between the points of attachment to the two components connected to the rope.
horizontal lifeline- a means of providing a certified anchorage for a personal fall arrest system, designed by a registered professional engineer.
in line- perpendicular with an area being accessed; a straight path between anchorage and suspended worker or between tieback anchorage and suspension device; parallel position of equipment or lifeline to work-face.
inside, from the- all of the window cleaner's body except one arm shall be on the interior side of the plane of the window frame.
installation- all equipment and all effected parts of a building which are associated with the performance of building maintenance.
lanyard- a flexible line to secure a wearer of a safety belt or harness to a drop line, lifeline or fixed anchorage.
level- a flat horizontal working surface.
lifeline- see drop line.

mobile scaffold, manual- a scaffold assembly supported by casters and moved manually.
outside, from the- more than a single arm of the cleaner's body is outside of the plane of the window frame
perpendicular- at a right angle to parapet or in line with an area being accessed.
platform- a working surface fabricated for persons that is capable of being elevated.
plumb line- is the shortest imaginary line that is formed from an elevated point to level ground.
portable equipment- equipment that is manually relocated from work position to work position on a given building.
power platform- a manned platform which is suspended by wire rope and operates by power to access areas of a building in the up or down direction for the purpose of building maintenance.
primary support/suspension- a working line or approved anchorage used for attachment of a working line.
professional engineer- one who has professional experience in the practice of design and installation of permanent window cleaning equipment, window cleaning devices, glass curtain wall and temporary scaffold rigging devices. Engineer must be familiar with all pertinent codes and standards and hold a valid license issued by the state in which he practices.
qualified person- a person who, by possession of a recognized degree or certificate of professional standing or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.
RDS (Rope Descent Systems)- an assembly of components that when properly configured will provide means to descend a drop in a manner whereby the acceleration forces of gravity are controlled, permitting the operator to slow or halt his/her descent on a synthetic fiber rope at any desired moment (aka, CDE, CDA).
rated load- the combined weight of men, tools, equipment and other materials which the device is designed and installed to lift and support.
safety line anchor- see anchorage.
sit harness- a design of simple or compound straps that may be secured about the wearer in such a manner as to distribute the stopping forces over the thighs, buttocks or any combination thereof, and with provisions for attaching a lanyard in the front waist.
shall- indicates the rule is mandatory and must be followed.
should- indicates a recommendation, the advisability of which depends on the facts in each situation.
sill- a component or group of components of the building or structure's exterior or interior, immediately below the window and of sufficient width and design to safely support a window cleaner while positioned by a window cleaner's belt.
slack- without tension or applied load.
standing line- a means to wind stabilize a work platform utilizing vertical lines strung between a fixture at the roof level and a ground anchorage.
static kernmantle- synthetic rope constructed of continuous filament strands woven into a dense cover over a unidirectional filament core and maintains low elongation (aka, static fiber rope, static rope).
swinging scaffold, manual- a platform suspended by two or more lines, designed to be raised and lowered by users and is independent of the building, except for attachment at the roof, parapet or other supporting fixture.
tie-back anchor- see anchorage.
transportable equipment- equipment that is relocated from property to property.
window cleaner- a person who by occupation and training is proficient in window cleaning.
window cleaner's belt anchor- specially designed fall preventing attachment points, permanently affixed to a window frame or to a building part, immediately adjacent to the window frame, for direct attachment of the terminal portion of a window cleaner's belt.
window cleaning- the operation of cleaning or restoring windows, wiping, or other methods of cleaning windows, window frame or curtain wall sections, spandrel panels, etc.
working line- a rope which is suspended vertically from an anchorage and is used for accessing parts of a building to provide maintenance (aka, drop line, main line).

END OF HIGH RISE RDS OPERATIONS STUDY SECTION