12.8.1.4 Fittings

(a) The material selected shall be compatible with the mechanical and environmental requirements imposed on the fitting. Material selected should be carbon steel, alloy steel, aluminum, or other suitable material.
(b) Fitting shall have sufficient strength to sustain twice the rated load of the sling without permanent deformation and a minimum breaking strength equal to five times the rated load of the sling.
(c) All surfaces shall be cleanly finished and sharp edges removed so as not to cause damage to the webbing.
(d) Slings incorporating aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustic, or acids are present.
(e) The eye opening in the fitting shall be the proper shape and size to insure that the fitting will seat properly in the hook or other attachment.

12.8.1.5 Marking (Sling identification)

Each sling shall be permanently marked to show.

(a) Name of trademark or manufacturer.
(b) Manufacturer's code or stock number.
(c) Rated loads for types of hitches used.
(d) Type of synthetic web material.

12.8.2 Design Factor

The design factor for synthetic web slings shall be a minimum of 5.

12.8.3. Rated Load

(a) A sling shall not be used at a load greater than that shown on its tags. Slings shall be used in accordance with the manufacturer's recommendations.
(b) Each manufacturer shall make available on request test data to justify these recommended rated loads.

12.8.4 Proof Test

When specified by the purchaser, web slings of all types shall be proof loaded:

(a) The proof load for single leg slings and endless slings shall be two times the vertical rated load.
(b) The proof load for multiple leg bridle slings shall be applied to the individual legs and shall be two times the vertical rated load of a single leg sling.

12.8.5 Effects of Environment

(a) Chemically active environments, such as acids and caustics, can affect the strength of slings the manufacturer should be consulted before slings are used in chemically active environments.
(b) Nylon and polyester slings shall not be used at temperatures in excess of 194°(F) 90°(C).

12.8.6 Inspection

(a) Initial Inspection. Before using any new or repaired sling, it shall be inspected to insure that the correct sling is being used as well as to determine that the sling meets the requirements of this standard.
(b) Frequent Inspection. This inspection should be made by the person handling the sling each day the sling is used.

(c) Periodic Inspection. This inspection should be conducted by the Competent Person. Frequency of inspection should be based on:
    (1) Frequency of sling use;
    (2) Severity of service conditions; and
    (3) Experience gained on the service life of slings used in similar applications
(d) Periodic inspections should be conducted at least annually.

12.8.7 Removal Criteria

A sling shall be removed from service if damage such as the following is visible and shall only be returned to service when approved by a Qualified Person.

(a) Acid or caustic burns
(b) Melting or charring of any part of the sling
(c) Holes, tears, cuts or snags
(d) Broken or worn stitching in load bearing splices
(e) Excessive abrasive wear
(f) Knots in any part of the sling
(g) Excessive pitting or corrosion, or cracked, distorted, or broken fittings
(h) Other visible damage that causes doubt as to the strength of the sling.

12.8.8 Repairs

(a) Slings shall be repaired only by a sling manufacturer or a Qualified Person. When repaired, a sling shall be permanently marked to identify the repair agent.
(b) Temporary repairs of either webbing, fittings, or stitching shall be not permitted.
(c) Repaired sling shall be proof tested to two times its assigned rated load before being put back into service.

12.8.9 Operating Practices

(a) The weight of load shall be within the rated load of the sling.
(b) Slings shall not be shortened or lengthened by knotting or other methods not approved by the sling manufacturer.
(c) Slings that appear to be damaged shall not be used unless inspected and accepted as usable under Section 12.7.6.
(d) Sling shall be hitched in a manner providing control of the load.
(e) Sharp corners in contact with the sling should be padded with material of sufficient strength to minimize damage to the sling.
(f) Personnel should stand clear of the suspended load.
(g) Personnel shall not ride the sling.
(h) Shock loading should be avoided.
(i) Slings should not be pulled from under a load when the load is resting on the sling.
(j) Slings should be stored in a cool dry, and dark place to prevent environmental damage.
(k) Twisting and kinking the legs shall be avoided.
(l) Load applied to the hook should be centered in the base (bowl) of hook to prevent point loading on the hook.
(m) During lifting, with or without load, personnel shall be alert for possible snagging.
(n) In a basket hitch, the load should be balanced to prevent slippage.
(o) The sling's legs should contain or support the load from the sides above center of gravity when using a basket hitch.
(p) Slings should be long enough so that the rated load is adequate when the angle of the legs is taken into consideration.
(q) Slings should not be dragged on the floor or over an abrasive surface.
(r) In a choker hitch, slings shall be long enough so the choker fitting chokes on the webbing and never on the other fitting.

(s) Nylon and polyester slings shall not be used at temperatures in excess of 194°(F) 90°(C).
(t) When extensive exposure to sunlight or ultraviolet light is experienced by nylon or polyester web slings, the sling manufacturer should be consulted for recommended inspection procedure because of loss in strength.

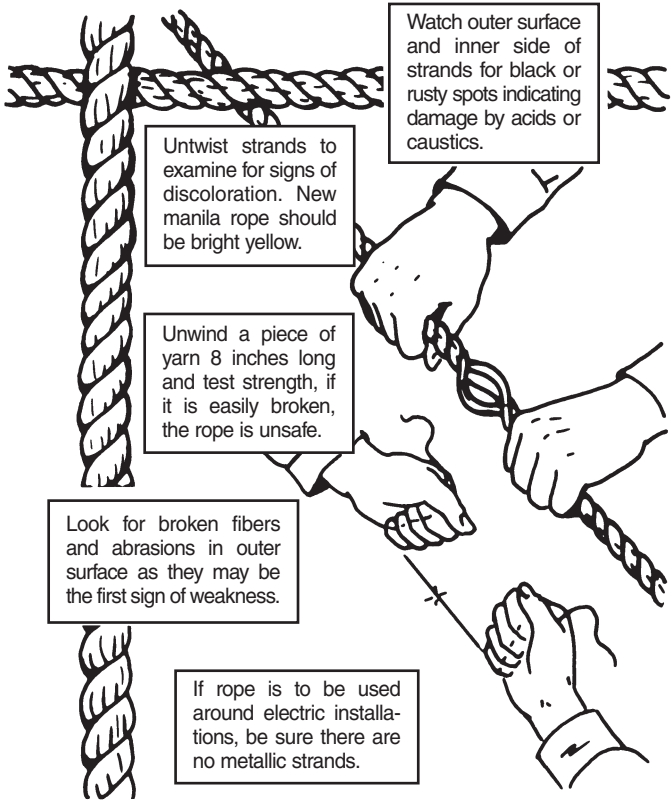
12.9 Beam Clamps

(a) A beam clamp used for rigging shall be engineered to properly support the expected load.
(b) Before moving extremely heavy loads, check with your Superintendent/Manager who shall obtain the maximum load the beam will support.
(c) Do not use a choker through the eye of the beam clamp while hoisting.
(d) Do not load the lower flange to more than 50% of the beam's capacity.
(e) Beam clamps shall be properly sized for the beam to which it is attached.
(f) Use only case-hardened bolts with lock nuts or nuts with lock washers for the beam clamp assembly.

Figure 12ad

Figure 12ae

INSPECTING MANILA ROPE



Safe Practice Rules

1. Frozen fiber rope shall not be used in load carrying service.
2. Fiber rope that has been subjected to acids or excessive heat shall not be used for load carrying purposes.
3. Fiber rope shall be protected from abrasion by padding where it is fastened or drawn over square corners or sharp or rough surfaces.

Figure 12af

Five-Part Falls

A five-part reeve is accomplished using a two- and three-sheave block as follows: Enter the lead line through the front of the stationary block at sheave (B), then go down in back of traveling block and through at sheave (E), up behind stationary block and through at sheave (C), down in front of traveling block and through at sheave (D), up in front of stationary block and through at sheave (A), down to the traveling block and becket off. This reeving is more widely used for rope falls (manila), but is also used for wire rope (cable).

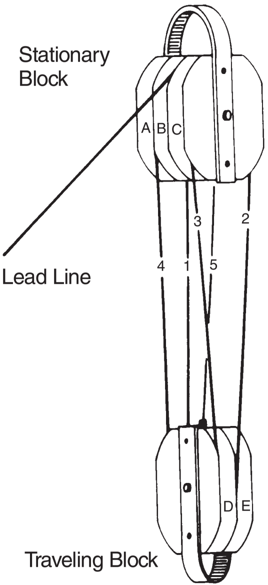
Six-Part Falls

Using a pair of three-sheave blocks, a six-part reeve is accomplished as follows: Enter the lead line through the front of the stationary block at sheave (B), then go down in front of traveling block and through at sheave (E), up behind stationary block and through at sheave (A), down behind traveling block and through at sheave (D), up in front of stationary block and through at sheave (C), down in front of traveling block and through at sheave (F), up to stationary block and becket off. This reeving is more widely used for rope falls (manila), but is also used for wire rope (cable).

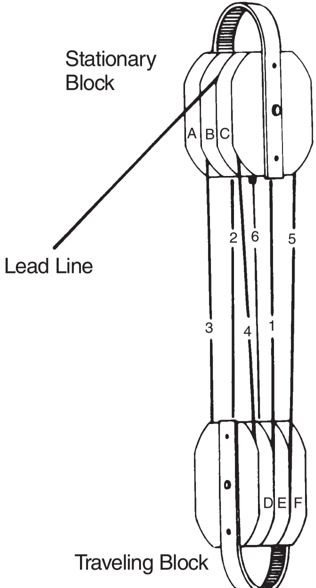
Seven-Part Falls

A seven-part reeve is accomplished using a three- and four-sheave block as follows: Enter the lead line through the front of the stationary block (four-sheave) at sheave (C), go down in front of traveling block and through at sheave (F), up behind the stationary block and through at sheave (A), down behind traveling block and through at sheave (E), up in front of stationary block and through at sheave (D), down in front of stationary block and through at sheave (G), up behind stationary block and through at sheave (B), down to the traveling block and becket off.

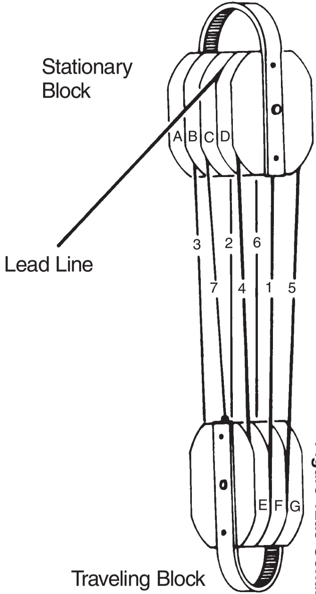
FIVE-PART FALLS



SIX-PART FALLS



SEVEN-PART FALLS



This theory applies to two-part, three-part and four-part falls.

Figure 12ae Continued

12.10 Manila Rope

(a) Frozen manila rope shall not be used in load-carrying service.
(b) Manila rope shall be protected from abrasion by padding where it is fastened or drawn over square corners, or sharp or rough surfaces.
(c) Even the finest-quality rope deteriorates very rapidly when not given the best of care. Kinking, overheating, moisture and acid all cause deterioration, which is not readily noticeable upon casual inspection.
(d) Manila rope shall be stored in a clean, dry location. Keep off pit floor, coil into protective device such as a drum.
(e) Manila rope is not a substitute for wire rope. It shall only be used for lashings, tackles, tag lines, straps on light leads and temporary guy lines and light hoisting.
(f) Points to look for during manila rope inspection are:

Good Characteristics	Poor Characteristics
Hard but pliant	Brown spots – weak, soft
Silvery or pearly luster	Black or dark spots – weak
Inner fibers bright & clean	Abrasion of fibers
Individual yarn strong	Loss of stretch
Uncut and unabraded	Cuts – Burns
outer & inner fibers	Dirt between inner fibers
Stretch and spring good	Freezing of rope

12.11 Synthetic Rope

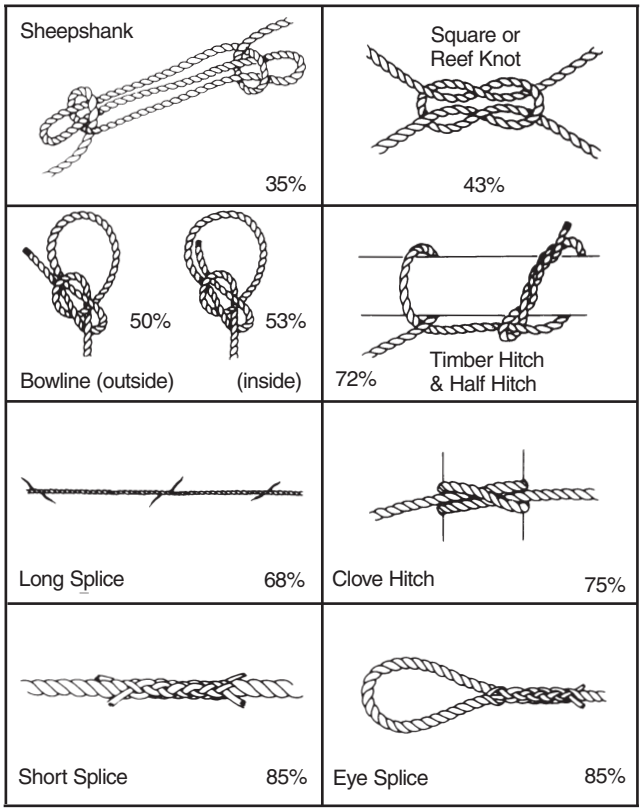
(a) Synthetic fiber ropes are made from nylon, polypropylene, or polyester. Synthetic fiber ropes consist of individual threads and fibers that run the full length of the rope (natural fibers are not continuous – in fact, they are short and overlapped).
(b) Do not choose synthetic rope when burning and welding. Synthetic rope is also more likely to be affected by chemicals and it tends to be slippery.
(c) Do not use clamps for splicing synthetic rope unless it is specifically designed for this purpose.

(d) Good practices when using synthetic rope:
    (1) Keep rope dry and clean and away from chemicals
    (2) Never overload a rope
    (3) Never use a frozen rope
    (4) Don't drag a rope on the ground. This will damage the outside surface of the rope.
    (5) Never allow the rope to bend over sharp edges
    (6) Don't permit the rope to drag against itself
    (7) Observe proper picking angles
    (8) Pad all corners when lifting materials
    (9) When coupling ropes, use thimbles
    (10) Inspect rope often by twisting to expose the inside yarns
(e) Synthetic rope shall be removed from service if it shows signs of:
    (1) Abnormal wear
    (2) Powder between strands
    (3) Broken or cut fibers
    (4) Variations in the size or roundness of strands
    (5) Discoloration or rotting
    (6) Distortion of hardware
(f) When rope is damaged and taken out of service, it shall be completely destroyed to prevent others from using it.

12.12 Knots Are Weak

If a knot or hitch of any kind is tied in a rope, its failure under stress is sure to occur at that place. Each fiber in the straight part of the rope takes proper share of the load. In all knots, the rope is cramped or has a short bend, which throws an overload on those fibers that are on the outside of the bend, and one fiber after another breaks until the rope is torn apart. The shorter the bend in the standing rope, the weaker the knot. The results given in Figure 12ag are approximate, but are sufficient to cause caution in all rope fastenings employed in important work.

Figure 12ag **Approximate Efficiency – Comparison of Rope Knots and Connections to Safe Load**

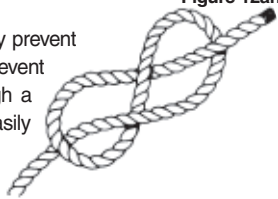


Source: Handbook for Riggers, 1977 Revised Edition

Note: Variations in test equipment, procedures, rope age, condition and construction, etc. may impact test results. The efficiencies shown above are for point of reference only. **Rigging methods, rope capacity, etc. shall well exceed the weight of the load to be hoisted. Knot efficiencies shall not be factored into the lift too closely; err on the side of caution.**

Figure Eight Knot

Figure 12ah



Used in the end of a rope to temporarily prevent the strands from unraveling. Useful to prevent the end of a rope from slipping through a block or an eye, and does not jam as easily as the overhand knot.

Figure 12ai

Catspaw

Used to secure the middle of a rope to a hook. Take two bights (loops) in the rope, twist in opposite directions and then bring the loops together and pass over hook.

Timber Hitch

(A) Used for hoisting planks, timbers and pipe. Holds without slipping and does not jam. A half-hitch is added in (B) This is done to keep a plank or length of pipe on end, while lifting.

Figure 12aj

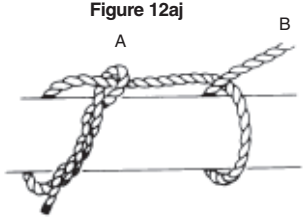
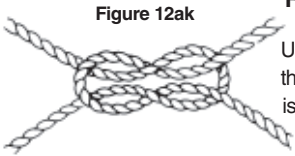


Figure 12ak



Reef Knot or Square Knot

Used to join two ropes or lines of the same size - holds firmly and is easily untied.

Figure 12al

Bowline on the Bight

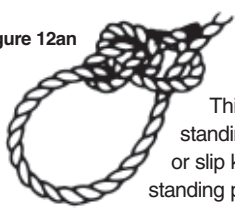
Used in emergencies to lift an injured person off a building or out of a hole. This is accomplished by sitting in one loop, and putting the other loop around the back and under the arms. Also used to tie bowline in middle of line.

Figure 12am

Clove Hitch or Builder's Hitch

Because of its wide use by construction workers in fastening rope to upright posts on staging to act as a rail or warning line, it is also known as a builder's hitch. Making a line fast is another common use.

Figure 12an

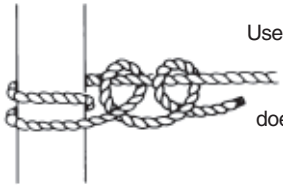


Running Bowline

This is merely a bowline knot made round the standing part of a rope to form a running noose or slip knot and is very reliable. Runs freely on the standing part and is easily untied. **This knot shall not be used for securing lifelines.**

Figure 12ao

Round Turn and Two Half Hitches



Used to secure a rope to a column or post, and will stand heavy strain without slipping. Easily tied and does not jam.

Figure Eight on a Bight

Figure 12ap

Provides a secure loop in the end of a rope. Made by doubling a line back on itself and then tying a Figure Eight knot in the double line. This knot may reduce the strength of a rope by 20%. **This knot shall not be used for securing a lifeline.** CAUTION: Be certain you tie a Figure Eight, not an Overhand on a Bight.

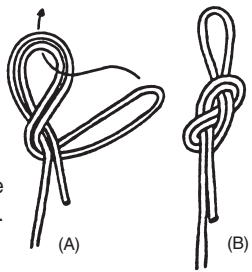
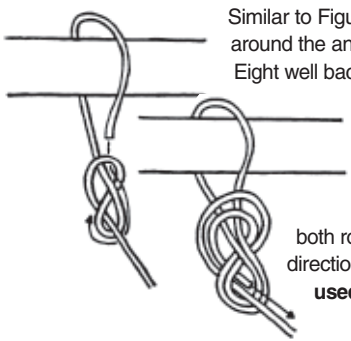


Figure 12aq

Figure Eight Follow Through



Similar to Figure Eight on a Bight, but is tied around the anchor point. Tie a simple Figure Eight well back from the end of the rope. Pass the end of the rope around the anchor point then follow back through parallel to the first knot. Follow every contour of the first knot with both rope ends going in the same direction. **This knot shall not be used for securing a lifeline.**

Bowline

One of the best-known and most-widely used of all knots. A favorite knot with riggers, it is easily constructed and used wherever a hitch is required that will not slip, jam or fail. (Hint: Leave a long tail and secure the tail with two half-hitches.) **This knot shall not be used for securing a lifeline.**

Figure 12ar

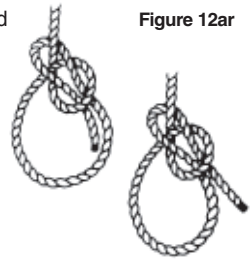
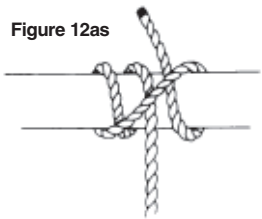


Figure 12as



Rolling Hitch

This knot is used for lifting round loads, such as pipe or bar steel. For a more efficient knot, add half-hitch, short end around long end.

Carrick Bend

Used for joining large ropes together, and easier to untie than most knots after being subjected to strain.

Figure 12at

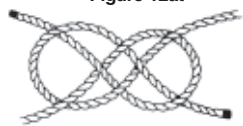


Figure 12au

Sheepshank

This knot is used for shortening a rope. The method shown is especially useful where the ends of the rope are not free, as it can be employed in the center of a tied rope. Taking the strain off a damaged piece of rope when there is not time to immediately replace with sound rope is another use. When seized, as shown, it is more secure.

Section 13
WELDING, CUTTING AND SOLDERING

13.1 General Precautions

(a) Local regulations or contract requirements may require a permit or license before using portable cutting or welding equipment.
(b) Move combustible material to a safe area. If combustible material can't be moved, cover completely with fire-retardant material.
(c) Provide a fire watch to make sure fires do not start. Have a fire extinguisher readily accessible where employees are working. Extinguishers shall be of ABC type, minimum 2A:20BC rating.
(d) Never burn or weld over other workers.
(e) After completing a burning or welding operation, monitor the scene of work for fires. Inspect adjacent areas as well.
(f) Use only non-flammable PVC glue to bond in-ground PVC hydraulic jack liners to prevent explosion hazard resulting from welding or burning operations. NEVER WELD OR BURN IN OR OVER AREAS WHERE FLAMMABLE AGENTS ARE PRESENT.
(g) Do not use cutting or welding equipment near flammable liquids. Do not cut or weld on closed tanks which have held flammable liquids or other combustibles.
(h) Ensure there is sufficient ventilation to remove potentially toxic fumes in areas of concern.

(i) Never use empty containers such as drums as a work station. They may contain potentially hazardous fumes. Consideration should be given for air monitoring by qualified personnel.
(j) Keep cutting and welding equipment in good operating condition at all times. Equipment found to be defective shall be tagged immediately and returned to the shop for repair.
(k) Operators shall never wear oil-stained clothing.
(l) Always hold lighted acetylene and propane torches – do not lay them down or hang them on beams or planks. A safe area shall be selected for resting a live electrode holder before striking an arc.
(m) Do not burn or weld in hoistways, where rails or other equipment are covered with oil or lint.
(n) Assure proper ventilation is provided for gas welders.
(o) Torch valves should be opened to vent pressure from the line and shut again.
(p) Use proper eye protection when welding, cutting and chipping. Reference Personal Protection Equipment – see Section 3.
(q) Wear a leather jacket or equivalent material to protect your skin from burns due to metal splatter and UV radiation.
(r) Use welding gloves to protect your hands
(s) Leather chaps are recommended to protect your legs and vital parts.
(t) When welding and cutting be aware of other people in the area. Advise them to look away when welding.
(u) Be aware of falling splatter, hot slag and sparks.

13.2 Acetylene, Oxygen and Other Pressurized Fuel Cylinders

Acetylene and oxygen cylinders are under high pressure and shall be handled with extreme care. Cylinders shall be kept in an upright position, either on a tank cart or tied to a vertical building member, such as a building column. Never lay cylinders down.

(a) Valve handles or valve wrenches shall be retained in place while cylinders are in use.
(b) Check all connections for leaks.
(c) Keep hose in the clear so that it cannot be damaged.
(d) Protect gauges and torches from damage.
(e) Keep cylinders away from work areas so that sparks cannot reach them.
(f) Oil and grease shall never be used on or around welding and cutting equipment.
(g) The use of regulators and flash arrestors are mandatory.
(h) Do not use oxygen to blow out or clean equipment.
(i) Do not take cylinders into elevator pits; keep them in a well-ventilated area.
(j) Do not lift cylinders by their protective caps.
(k) Propane and butane are heavier than air, and highly explosive. Guard against leaks when using this equipment. Use only in well-ventilated areas. Unburned gas from even a small leak will settle in pockets such as elevator pits, stairwells or other areas.
(l) Shut off valves and purge all hoses immediately after each use.
(m) Cylinder caps shall be in place whenever cylinders are not in use, being moved, or while they are in storage.
(n) Acetylene and oxygen cylinders can be temporarily kept in a hand cart if they were used in the current 24 hour period.

(o) When not in use, oxygen and acetylene cylinders shall be stored at least 20 ft (6.1 m) apart, or separated by a one-half-hour (30-minute) rated fire-resistive wall or partition at least 5 ft (1.5 m) high, and shall be secured to prevent tipping.
(p) Empty cylinders shall be marked "MT."
(q) Cylinders shall never be stored in gang boxes.

13.3 Soldering

(a) Solder containing lead shall not be used.
(b) Be careful of splatter.
(c) Burns from hot solder are painful and may lead to infection. Treat all burns immediately.
(d) Wear a face shield, especially if you are soldering overhead. See Section 3.2.
(e) Keep shirt collar buttoned.
(f) Wear a long sleeve shirt and button the cuffs.

Section 14
HAZARD COMMUNICATIONS (HAZCOM)

14.1 Working With Chemicals

The OSHA Hazard Communication (HAZCOM) (Right-To-Know) Standard requires all employees be given adequate information and training on the long- and short-term health effects of chemicals they work with. Your company has established a Hazard Communication (HAZCOM) Program to provide this information to you. You can take the steps necessary to safeguard your health by following the procedures established in this program.

A copy of this program – along with a chemical inventory list and corresponding Material Safety Data Sheets (MSDSs) are available for your review and is required to be kept at your local office and at all construction and major modernization jobsites or any other sites where you spend a full shift or eight hours. This program may be made available to others upon request to your Superintendent/Manager.

Chemicals affect the human body differently. The physical makeup of the chemical, the amount of exposure (time and quantity), and the manner in which the chemical is absorbed by the body all play a role in the resulting effects. As long as exposures are not excessive, many potentially dangerous substances are eliminated naturally from the body. It is important to remember that most materials can be removed this way, and their effects are usually not cumulative.

What is important is the dose or amount of a particular chemical that is absorbed over a period of time. Too much of a chemical, either all at once or over time, may be dangerous. Chemicals are absorbed into the body in three ways:

(a) Inhalation – The chemical is taken in with the air we breathe, either as a vapor, dust, gas, fume or mist.
(b) Ingestion – The chemical is ingested either intentionally or accidentally. It can be taken in with the food you eat (or drink) especially if you fail to wash your hands before eating or smoking.
(c) Absorption – It is absorbed through the skin. This occurs for only a limited number of chemicals.

Inhalation is by far the most common way in which chemicals enter the body. How much enters and is subsequently absorbed through the lungs is a function of the chemical. The human respiratory system is extremely effective at removing dust from the air that is breathed. Only the smallest particles reach the lungs. The majority are trapped in the nose and throat, and later eliminated.

The amount of liquid chemicals entering the lung depends on how fast the liquid evaporated into the air. This is a function of the surrounding (ambient) temperature and the vapor pressure of the liquid (the higher the vapor pressure, the faster the evaporation rate). How much is absorbed varies with each chemical.

Industrial Hygienists are engaged in the science of protecting workers from the harmful effects of chemicals. They are trained to recognize, evaluate and control potential exposures to chemicals in the workplace. Today, many chemicals have been studied, and as a result, their effects have been identified. Levels of acceptable exposure for a normal work day have been determined. These are known as threshold limit values (TLV), or permissible exposure limits (PEL).

In general, there are two major types of effects which are of concern when talking about chemical exposure – the short term or acute effects, and the long term or chronic effects. Some chemicals have both, some one or the other.