



EMPLOYEE SAFETY HAND BOOK

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INTRODUCTION

You are now a member of a team working in a challenging industry, which is exposed to many changing hazards. Your fellow workers will be depending on you to do your part in keeping everyone safe.

As a part of our overall safety program, this handbook is designed to help you do your job safe and effective.

More detailed information is contained in the company Safety, Health, and Environmental Programs Manual, and our Safety Plan specific for this job, which is available for your review at all job locations.

Our goal is to provide a safe and healthful work place so that a quality product can be produced using the most qualified Craftsmen available.

Working together as a Team, we can achieve that goal.

SAFETY POLICY

It is the policy of Service Specialists, LLC. to provide a safe and healthful workplace for our employees and to observe all SSI, Client, State and Federal Laws and Regulations.

SSI has and will continue to maintain a safety and health program designed to train our employees to follow work safe practices and to recognize and correct unsafe working conditions.

Safety is part of each employee's job. Active participation and adherence to the Safety Program are a condition of each employee's employment. No employee is required to work at a job that he or she knows is unsafe. Therefore, we must work to make every workplace safe by recognizing and correcting unsafe working conditions, as well as the detection of unsafe work practices.

SSI empowers all of its employees to refuse to perform any task that they deem to be unsafe without retaliation from supervision until the hazard is mitigated or eliminated. SSI acknowledges that all incidents or accidents are preventable.

Your fellow workers will be depending on you to do your part in keeping everyone safe. As a condition of employment, it is your responsibility to call a "Time Out" when you discover any condition or situation that you deem to be unsafe. It is your responsibility to call a "Time Out" when you witness another person committing an unsafe act or attempting to commit an unsafe act.



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“Time Out”

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“Take Two”

“Take Two” to Think it Through

“Take Two” to See it Through

Talk: Have I talked with everyone involved with this job.

Action: Do I know the proper actions I need to follow to do this job safely.

Knowledge: Do I have the proper Knowledge to do this job safety.

Equipment: Do I have the proper equipment, including the proper personal protective equipment, to do this job safely.

HAZARD COMMUNICATION

THE EMPLOYEE

“RIGHT TO KNOW”

The Occupational Safety and Health Administration has issued a rule that states the employee has a “Right to Know” what hazards he or she may face on the job and how to protect against them. That’s your Right to Know.

In order to meet this objective, we have developed a written hazard communications program. Each employee has access to any information from this program through their respective superintendent. It is important to the safety of the job for employees to take the initiative to be informed in the area. There are three ways in which the hazards are communicated to the employee – 1) through site specific training, 2) through the use of labels and 3) through the use of material safety data sheets.

LABELS

1. Chemical manufacturers and/or importers must provide warning labels on their containers to:
 - Identify the product
 - Give appropriate warning, and
 - Include their name, address, and telephone number in case of an emergency.
2. Labels must also be used on containers to designate hazardous materials that are temporarily being stored or transported.

MATERIAL SAFETY DATA SHEETS (MSDS)

SDS's are detailed technical information sheets developed and furnished by the hazardous chemical manufacturer or importer. Each job site will have a copy of an SDS on every hazardous chemical at that location. Each employee has the right to be provided this information.

ACCESS TO EMPLOYEE EXPOSURE AND MEDICAL RECORDS

Section 1910.20 of the Code of Federal Regulations provides the employee the right to have access to relevant exposure and medical records. Employee medical records shall be preserved and maintained for at least the duration of employment plus thirty (30) years. Employee exposure records shall be maintained for at least thirty (30) years.

Whenever a request for access to a record is made, the company has up to fifteen (15) days to comply with that request. A copy of the record shall be provided without cost to the employee.

The records are located in the employee's personnel and medical files and can be obtained by a written request.

A copy of the 1910.20 standard is readily available to employees at each of our field offices. If you have any questions pertaining to your right to have access to your records, please ask.

REPORTING OR INJURIES AND INCIDENTS

Guidelines for Investigation, Communication, Documentation, and Follow-up Procedure when a safety incident has occurred that involves an injury or a near miss.

Site Safety Manager's/Safety Tech and/or Site Supervision Responsibility:

As soon as an Incident occurs these are some steps that should be followed immediately:

- Find out immediately if anyone is injured.
- If someone is injured, take immediate steps to care/get treatment for them.
- Make immediate arrangements to secure the area, so that no one else is in harms way (barricade area if possible).
- Get proper notification to Site Management and Upper Corporate Safety Management as soon as possible.

Site Safety Manager's/Safety Tech and/or Site Supervision Responsibility:

- A decision must be made as soon as possible on medical treatment needs.
 - None
 - First Aid
 - Treatment by a medical doctor or medical facility.
 - Emergency room treatment/hospital.
 - Some other type of care.

- If medical treatment is needed, the person injured **MUST** be accomplished by a Safety Person and/or by a member of supervision.
- The person that accompanies the injured person must be aware of the specific reason the injured person is seeking medical treatment and if the injury is directly related to the incident on the job.

Site Safety Manger's/Safety Tech and/or Site Supervision Responsibility:

- From the very beginning of the awareness of the incident; specifics must be gathered for proper documentation.
- An investigation must take place as soon as possible to gather specifics on what happened, how it happened, how it could have been prevented and if it is safe for others to go back to work in the affected area.
- A member of the Safety Dept. and a member of management for the work group, should work together to gather information concerning the incident.

Site Safety Manager's/Safety Tech and/or Site Supervision Responsibility:

- It should be determined:
 - If there were any witnesses, and if there were, make sure we should ask each witness for an accurate, written, signed statement.
 - What caused the Incident/Accident to occur?
 - Who was directly involved?

- What tools/equipment was being used?
- The area the Incident/Accident occurred.
- What job was being performed?
- Did we have a JHA/JSA in place?
- Did the employees involved participate in the JHS/JSA process?
- How this incident could have been prevented?
- Immediate action to be taken to prevent this type of incident from happening again in the work place.

Site Safety Manager's/Safety Tech and/or Site Supervision Responsibility:

- An immediate decision on whether or not we need to seek help from other resources.
- An immediate action must be taken to test for substance abuse. Individuals involved in the cause of this type of incident must be tested as soon as possible.
- During the Investigation Process, we need to determine if a Policy and/or Procedure was in place for proper execution of that particular task.
- If a Policy and/or procedure were in place for that particular task, proper information must be gathered to determine if the Policy and Procedure was complied with or violated.
- A decision then should be made to determine if some type of disciplinary action is needed.

Site Safety Manager's/Safety Tech and/or Site Supervision Responsibility:

- After gathering the specific information relating to the incident, the Site Safety Personnel must then write a Formal Report to our Corporate Safety Manager for review and approval.
 - Everything in the report must be consistent with the findings. If we acquire a medical report, it should accompany this report and all statements from the witnesses. If a Policy was in place, a copy of the Policy and a copy of the JHA/JSA should also be included.
 - After approval of the report by the Safety Manager, the next step should be formalizing a written report to Site Management and Upper Corporate Management.
 - Next, our Site Management and the Safety Dept. Personnel must present a written report to our client in compliance with their expectations.

Site Safety Manager's/Safety Tech and/or Site Supervision Responsibility:

- Follow-up with Communication to all employees involved and any employees who may be subject to such an incident is Mandatory. If additional training is needed, an immediate decision must be made to satisfy that need.
- If medical treatment was necessary, we should follow-up in all cases, whether it is based on a doctor's recommendation or not.
- A decision must also be made with our Corporate Safety Manager's participation, on how to classify the Incident for recording purposes.

EMPLOYEE RESPONSIBILITIES

All employees are required, as a condition of employment, to develop and exercise safe work habits in the course of their work to prevent injuries to themselves, their fellow workers, and conserve material resources and time.

The items listed below are part of the employees' responsibilities:

- Promptly report to their Supervisor/Foreman all accidents, near misses and injuries occurring within the course of their employment.
- Cooperate with and assist in investigation of accidents to identify correctable cause and to prevent recurrence.
- Promptly report to their Supervisor/Foreman all unsafe actions, practices, or conditions they observe.
- Become familiar with and observe approved safe work procedures during the course of their work activities.
- Keep work areas clean and orderly at all times.
- Avoid engaging in any horseplay and avoid distracting others.
- Obey all safety rules and follow published work instructions.

- Wear protective equipment when working in hazardous areas or jobs, and/or as required by supervision.
- Submit any suggestions for accident prevention, which may assist in improved working conditions or work practices to your immediate supervisor.
- It is your responsibility to call a “Time Out” when you discover any condition or situation that you deem to be unsafe. It is also your responsibility to call a “Time Out” when you witness another employee committing an unsafe act or attempting to commit an unsafe act.

DISCIPLINARY POLICY

INTRODUCTION

This policy is intended to provide rules and guidelines for administering disciplinary action to employees who violate safety rules and procedures or who, by their record or actions, indicate a disregard for safety and/or company policy.

Safety related disciplinary action would be administered through the Safety Coordinator or Project Management.

PURPOSE

The purpose of this policy is to enhance safety awareness in all employees, and to motivate them to perform their work safely, in accordance with established safety rules, procedures, and instructions.

CIRCUMSTANCES LEADING TO DISCIPLINARY ACTION

Listed below are conditions that could be considered for disciplinary action under the provisions of this policy:

- Violation of a supervisor's safety related instructions.
- Violation of established safety rules and/or procedures.
- Violation of instructions on posted safety related signs.
- Accumulation of an excessive number of violations (3 or more within a 24 month period).

- Obvious unsafe actions as may be indicated by the improper use of equipment, horseplay or practical joking, poor housekeeping practices, etc.
- Lack of concern toward safety instructions and programs.

The above circumstances are not intended to be all-inclusive. Any other circumstances that indicate an employee's disregard for his own safety, the safety of others, or the neglect of proper care for company equipment, may also result in disciplinary action under the provisions of this policy.

PROCEDURE:

- This program is effective as of 1/1/97.
- The twelve (12) month period is a continuous period.
- Whenever a Project Supervisor or Supervisor/Foreman observes a company employee committing an unsafe act or creating or allowing a hazardous condition to exist, a Safety Violation Notice should be completed. A copy of the violation form should be retained in the employee's personnel folder, and each time a new violation form is received, the employee's file will be reviewed for previous violations. Where previous violations appear during a 12-month period, the sanctions listed below will be implemented.
- A Safety Coordinator will investigate any violation of the safety procedures and any accident where the cause is not clear. Their recommendations as to cause, preventable or non-preventable, will be made to the Company President.
- If the employee feels they have been treated

unjustly, they will be allowed to appeal the decision. The appeal will be reviewed by the Company President, Safety Coordinator, and employee's Supervisor/Foreman.

EMPLOYEE SANCTIONS:

The following sanctions apply for violations of safety procedures or involvement in a preventable accident:

- First Incident – Verbal warning with documentation.
- Second Incident – Written warning with possible suspension.
- Third Incident – Disciplinary action up to and including discharge.
- Fourth Incident – Discharge.

SUPERVISION SANCTIONS:

The above sanctions also apply to supervision who will also be subject to disciplinary action when their employee receives some form of disciplinary action as noted above, or who show negligence in their implementation or enforcement of company policy. Any member of supervision may be subject to these disciplinary guidelines as an individual or as a member of management.

The above disciplinary actions are a minimal guideline. Depending on the circumstances or the severity of the violation or incident, any level of discipline, which is most appropriate for the time and the company may implement action up to, and including termination, employee or supervision.

KEY INDIVIDUAL REQUIREMENTS

Some of the key individual responsibilities are as follows:

1. Report to works rested and physically fit to perform your job.
2. Wear clothing suitable for weather and your work.
3. Wear sturdy leather safety-toed work shoes or boots which have a defined heel.
4. Jewelry is not permitted for field operations except for watches or medical alerts.
5. Prescription safety eyewear shall be of industrial grade, with attached side shields.
6. Work at a safe speed. Foolish hurry is dangerous.
7. Be sure you understand what must be done before you begin a job.
8. Obey all warning tags and signs. Read danger warnings on container labels and follow precautions.
9. Do not participate in horseplay or practical jokes.
10. Smoke in designated areas only.
11. Report all injuries and property damage to you supervisor immediately.
12. Do not operate vehicles or equipment unless qualified or authorized to do so.
13. Keep your work area clean, neat, and orderly.
14. Avoid shortcuts. Use ramps, stairs, walkways, ladders, etc.
15. Be sure of your footing. Watch out for overhanging or broken planks, slippery spots, loose objects, etc.

16. Bend knees, keep back nearly straight when lifting. Leg muscles, not your back, should do the work.
17. Get help with heavy or bulky materials to avoid dropping load or getting thrown off balance resulting in body injury.
18. ALWAYS keep you mind on your job and temper under control.
19. Intoxicants, firearms, and unauthorized drugs are not permitted.
20. Report any unsafe condition or equipment to your supervisor.
21. Do not place your fingers or hands in potential pinch points or where they can be struck by an object.
22. Gloves shall be worn to perform work except around rotating equipment or where they pose a greater hazard.
23. Do not position your body between any moving equipment and stationary object.
24. Use both hands to hold and operate power tools.
25. Give your wholehearted support to our safety activities and familiarize yourself with our written safety program.
26. Perform a task hazard analysis prior to each task.
27. Work in a craftsman like manner and in a team effort with co-workers to get the job done safely.
28. Observe for unsafe actions of co-workers and intervene to prevent injury.

GENERAL HOUSEKEEPING

REQUIREMENTS

1. As the job progresses, work areas must be kept clean at all times.
2. All materials, tools, and equipment must be stored in a stable position to prevent rolling or falling. Materials and supplies shall be kept away from edges of floors, hoist ways, stairways, and floor openings. When exterior walls are being built, materials and supplies shall be kept away from the perimeter of the structure.
3. A safe access way to all work areas and storage areas must be maintained. All stairways, corridors, ladders, catwalks, ramps, passageways, roadways, and work platforms shall be kept clear of loose material and trash.
4. Forms, scrap lumber and all other debris shall be cleared from work areas, passageways, stairs, and in and around buildings or other structures daily. Nails or sharp projections shall never be permitted to protrude from forms, lumber, or any material.
5. Combustible scrap and debris shall be removed at regular intervals. Safe means shall be provided to facilitate such removal.
6. There shall be an adequate number of dumpsters to ensure a clean working area at all times. All refuse and debris shall be transported to a suitable disposal area away from the job site and disposed of in a lawful manner.
7. Parking areas shall be maintained clean and free of paper, cans, and other debris at all times.
8. The eating areas shall be maintained in a clean and orderly condition. Trash containers with lids

should be placed in these areas and frequently emptied.

9. Cords and hoses shall be placed overhead or laid flat outside of walkways.
10. Tools and equipment shall not be strewn about where they might cause tripping or falling hazards and shall, at the end of each workday, be collected and stored in the tool room or craft gang boxes.
11. Each employee shall be instructed to practice required housekeeping as part of assigned duties.
12. Trucks and other vehicles or equipment shall be kept orderly and trash free.
13. Tools and materials shall be stored properly and/or removed on a daily basis.

PERSONAL PROTECTIVE EQUIPMENT

1. All personal protective equipment shall comply with the applicable standards set forth by the American National Standards Institute (ANSI) or the National Institute for Occupational Safety and Health (NIOSH).
2. Protective clothing and equipment shall not be misused or altered in such a way that its original protective features are rendered less effective.
3. Safety glasses with permanently affixed or approved clip-on side shields are a requirement on all jobs. Each employee is responsible for knowing the requirements of the plant where the job is located. Prescription eye wear shall meet the same requirements as standard issued safety glasses. Goggles can be placed over prescription glasses until they meet the safety requirements.

4. Chemical goggles are required for working in or entering posted chemical areas. When chemical type goggles are in use, the headband must be around the back of the head and not on the employee's safety hat. Chemical goggles are also required when transferring liquids from one container to another, i.e. gasoline from gas can to the gas tank of a welding machine.
5. Safety glasses or goggles with dark tinted lenses are not to be worn at night or in dark locations during the day.
6. A face shield shall be worn over goggles with chipping, using grinders, buffers, friction cut-off saws, impact wrenches, chisels or if the job involves flying debris. Note that often times the job may not involve flying debris, i.e. drilling holes but often times drill bits will shatter and become projectiles. Each job needs to be looked at very closely and all potential hazards identified. If it is determined that there may be some type of flying debris, then a face shield is required. Goggles should also be worn when wind conditions are such that dust particles become airborne creating an eye hazard or if overhead work activity causes particles to fall toward the face.
7. Hard hats are required for all work unless a deviation has been granted.
8. Hard hats and side shield safety glasses must be worn while wearing a welding hood. This requirement may be waived only if it is determined that wearing the hard hat creates a greater hazard than without.
9. Appropriate welding goggles shall be used for all gas welding or cutting, and welding

hoods shall be used for all electric welding and cutting.

10. In plants where it is required, an escape respirator approved for the specific work area hazard must be kept with employee and ready for use at all times. Personnel required to use respirators must be trained in their use.
11. Employees required by their job assignments, both routine and emergency response, to wear nose-mouth respirators, full face respirators, fresh air mask, SCBA's or other such protective equipment shall be clean shaven in the areas between the mask seal surface and facial skin, medically certified and fit tested to wear such equipment.
12. Each employee is expected to wear personal clothing that is safe and proper for the job.
13. It is required that safety-toed shoes with a defined heel be worn to reduce toe and foot injuries. Canvas, cloth, nylon, or open shoes (with ventilation holes) shall not be worn in a chemical environment.
14. When an air operated jackhammer is used for breaking concrete, the user shall wear a face shield, goggles, hearing protection, and metatarsal guards. Personnel in close proximity shall also wear a face shield and hearing protection.
15. When working over or near water where a drowning hazard exists, personnel must be protected by:
 - A coast guard approved life jacket, handrails or lifelines.
 - Ring buoys with at least 90 feet of line shall be readily available.

- At least one lifesaving skiff shall be readily available.
16. Hearing protection approved for the specific noise level shall be worn whenever employees are exposed to sound levels of 90dB or greater.
 17. Do not wear loose clothing, or unconstrained long hair around machinery.
 18. Gloves are required to protect the hand from potential injury and provide proper protection for the recognized hazards.
 19. Specialized protective clothing is required when there is a possibility of exposure to extreme temperature, acid, caustic, or other hazardous materials. Fire retardant clothing (FRC) shall be worn in all FRC areas.
 20. Contaminated clothing shall not be worn.
 21. A Full Body Safety Harness with double lanyards is required when working in elevated areas to assure 100% tie off. Refer to the Fall Protection Program for more detailed information.
 22. Highly visible vest or equivalent shall be worn when working on roadways or directing traffic.
 23. Wear seat belts when operating equipment and driving or riding in motor vehicles.
 24. PPE shall be inspected and cleaned on a regular basis and prior to each use. Defective or damaged PPE shall not be used; it shall be taken out of service and replaced by usable equipment. Defective or damaged equipment should be returned to job supervision or project safety coordinator for inspection and/or proper disposal. Contaminated PPE, which can not be decontaminated, shall be disposed of at the work site in such a manner to protect employees from exposure to the hazard.

HAND TOOLS

1. Inspect the tool prior to each use.
2. Do not use broken or unsafe hand tools.
3. Keep cutting tools sharp and carry in a safe container.
4. Use the right tool for the job.
5. Keep all tools and materials away from edge of scaffolds, platforms, floor openings, etc.
6. Have tools with burred or mushroomed heads dressed.
7. Be sure you have clear area behind you before swinging sledgehammer, pick, or other tools.
8. Do not position hands or fingers within 6" of sledgehammer head. Place tape 6" down from the head of mark this "no hands" area.
9. When using a wrench, pull, don't push. Brace yourself to avoid slipping or being thrown off balance.
10. Place wrenches so that the pull will be on the stationary jaw.
11. Do not place "cheater pipe" on a wrench handle to increase leverage.
12. Never hit a wrench with a hammer unless the wrench is made for striking.
13. Use a "tool holder" when it is necessary to strike a tool (i.e. hammer wrench) or stake with a hammer.
14. When using sharp tools, use a cutting motion away from the body or extremities.
15. When using a tool, place the work on a solid surface, never in the palm of the hand, on your thigh or other body part.
16. If it becomes necessary to modify or fabricate a tool, it must be done under the direction and approval of the project manager.
17. Any repair to tools shall be done by a qualified person.

ELECTRICAL TOOLS

1. Be sure electrical equipment is properly grounded and/or use a GFCI. Make sure that electrical tools have a current inspection.
2. Do not use electrical tools or equipment while standing in water.
3. Keep cords out of water and away from sharp edges.
4. Only qualified personnel shall make electrical repairs on power tools.
5. Cord splices or repairs shall be made by qualified personnel, using material that is equal to that cord's quality.
6. Have cords, leads, etc., placed overhead when possible, or out of walkways, and placed to avoid tripping or getting damaged.
7. Unplug power tools when not in use.
8. Tools with lock-on triggers are not permitted.
9. Be sure the electrical tool is plugged into the proper type of electrical current (AC or DC)
10. Do not wear gloves or loose clothing when using any tool where the gloves can become entangled in the moving parts of the tool.
11. Choose the right tool for the job.
12. Inspect each tool to assure its safe working condition. Defective or damaged tools must not be used.
13. Keep all guards and handles on the tool and control the tool with both hands and a firm grip.
14. Use a vice or clamp to hold the material so you can keep both hands free to control the tool.
15. Remove adjusting key and wrenches before starting the tool so they won't fly off at high

speeds and strike someone.

16. Do not yank on the cord to disconnect the plug.
17. Do not touch or surprise anyone who is using a power tool.
18. Do not carry a tool with your finger on the switch or dangle by the cord.
19. Do not adjust blades, bits or cutters while the tool is plugged in.
20. Do not remove the third prong (ground) from the tools electrical cord plug.
21. Tools shall not be subjected to undue stress or pressure.
22. Personnel operating electrical tools shall be qualified through training and performance evaluation.

AIR TOOLS

1. Be sure the air tool is secured to the hose in a positive manner to prevent accidental disconnection. You can assure the connection by using safety pins and safety cable.
2. Use safety clips on pneumatic impact tools to prevent attachments from being accidentally expelled.
3. Do not exceed the manufacturer's safe operating pressure.
4. When using hoses that exceed ½ inch inside diameter, be sure there is a safety device at the source of supply or branch line to reduce pressure in case of hose failure.
5. Before disconnecting an air tool or changing attachment, shut off the air and bleed the pressure from the line.

6. Never use compressed air to blow dirt, dust, or chips from hands, face, or clothing or to clean other equipment.
7. Wear proper eye and face protection if exposed to flying objects or dust.
8. Personnel operating air (pneumatic) tools shall be qualified through training and performance evaluation.

ENGINE POWERED TOOLS

1. Comply with all fire prevention regulations and have appropriate fire fighting equipment available for immediate use.
2. Use the appropriate type of fuel container.
3. Do not permit flame or sparks near fuel supplies or while re-fueling.
4. Wipe any spilled fuel off the equipment. Move at least 10 feet from the fueling spot before starting the engine.
5. Never fuel while the engine is hot, or fuel a running engine.
6. Do not operate the engine indoors, or where there is poor ventilation.
7. Wear the recommended hand, foot, leg, head, eye, and hearing protection at all times during operation.
8. Never operate the equipment without the proper shields, guards, attachments, and other protective devices.
9. Never operate the equipment without good visibility and light.
10. Always disconnect the wire from the spark plug to make the engine unstartable before you work on the equipment.
11. Personnel operating gasoline operated tools/equipment shall be qualified through training and performance evaluation.

POWDER ACTIVATED TOOLS

1. Only authorized and trained employees are permitted to operate powder activated tools.
2. Be sure to test all powder activated tools daily before use.
3. Do not load tool until immediately before use.
4. Do not leave loaded tool unattended.
5. Never point a loaded tool at anyone.
6. Wear gloves, safety glasses, face shield, and earplugs to prevent injury from flying objects.
7. Clear work area of all personnel who could be struck by the projectile.

ABRASIVE GRINDING

1. Be sure the proper safety guard(s) and handle(s) are in place and used while grinding to protect from the effect of a bursting wheel.
2. When changing abrasive wheel, make sure the power is disconnected, then inspect the wheel closely, ring test before mounting, and test run the grinder for approximately one minute in a safe area.
3. Make sure the RPM rating of the wheel matches the rating of the grinder.
4. The tool rest, on the floor and bench-mounted grinder, must be kept adjusted to a clearance not to exceed 1/8 inch from the wheel.
5. A face shield, goggles, and ear plugs must be worn while using a grinder of any size, with grinding wheels or wire wheels.
6. Inspect tool prior to each use and assure compliance with monthly inspection requirements.

7. Washers or other material shall not be used as spacers. Only properly designed flanges shall be used.
8. Each employee shall receive grinder training prior to operating that tool.

POWER DRILLING

1. Be sure tool has been properly inspected (monthly, assured grounding, etc.)
2. Inspect tool before use making sure all guards, handles, and safety equipment are in place.
3. When changing cutting tools (bits, holesaws, etc.) unplug drill motor.
4. Use security rope on magnetic drills to keep them from falling in case of power failure or displacement by torque.
5. Establish firm footing when using high torque drills, especially when working from a ladder.
6. Control drill with both hands, using handles that are provided.
7. Wear face shield when drilling for protection in case of cutting tool failure or flying chips.
8. Anticipate effects of binding and do not put yourself in harms way.
9. Keep hands as far away from rotating parts as possible while maintaining control of the drill.
10. Be sure chuck wrench is removed from chuck after tool change before using a drill. The wrench could be slung out by drill.
11. Be aware of the possibility of gloves getting caught by the rotating parts of the drill.

POWER SAWS

1. Be sure that the power saw has been properly inspected monthly and that the ground fault circuit interrupter (excluding chain saws) is good.
2. Inspect power saws before use, making sure all guards, handles, and safety equipment are in place. Be sure that the blades are secure and tight.
3. Before changing blades, be sure to unplug the power saw first.
4. Use power saws with both hands.
5. Anticipate effects of a power saw blade binding and do not put yourself in harms way.
6. Keep hands as far away from rotating blades as possible while maintaining control of the saw.
7. Be sure that the wrench is removed after the blade has been changed before using the power saw. The wrench could be slung out of the saw.
8. Be aware of the possibility of gloves getting caught by the rotating blades of the saw.
9. When cutting above the shoulder height, you must wear a face shield and/or goggles.
10. When replacing or unjamming a saw blade, make sure that the power is disconnected.
11. When using either a circular saw, sawzall, table saw, or a radial saw, never leave it running when not in use and/or unattended. Never start any of these saws without completing the training module. Only trained and qualified personnel shall operate this equipment.
12. When starting and using a german saw, be clear of the moving blade.
13. When using a cut-off saw, if the material to be cut cannot be chained down (whether it be too short or any other circumstances), do not cut it. Never use your hands to hold material down when using this type of saw.

14. Check the blade on the saw for any type of damage. If any damage, replace immediately.
15. When using port-o-band saw, be sure material to be cut is secured. Never use your own hands to hold the material. Keep them on the saw.
16. For any power saw, be sure that you are using the proper saw and blade that was meant to cut the material that you are wanting to cut.

COMPRESSED GAS CYLINDERS

1. Keep valve protection caps on cylinders while they are being transported, moved, or stored.
2. Close valves and replace protection caps when work is finished and when cylinders are empty or being moved.
3. Secure cylinders in an upright position at all times.
4. Keep cylinders in an upright position at all times.
5. Be sure the oxygen and fuel gas regulator are equipped with flash back arrester, and are in good working order.
6. Keep the valve key wrench on the spindle while using fuel gas cylinders.
7. Keep oily cloth away from oxygen to avoid the danger of explosion.
8. Always light torch with a "torch lighter".
9. Stand to the side when opening valves to prevent injury in the event of regulator failure.
10. Open valves slowly to prevent damage to regulator.
11. Do not open acetylene cylinder valves over one and one-half turns.
12. Be sure to store oxygen and fuel gas cylinders at least 20 feet apart unless separated by an approved fire barrier.

MOBILE HOISTING EQUIPMENT

1. Only authorized and qualified persons are permitted to operate equipment.
2. Be sure a load chart and fire extinguisher are available and instructions or warnings can be seen from the operator's station.
3. Inspect equipment before and during each use.
4. When operating equipment, remain at least 10 feet away from electrical lines rated 50KV or less; 10 feet plus 0.4 inches for each KV over 50KV.
5. Keep machines clean from trash, oil, and grease to prevent slips and falls.
6. Properly barricade the rear swing radius to prevent employee from being struck or crushed by the equipment.
7. Use tag lines to control loads and to maintain a safe distance from loads; be careful not to place yourself between load and other objects.
8. Do not get under or near a suspended load.
9. To avoid tipping, full extend all outriggers and use mats to assure safe footing.
10. Inspect wire ropes, chains, rope, and other rigging equipment before each use.
11. No load is to be lifted which exceeds the manufacturer's rated capacity.
12. Be sure the safety mouse on all hooks is in good operating condition.
13. Use a flagman when the equipment blocks roadway, is being moved in tight places, poses a hazard, and when the load cannot be seen by the operator. If operator cannot see flagman he must stop.
14. Rigging a load shall be done by a qualified person.

HEAVY CONSTRUCTION

EQUIPMENT

1. Do not approach any operating equipment from the rear.
2. Do not enter a job site unless directly essential to the job or authorized.
3. Do not enter operating radius of equipment until visual contact has been made with equipment operator.
4. Do not travel with equipment without a warning horn and back-up alarm unless under the guidance of a flagman.
5. Use an escort if traveling in equipment with obstructed visibility.
6. Wear seatbelts in all equipment which does not have a roll-over protective structure (ROPS).
7. Notify equipment operator immediately if you observe a safety hazard or violation of any of the above rules.

LADDERS

1. Before use, inspect ladder. If broken or unsafe, do not use. If unsafe it must be tagged and removed from the job site.
2. Be sure the ladder is long enough to extend 3 feet above landing and tied off.
3. Have someone hold the ladder while you tie it off. Make sure you barricade the area to keep people from working under it.
4. Set the ladder on a firm and level base, clear of tripping hazards.
5. Do not use metal ladders near electrical lines or equipment.

6. Do not use step ladders as a straight ladder.
7. Face ladder and grip the side rails with both hands to maintain three point contact when climbing up or down.
8. Do not carry tools or materials while climbing. Use a rope and approved bucket to get tools to work area.
9. When working from a ladder 4 feet or higher, you must be 100% tied off.
10. Do not over-reach while working from a ladder. Move ladder as needed.
11. Do not stand on the top 2 steps of a step ladder.
12. The proper angle for ladder usage is 1 foot out for every 4 feet up.

SCAFFOLDS

1. Only qualified and authorized personnel shall erect, modify or dismantle scaffolds.
2. The scaffold is to be inspected by a competent person before each shift.
3. Use the access ladder to reach the work platform. Do not climb on the scaffold bracing.
4. Be sure the scaffold has a current inspection.
5. Do not step on overhanging planks.
6. Use the guardrail post for support to reach the work platform. Do not use the toe board, midrail, or handrail. Preferred access would be through a gate.
7. Use both hands to climb the access ladder in order to maintain a three point contact. Do not carry tools or materials.
8. Do not throw tools or materials from one level to another. Use approved bucket or similar device and rope.

9. Report any scaffold defects or damage to your supervisor immediately.
10. Be sure the scaffold is safe before using.

FIRE PROTECTION

1. Smoke only in designated areas. Obey (No Smoking” signs.
2. Know the location and type of fire extinguishing equipment.
3. Use flammable liquids in small amounts in approved container with label, self closing caps, and flame arresters. When not in use, store in approved flammable storage cabinet.
4. Do not refuel a hot or running engine.
5. Never use gasoline as a cleaner.
6. Never use an air hose for pressure to empty gasoline drum.
7. Do not leave the fuel hose unattended when fueling vehicles or equipment.
8. Store oily rags and other combustible waste material in covered metal containers.
9. Keep a trained fire watch posted during “hot work” and for 30 minutes afterward.
10. Do not block access to fire extinguishers.
11. Report any extinguishers that are damaged or need recharging.
12. Keep salamanders or other heaters away from combustible materials.
13. Remove or shield combustible material from welding or cutting operations.
14. Do not use oxygen near grease or other oil-based products, and not while wearing oily or greasy clothing.
15. Report all fires to your supervisor immediately.

TEMPORARY FLOOR AND **WALL OPENINGS**

1. Do not leave floor and wall openings unprotected.
2. Temporary floor openings must be protected by one of the following:
 - Standard handrail, midrail, toeboard
 - Substantial labeled, and secured cover, or
 - Be attended by someone.
3. Be sure open-sided floor, platform or wall openings are guarded by standard railing.

HAZARD RECOGNITION

In our effort to increase awareness, inform and train employees of the hazards associated with their work, we have developed the “Safety Task Evaluation Process” (STEP). This task hazard analysis process is designed to address the work place interfaces among co-workers, tools, equipment, materials, process systems, and environmental to determine potential events that could negatively impact completion of the task safely.

A hazard is defined as a condition or changing set of circumstances that present a potential for injury, illness, property damage, or process interruption. It also includes the potential or inherent characteristics of an activity, condition, or circumstance, which can produce adverse or harmful consequences.

An accident is defined as an unfortunate, unforeseen and unplanned event often the result of carelessness or ignorance resulting in an unfavorable outcome.

Complacency, acceptance of risk and taking things for granted are causes of a tremendous number of injuries each year. Recognizing hazards and doing something about them is everyone’s responsibility. So as you begin work, ask yourself:

- Do I have the right tools and equipment for the job?
- Have I inspected the tools and equipment to make sure they are in safe condition or am I trying to get by?
- Is the work planned to provide safe completion of the job?

- Are the materials I am using safe and do I need additional personal protective equipment such as goggles, face shield, respirator, ear plugs, or body harness in addition to the standard requirements of hard hat, safety glasses, gloves, safety-toed boots, etc?
- Is there a safer way to accomplish the task?
- Are all necessary equipment guards in place?
- Are written procedures such as lockout-tagout being followed?
- Will my hands or fingers be exposed to potential pinch holes?
- Will my body be positioned between objects and/or equipment where it can be caught between if the unexpected happens?
- Do I have a thorough understanding of what must be done?
- Have all hazards been identified?
- How can the hazard(s) or exposure(s) be eliminated? How can they be controlled?

The section of the handbook provides some examples of task assessments and hazards associated with some of our common work activities. These examples can be used to assist in hazard recognition while developing your task specific analysis. Each craft will have its unique work assignments with related hazards or exposures. Therefore, each task must be analyzed for its potential safety issues.

Do not accept risk. Work together to identify and solve problems. Intervene and protect your co-worker.

EXCAVATIONS

An excavation is any man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal. Sources of hazards associated with this type of work fall into three major categories:

- Underground utilities, piping, etc.;
- Confined space and
- Cave-ins

POTENTIAL UNDERGROUND HAZARDS

HAZARD	SOURCE
Electrical shock	Buried live power lines
Fire and explosion	Process lines and piping containing flammable gasses and/or liquids
Disrupting communications	Underground communication lines or cables.
Loss of water and sewer service	Underground water & sewer lines.

Solutions to Addressing Underground Hazards

- Obtain the proper "Excavation Safe Work Permit" prior to any excavation work activity.
- Contact utility companies and property owner to ensure underground installations are found.
- Make sure there is an "Excavation Competent Person" present at all times when excavating or working in an excavation.
- Many "lines" are uncharted so probing the intended excavation area will be required.
- As underground installations are uncovered, make sure they are protected and supported

properly. Refer to the “Confined Space Entry” process for proper work procedures. Additional hazards could be caused by some of the following conditions:

- Soil could be contaminated releasing potentially toxic fumes or causing skin irritation upon contact with dirt, mud, or water seeping into the excavation. If this is suspected, proper clothing and respirator usage will be required to address the problem.
- If required to enter bell-bottom holes, or similar deep and confined footing excavations, you must wear a harness with life-line at all times.
- Ensure there is adequate access/egress from the excavation.

CAVE-IN HAZARDS	SOLUTION
Collapsing walls	Be sure the excavation is properly sloped, stepped back, shored, or personal shield used while in the excavation.
Material/equipment falling into the excavation	Do not position yourself under loads or equipment which is operating overhead. Make sure spoil is away from the edge of the excavation. Make sure barricades have been erected to keep vehicles/equipment away from the excavation. Make sure surface water is diverted away from the excavation. Do not undermine adjacent structures unless adequate support system is in place. Remove all surface encumbrances near the excavation.

CONFINED SPACE ENTRY

A confined or enclosed space is any space having limited means for entry or exit, configured so that an employee can bodily enter and perform work and not designed for continuous occupancy:

Examples of Confined or Enclosed Spaces:

- Storage tanks
- Process vessels
- Vessel skirts
- Bins
- Boilers
- Ducts
- Sewers
- Underground vaults
- Excavations
- Manholes
- Tunnels
- Pits and shafts

If you must enter a confined space, ask these questions:

1. What kind of hazards will I run into and why are these hazards dangerous?
2. What are the necessary precautions to take for each hazard?
3. What PPE, emergency equipment and instruments are required?

EXAMPLES OF CONFINED OR ENCLOSED SPACE HAZARDS

PHYSICAL HAZARDS	SOLUTIONS
Mechanical, electrical and hydraulic energy	De-energize and lock-out before entering
Being buried by material	Assured proper sloping or shoring and inspected by competent person. Be aware of soil conditions and activities near the excavation.
Communication problems	“Hole Watch” should be in voice and/or visual contact with those in the space.
Noise or environmental factors	Proper PPE to address the specific hazard. Assure adequate air movement. To prevent heat stress, consider air conditioning and frequent rest periods.
Electrical shock	Utilize a ground-fault-circuit interrupter for power tools. Consider pneumatic tools.
Fire and explosion potential	Use equipment rated as explosion proof, non-spark producing tools and “sniff” the space to assure a non-explosive atmosphere.
Existing pipes and lines	Identify, isolate and clear
Contaminated soil	Identify contaminant, review MSDS, use proper PPE and prevent direct contact or inhalation of fumes.

EXAMPLES OF CONFINED OR ENCLOSED SPACE HAZARDS

ATMOSPHERIC HAZARDS	SOLUTIONS
Oxygen deficiency (due to O ₂ consumption by work activity, i.e. welding)	Monitor air for safe oxygen range 19.5 – 23.5 percent Provide air mover to force air into space. Use airline respirator if safe range can not be maintained.
Oxygen deficiency (replaced by other gasses, i.e. argon, nitrogen, methane)	(Same as above)
Oxygen deficiency (due to bacterial action i.e. fermentation)	(Same as above)
Oxygen deficiency (due to chemical reaction, i.e. formation of rust/scale)	(Same as above)
Flammable Air (fire and explosion potential)	Eliminate and control sources of ignition or eliminate the flammable air.
Toxic Air Contaminants	Provide air mover to force air into space and use an airline respirator.
Oxygen enrichment (due to oxygen hose leak, or chemical reaction that releases oxygen)	Eliminate sources of O ₂ leakage, eliminate source of chemical reaction or control oxygen level by forced air ventilation.

Before Entering a Confined Space

- Obtain an “Entry Permit”.
- Control hazardous energy and/or process systems by following Lockout/Tagout procedures.
- Make sure the confined space air is tested for oxygen content, flammable gasses and toxic hazards.
- Provide an insulated protective shield to prevent contact with any energized parts in the space.
- Use safety harness and lifeline for emergency extraction from the confined space.
- Establish sufficient ventilation to ensure oxygen levels are safe and flammable or toxic air cannot reach dangerous levels.
- A trained “Manway Watch” must be stationed outside the confined space and assigned to maintain communications with you and assist in case of any emergency.
- Inspect PPE, equipment and tools to ensure safe condition prior to entry.
- Consider potential heat stress problems due to PPE, work activity and environmental factors.

WORKING AT ELEVATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Climbing and descending ladders	<p>1a. Slips and falls due to loss of footing or grip.</p> <p>1b. Falls due to unstable ladder or over reaching.</p> <p>1c. Strains while climbing or performing work.</p>	<p>1a. Check ladder rungs and side rails for mud or other slippery surface. Do not carry tools or material in the hands. Maintain three point contact with ladder.</p> <p>1b. Have a co-worker hold the ladder steady and tie-off the ladder to the structure. Do not extend the body sideways to perform work, move the ladder as needed. Use fall restraint system.</p> <p>1c. See 1a. above. Do not over reach or place body in an awkward working position. Be sure to have the right tool for the job.</p>	<p>1a. Safety-toed shoes/boots with a defined heel. Tool belt or bucket and rope.</p> <p>1b. Full body harness and twin lanyard.</p>

WORKING AT ELEVATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
2. Working in limited/congested areas.	<p>2a. Burns from coming in contact with hot piping.</p> <p>2b. Strains due to poor or awkward body position.</p> <p>2c. Caught between structure, piping, and load.</p> <p>2d. Pinch points due to handling tools and materials</p>	<p>2a. Wear PPE and long sleeve shirts. Place insulated blanket over hot surface.</p> <p>2b. Get into a good position to do the work. Do not attempt to man-handle the load. Let the machinery and tools do the work.</p> <p>2c. Do not position any part of the body between two moving objects or a moving and stationary object. Do not place hands on slings or other rigging devices.</p> <p>2d. Do not place finger/hands on ends of pipe, in bolt holes, etc. Do not attempt to push/pull load with the hands. Use tag lines.</p>	<p>2a. Leather gloves, insulated blanket.</p> <p>2d. Tag lines</p>

WORKING AT ELEVATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
2. Working in limited areas. (cont.)	<p>2e. Fall due to loss of balance, slips, etc.</p> <p>2f. Dropping tools, materials to lower levels.</p> <p>2g. Having objects dropped from work above.</p>	<p>2e. Use 100% tie off.</p> <p>2f. Barricade area below, post signs or tags advising of hazard and communicate with other workers in area.</p> <p>2g. Communicate and coordinate work with those working above. Erect overhead protection if necessary.</p>	<p>2e. Full body harness and twin lanyards.</p> <p>2f. Barricade tape/rope.</p>
3. Working from personnel lifting machine (JLG).	3a. Fall from basket to lower level.	3a. Use 100% tie off. Do not stand on boxes, buckets, mid-rail, handrail, or other object. Do not lean outside of basket.	3a. See 2e. above.

WORKING AT ELEVATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
3. Working from basket. (cont.)	<p>3b. Caught between basket and structure.</p> <p>3c. Dropping objects to lower level.</p>	<p>3b. Keep body parts inside of basket. Look around for any obstructions and maintain a safe distance. Maintain proper directional orientation of controls to machine movement. (i.e. 180% basket rotation will reverse controls).</p> <p>3c. Barricade area below the work station. Keep bolts, tools, and other small objects in a bucket. Put netting material around guard rail system if necessary. Maintain a firm grip while handling objects. Communicate with others that might enter the area.</p>	3c. Barricade tape.

WORKING AT ELEVATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
3. Working from basket. (cont.)	<p>3d. Striking personnel or other objects while moving and operating the machine.</p> <p>3e. Electrical shock from energized lines or equipment.</p>	<p>3d. Use a flagman when moving the machine to observe traffic, personnel and other stationary objects.</p> <p>3e. Get owner of the energized line/equipment to de-energize it. Use insulation blankets. Maintain proper clearance from all energized sources. Use a flagman/spotter to observe for this hazard.</p>	3d. Flagman/spotter.
4. Working near wall openings, open floor holes, open sided decking, etc.	4a. Fall from one level to a lower one.	4a. Erect standard guardrail system for wall openings and open sided decking. Cover or guard rail system for floor openings/holes. Utilize warning rope and 100% tie off.	4a. Guardrail, hold cover, a full body harness with twin lanyards.

LOAD, HAUL, AND UNLOAD MATERIAL (MANUALLY)

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Load/unload material.	<p>1a. Strains and sprains while lifting or carrying heavy or awkward objects.</p> <p>1b. Cuts from sharp edges or banding straps.</p> <p>1c. Pinch points to hands and fingers when placing material on surface.</p>	<p>1a. Use proper lifting technique. See assistance of co-worker and establish good communications to assure a coordinated effort. Do not over-reach or twist while handling material. Use hand dolly, conveyor, etc., when possible. Do not jump from one level to the next.</p> <p>1b. Use proper PPE and clothing. Inspect the material for any surfaces with sharp edges/corners/points, etc.</p> <p>1c. Set opposite side of material down first. Coordinate placement with co-worker to assure one does not drop or pinch the other with load. Use cribbing to eliminate the potential hazard.</p>	<p>1a. Hand dolly, roller conveyor. Safety-toed shoes, leather gloves.</p> <p>1b. Long sleeves and leather gloves.</p> <p>1c. Timber for cribbing.</p>

LOAD, HAUL, AND UNLOAD MATERIAL (MANUALLY)

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Load/unload material. (cont.)	<p>1d. Slips, trips, and falls while moving in congested areas or on uneven/wet surfaces.</p> <p>1e. Being struck by material.</p> <p>1f. Falls from one level to a lower level.</p>	<p>1d. Clear the intended work area/route of any obstacles and inspect to identify surface problems.</p> <p>1e. Do not throw material from one location to another. Position yourself away from unstable or improperly stacked material. Set materials in place. Maintain a firm grip. Hoist materials to different levels with ropes, chainfalls, etc.</p> <p>1f. Maintain awareness of edge of delivery vehicle bed. Use steps to access bed of vehicle. Hand material to someone at ground level. Do not back-up toward edge of vehicle.</p>	<p>1e. Ropes, chainfalls, etc.</p>

LOAD, HAUL, AND UNLOAD MATERIAL (MANUALLY)

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
2. Haul Material.	<p>2a. Being struck by a material transporter (dolly).</p> <p>2b. Objects falling from transporter.</p> <p>2c. Injury caused by contents of load, i.e. chemical burns.</p>	<p>2a. Make sure route is clear of other personnel. Do not block vision with stacked material on dolly. Use a spotter if necessary.</p> <p>2b. Use straps to secure load. Do not over load.</p> <p>2c. Identify the contents and review hazards associated with it.</p>	<p>2c. Material Safety Data Sheets. Appropriate PPE for the potential exposure.</p>

LOADING/UNLOADING MATERIAL (MECHANICALLY)

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Off loading, 90's and flanges from trailer with crane.	<p>1a. Falls to lower levels due to slipping or tripping.</p> <p>1b. Pinch points to hands/fingers while attaching slings/chokers.</p>	<p>1a. Cleaning any mud, grease, or other slippery substance from the walking/working surface. Use a ladder or equivalent to gain access to the trailer.</p> <p>1b. Do not place hand/fingers between sling and load. Attach tag lines to load, do not attempt to direct or control load with hands or other body parts. Do not place hands between load and other objects while load is being moved. Do not slide hands on sling/choker, be aware of frayed areas or burrs on sling. Place load on cribbing when off setting load.</p>	<p>1a. Safety toed shoes/boots.</p> <p>1b. Leather gloves, tag lines, cribbing timbers.</p>

LOADING/UNLOADING MATERIAL (MECHANICALLY)

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Off loading from trailer with crane. (cont.)	1c. Caught between objects if stored energy due to load tension is suddenly released.	1c. Expect stored energy due to load shifting/ settling while in transit to the site. Do not position body parts between objects before this tension is released. After slings are attached, personnel must get off the trailer before the lift is made. Use a stick/bar to reposition or move piping as load is being maneuvered.	1c. Pry bar or similar tool
2. Off loading 90's and flanges using a forklift.	2a. Cuts and abrasions from sharp edges while releasing the tie-downs for the crates.	2a. Wear gloves to help protect the hands and fingers. Use the proper tool to cut the tie-down material. Keep hands clear as tension is released from the tie-downs.	2a. Leather gloves, side cutters, nippers, etc.

LOADING/UNLOADING MATERIAL (MECHANICALLY)

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
2. Off loading 90's and flanges using a forklift. (cont.)	<p>2b. Falls from one level to another.</p> <p>2c. Caught between or stuck by objects due to poor body position.</p>	<p>2b. See 1a. above.</p> <p>2c. Stand on the same side of the trailer as the forklift while it is loading its forks. Keep a safe distance from this off loading procedure. No personnel shall be positioned on the opposite side where materials could be pushed off the edge of the trailer. The material shall be carried low on the forklift.</p>	<p>2b. See 1a. above.</p> <p>2c. A certified forklift operator.</p>

ABRASIVE WHEEL GRINDING

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Inspect abrasive wheels, grinder, and electrical cord or air hose for any type of damage.	1a. Dropping abrasive wheels or grinder on feet. 1b. Energy source-electrical or air pressure.	1a. Use two hands when handling wheels and grinder. Inspect wheels for cracks or chips with ring test. 1b. Make sure electrical grinder is not plugged prior to inspecting. Make sure pneumatic grinder is not connected to air hose.	1a. Wear leather gloves and steel-toed shoes.
2. Grind end of pipe.	2a. Abrasions or cuts from abrasive wheel. 2b. Strains to wrist from prolonged use.	2a. Make sure guards are in place, use both hands when grinding, and keep clear of abrasive wheel when in operation. 2b. Try to grind at waist height take breaks, and alternate persons grinding.	2a. Tool guards, leather gloves, goggles, and face shield.

ABRASIVE WHEEL GRINDING

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
2. Abrasive wheel grinding (cont.)	<p>2c. Noise from grinder.</p> <p>2d. Flying debris from grinding.</p> <p>2e. Burns from heated pipe.</p> <p>2f. Grinder falling off of table or work area.</p>	<p>2c. Wear ear protection when grinding.</p> <p>2d. Make others aware of work being done in that area. Wear goggles and face shield.</p> <p>2e. Wear long sleeved shirts and hand protection.</p> <p>2f. Store grinder on grinder holder.</p>	<p>2c. Ear plugs.</p> <p>2d. Set up a welding curtain if possible, goggles, and face shield.</p> <p>2e. Wear leather gloves, or leather sleeves.</p> <p>2f. Obtain a grinder holder.</p>

WELDING/CUTTING

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Set up welding/cutting rig.	<p>1a. Trip hazard from leads/hoses in walkways or stairways.</p> <p>1b. Shock hazard from exposed or damaged wires.</p> <p>1c. Spill potential from welding machine or truck.</p> <p>1d. Explosion hazard from improper handling of gas cylinders.</p> <p>1e. Fire hazard from leaking hoses or gauges.</p>	<p>1a. Run hoses and leads clear of walkways and stairs, barricade area.</p> <p>1b. Inspect cables for damaged insulation/ exposed wires. Avoid damp or wet areas.</p> <p>1c. Maintain vehicle and machine on proper schedule, inspect for coolant, oil, or fuel leaks.</p> <p>1d. Keep protective caps in place. Use proper dolly or cart to move cylinders.</p> <p>1e. Inspect hoses and gauges prior to use. Use flashback protectors. Tighten all connections. Keep sparks/slag off hoses.</p>	<p>1c. Spill kit, drip pan.</p> <p>1e. Flashback protection.</p>

WELDING/CUTTING

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Set up welding rig. (cont.)	1f. Pinch holes from changing cylinders or handling equipment.	1f. Keep hands out of pinch point areas, wear leather gloves.	1f. Leather gloves.
2. Cut/weld pipe or steel.	2a. Burns from torch, hot slag, or hot metal. 2b. Burns to eyes or body from UV rays. 2c. Shock hazard from bad welding leads or improper grounding. 2d. Fire from sparks igniting flammables in work area	2a. Wear dry leather gloves, mark hot pipe. 2b. Wear proper protective clothing and eye protection. 2c. Ground equipment and work piece to earth, wear dry clothes; avoid wet workplaces. 2d. Remove flammables, take work to area free of flammables. Wet tarps; use a fire watch.	2a. Paint markers, leather gloves. 2b. Welding hoods, cutting goggles, long sleeved shirt, gloves. 2d. Fire extinguisher.

WORKING CONCRETE AND WRECKING FORMS

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
<p>1. Working Concrete.</p>	<p>1a. Burns to skin from contact with concrete.</p> <p>1b. Concrete splashing in eyes and mouth while pouring.</p> <p>1c. Falls to a lower level. Making a pour at elevation.</p> <p>1d. Slips, trips, and falls due to walking on rebar and uneven/wet surfaces.</p>	<p>1a. Use proper PPE to protect the skin.</p> <p>1b. Stay away from hose or chute while pouring concrete. Wear adequate eye protection and keep the mouth closed.</p> <p>1c. Erect standard guard rail System to protect elevated work activity and/or assure 100% tie off with fall restraint system.</p> <p>1d. Place plywood on rebar to create a good work surface. Use extreme caution and watch every step.</p>	<p>1a. Rubber gloves, boots, and protective clothing.</p> <p>1b. Side shield glasses or goggles.</p> <p>1c. Full body harness with twin lanyards.</p>

WORKING CONCRETE AND WRECKING FORMS

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
<p>1. Working Concrete.(cont.)</p>	<p>1e. Electrical shock while using vibrator or from contacting energized lines and equipment with bull float.</p> <p>1f. Overheating or overexertion while pulling concrete with come-a-long and screed board.</p> <p>1g. Implement on exposed rebar ends.</p>	<p>1e. Inspect tool/ cord for damage and use a GFCI. Have overhead/ Adjacent lines/ equipment de-energized and insulate bull float handle. Remove excess joints of handle if not needed to prevent contact with other objects.</p> <p>1f. Rotate personnel in working positions, take self paced breaks and drink plenty of liquids.</p> <p>1g. Avoid working over any exposed rebar and cover ends with caps or board.</p>	<p>1e. GFCI and insulation material for tool handle.</p> <p>1g. Rebar protective caps</p>

WORKING CONCRETE AND WRECKING FORMS

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
2. Wrecking Forms	<p>2a. Strains/sprains while handling heavy forms.</p> <p>2b. Abrasions and punctures from exposed nails and splinters.</p> <p>2c. Slips, trips, and falls due to wet conditions, wrecked forms and tools.</p>	<p>2a. Use backhoe or track hoe to lift and carry forms. Get assistance from co-worker(s) when manually handling material.</p> <p>2b. Remove or bend nails as they are exposed and remove splinters. Wear hand protection and be alert for the possibility of exposed nails or splinters. Do not slide hands on material.</p> <p>2c. Stack the damaged form material out of the immediate work area and pick up and remove all tools and cords that are not needed.</p>	<p>2b. Leather gloves</p>

PIPE FABRICATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Moving pipe and materials into the shop/fabrication area.	1a. Pinch points while unstacking pipe and material. 1b. Muscle strains from lifting heavy or awkward loads.	1a. Mental awareness of where you place your hands. Do not place hands/fingers between objects. 1b. Get help from a co-worker. Use mechanical lifting devices.	1a. Wear leather gloves to minimize possible injuries. 1b. Use a crane when possible.
2. Cut, grind and prepare pipe and fittings for fabrication.	2a. Airborne particles in the eye. 2b. Cuts and abrasions from sharp edges and grinding disc. 2c. Electrical shock from bad extension cords and electrical tools.	2a. Wear proper eye protection. 2b. Wear arm and hand protection. 2c. Assured grounding program. Inspect cards and tools prior to use. Avoid damp/ wet areas.	2a. Goggles and full face shield. 2b. Good quality leather gloves and long sleeve shirts. 2c. Wear dry gloves, use ground fault circuit interrupter (GFCI).

PIPE FABRICATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
3. Tack-weld fittings and pipe together.	<p>3a. Eye irritations from welding flash.</p> <p>3b. Burns from hot welds.</p> <p>3c. Pinch points from setting pipe in jack-stands and attaching fittings.</p>	<p>3a. Proper eye protection. Shield eyes from rays.</p> <p>3b. Skin protection.</p> <p>3c. Get help from a co-worker to lift or align material. Use mechanical lifting device.</p>	<p>3a. Shaded safety glasses. Welding hood. Use curtain around work station.</p> <p>3b. See 2b. above.</p> <p>3c. Come-a-long, chain fall or hydraulic crane.</p>

PIPE FABRICATION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
4. Weld-out fabricated spool pieces.	<p>4a. Burns from hot welds.</p> <p>4b. Pinch points while positioning pipe.</p> <p>4c. Airborne particles from grinding and buffing welds.</p> <p>4d. Cuts and abrasions from grinding disc.</p>	<p>4a. Skin protection.</p> <p>4b. See 1a. above.</p> <p>4c. Proper eye protection.</p> <p>4d. Wear proper arm and hand protection.</p>	<p>4a. See 2b. above.</p> <p>4b. Leather gloves.</p> <p>4c. See 2a. above.</p> <p>4d. See 2b. above.</p>

STEEL ERECTION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
1. Load/unload trucks, floats, etc.	<p>1a. Falling off truck or when climbing on/off truck.</p> <p>1b. Pinch points or cuts to hands from pipe, steels, etc.</p> <p>1c. Pinch point to body, caught between load and truck or struck by load.</p> <p>1d. Losing the load.</p>	<p>1a. Have sideboards on truck if possible. Use ladder when climbing on or off truck.</p> <p>1b. Use tag lines to keep hands off materials and out of pinch points.</p> <p>1c. Get off truck when material is moving on or off truck (using rig, forklift, etc.) Stay out from under load.</p> <p>1d. Inspect rigging before use, use proper type slings and technique. Use tag lines to control load.</p>	<p>1a. Access ladder.</p> <p>1b. Wear leather gloves.</p> <p>1c. Protected platform area on trailer.</p> <p>1d. Use softener to protect slings.</p>

STEEL ERECTION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
2. Drill holes for new steel.	<p>2a. Drill binding in hold causing sprained hand or wrist. Loud noise.</p> <p>2b. Eye injury from drill shavings.</p> <p>2c. Cuts to hands/ arms from metals shavings.</p> <p>2d. Electric shock from drill.</p>	<p>2a. Use sharp drill bit and decrease pressure as bit nears end of cut. Use both hands to control drill (ensure auxiliary handle is on drill). Be in proper body position to control drill.</p> <p>2b. Wear side shield safety glasses. Position body/work where drilling is below head level.</p> <p>2c. Wear leather gloves and long sleeves, cuffs buttoned. No loose clothing. Release cutting pressure to break drill shavings.</p> <p>2d. Use GFCI. Check drill and cords for inspection color code (Assured Grounding). Visually inspect for condition (cuts in cords, grounding prong to plug, general condition).</p>	<p>2a. Hearing protection.</p> <p>2b. Goggles and face shield if drilling at or above head level or if drill shavings are flying.</p> <p>2c. Leather gloves, long sleeves with cuffs buttoned.</p>

STEEL ERECTION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
3. Fabricate Steel.	<p>3a. Burns to eyes while using cutting torch.</p> <p>3c. Burns to hands, arms, and body while using band saw.</p> <p>3d. Burns to eyes from welding.</p> <p>3e. Burns to hands and arms from hot metal during/after welding.</p>	<p>3a. Wear cutting goggles (#5 shade lens).</p> <p>3c. No loose clothing, button long sleeves, tuck in shirt.</p> <p>3d. Do not look at welding flash. Erect flash barricades to protect others.</p> <p>3e. Do not touch hot metal. Keep others from touching hot metal. Wear leather gloves and long sleeves. Erect barricade if needed.</p>	<p>3a. Cutting goggles.</p> <p>3d. Welding hood, erect curtain or similar barricade.</p> <p>3e. Leather gloves, long sleeves.</p>

STEEL ERECTION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
<p>3. Fabricate Steel. (cont.)</p>	<p>3f. Steel falling off jack stands, table, saw horses, etc., and landing on foot, toes, etc.</p> <p>3g. Particles in eyes from grinding.</p> <p>3h. Hearing loss from grinding noise.</p> <p>3i. Material nearby catching on fire.</p>	<p>3f. Use c-clamps or other means to keep material in place. Check jack stands for locking rings and condition. Have proper and sufficient number of supports for the job. Wear foot protection.</p> <p>3g. Have guard on grinder to direct sparks away from face/head area and others. Erect shield to contain particles from flying towards others. Wear face shield and goggles.</p> <p>3h. Wear hearing protection-advise others in area.</p> <p>3i. Have fireextinguisher available, remove all flammable material from immediate area.</p>	<p>3f. Safety-toed boots.</p> <p>3g. Face shield, goggles.</p> <p>3h. Hearing protection.</p> <p>3i. Fire extinguisher.</p>

STEEL ERECTION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
4. Install Steel (erection and impacting)	<p>4a. Fall from elevated area.</p> <p>4b. Dropping tools, bolts, etc. to lower level.</p>	<p>4a. 100% tie-off. Inspect harness and lanyards. Have proper anchor point. (not conduit, screw pipe, lined pipe, plastic, or fiberglass pipe). Tie off above head if possible. Limit fall to 6' max. Look to see what obstructions are below that might be struck before lanyard arrests fall. Erect approved lifelines if no other proper anchor point is available.</p> <p>4b. Use tool belt and pouch. Maintain proper grip on tools, bolts, etc., barricade area below. If there a floor below, lay down plywood, tarps, etc. to prevent items from falling through grating.</p>	<p>4a. Harness with two lanyards (lifelines).</p> <p>4b. Tool belt, pouch.</p>

STEEL ERECTION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
<p>4. Install Steel (erection and impacting) (cont.)</p>	<p>4c. Pinch points to hands when connecting steel.</p> <p>4d. Damage to hearing from impact.</p> <p>4e. Air hose coming loose or rupturing causing hose to whip- could strike me or co- worker.</p> <p>4f. Beams, etc. falling during installation.</p>	<p>4c. Use tag line to control load. Keep hands from between steel. Wear leather gloves.</p> <p>4d. Wear hearing protection.</p> <p>4e. Insure "Excessive Flow Valve" is installed on air line. Inspect hoses. Insure proper connections (pins in crow's foot, lock rings on cleco, etc. and safety tie- back wire. Insure that hose is tight in impact wrench.</p> <p>4f. Use secondary stopping device to prevent choker from slipping. Use proper rigging (double wrap, etc.) and softeners. Inspect rigging. Use clear hand signals to operator.</p>	<p>4c. Leather gloves.</p> <p>4d. Ear plugs/muffs.</p>

PIPE DEMOLITION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
<p>1. Walk out line to make sure you have the correct pipe to demo. Make sure line is locked/tagged out and isolated correctly.</p>	<p>1a. Chemical exposure from checking low point drains.</p> <p>1b. Falls from climbing in the pipe rack or other elevated areas.</p>	<p>1a. Know that chemical is in the line and use appropriate PPE. Review the MSDS. Rod drains to make sure they are not plugged. Mark line.</p> <p>1b. Stand on secure piping. Watch your footing and stay 100% tied off. Use scaffold or personnel lift where practical. Be aware of corrosion in pipe way structure.</p>	<p>1a. Wear acid suit, acid gloves, and boots and approved respirator. Review permit and entry procedure.</p> <p>1b. Wear full body harness with double lanyards.</p>

PIPE DEMOLITION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
<p>2. Rig up pipe to secure it.</p>	<p>2a. Dropping equipment or tools.</p> <p>2b. Pinch points to hands while rigging chokers.</p> <p>2c. Falls while climbing in pipe rack.</p>	<p>2a. Barricade area and make sure equipment is secured properly.</p> <p>2b. Keep hands from getting between objects.</p> <p>2c. Stand on secure piping. Watch your footing and stay 100% tied off.</p>	<p>2a. Use proper attachment devices, i.e. beam clamps, steel chokers, nylon chokers.</p> <p>2b. Wear leather gloves.</p> <p>2c. See 1b. above.</p>

PIPE DEMOLITION

TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
3. Cut pipe or unbolt flanges.	<p>3a. Possible chemical exposure from product still in line.</p> <p>3b. Fire/explosion potential.</p> <p>3c. Fall from pipe rack.</p> <p>3d. Cuts from saw blades or pinch points when using wrenches.</p> <p>3e. Dropping material to lower level.</p>	<p>3a. See 1a. above.</p> <p>3b. Use non-sparking tools or equipment. Post a Fire watch with fire extinguisher.</p> <p>3c. See 1b. above.</p> <p>3d. Keep both hands on the tool and clear of saw blades wrench.</p> <p>3e. Make sure rigging equipment is in good condition and will hold the weight of the load. Use the box end of the wrench.</p>	<p>3a. See 1a. above.</p> <p>3b. Use German saw with water or brass wrenches.</p> <p>3c. See 1b. above.</p> <p>3d. Wear leather gloves.</p> <p>3e. Use crane, chain falls or come-a-longs rated to hold the load.</p>










PIPE DEMOLITION

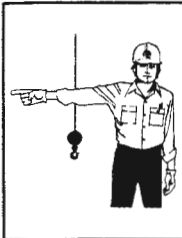
TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
3. Cut pipe (cont.)	3f. Pipe shifting or moving unexpectedly causing injury by pinching or striking.	3f. Keep good communication with rig operator and crew. Don't stand or put hands in potential pinch points. Expect the pipe to shift when cut or freed.	3f. Use additional ropes, chain falls, come-a-longs and secondary stopping devices to control the load.
4. Lower pipe out of rack or fly pipe out with a rig.	4a. Struck by or pinched by the load. 4b. Falling out of pipe rack. 4c. Losing control of the load.	4a. Use rope to control the load. Wear leather gloves. 4b. See 1b. above. 4c. Use yellow barricade tape. Use horn on the rig when swinging load. Tag barricade with information signs.	

PIPE DEMOLITION

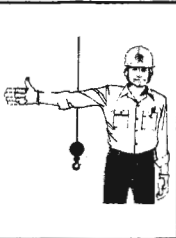
TASKS	HAZARDS	SOLUTIONS	SPECIAL PPE/TOOLS
5. Lower load to the laydown area.	5a. Load shifting or rolling when in the ground. 5b. Being stuck by falling object due to walking under suspended load.	5a. Chock load properly and make sure load is not top heavy. 5b. Barricade area.	5a. Use wood chocks or mats to secure the pipe. 5b. Use yellow barricade tape with information tags.

HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

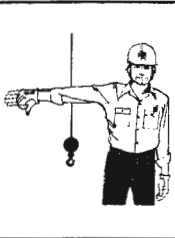
		
<p>STOP. Arm extended, palm down, move hand right and left.</p>	<p>DOG EVERYTHING. Clasp hands in front of body.</p>	<p>MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (HOIST SLOWLY SHOWN AS EXAMPLE.)</p>
		
<p>HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circles.</p>	<p>LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circles.</p>	<p>USE MAIN HOIST. Tap first on head; then use regular signals.</p>
		
<p>USE WHIPLINE. (Auxiliary hoist.) Tap elbow with one hand; then use regular signals.</p>	<p>RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.</p>	<p>LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.</p>



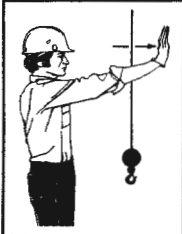
SWING. Arm extended, point with finger in direction of swing of boom.



RAISE THE BOOM AND LOWER THE LOAD. With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.



LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.



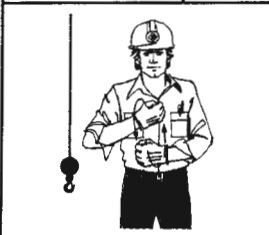
TRAVEL. (Rail Mount or trolley.) Arm extended forward, hand open and slightly raised, making pushing motion in direction of travel.



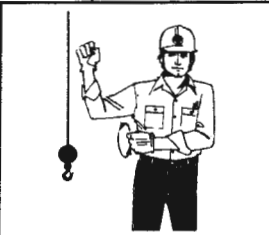
EXTEND BOOM. (Telescoping booms.) Both fists in front of body with thumbs pointing outward.



RETRACT BOOM. (Telescoping booms.) Both fists in front of body with thumbs pointing toward each other.



TRAVEL. (Both tracks.) Use both fists in front of body, making a circular motion about each other, indicating direction of travel; forward or backward. (For crawler cranes only.)



TRAVEL. (One track.) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For crawler cranes only.)

CONVERSION OF METRIC SYSTEM TO ENGLISH MEASUREMENTS

METIC SYSTEM	ENGLISH MEASUREMENTS
<p style="text-align: center;">Length</p> <p>Meter = 1.093 yards = 3.281 feet = 39.370 inches</p> <p>Kilometer = 0.621 mile</p>	<p style="text-align: center;">Length</p> <p>Yard = 0.9144 meter Foot = 0.3048 meter Inch = 0.0254 meter Mile = 1.609 kilometers</p> <p style="text-align: center;">To turn miles into kilometers, Multiply by 8 and divide by 5.</p>
<p style="text-align: center;">Surface</p> <p>Square Meter = 1.196 square yards = 10.764 square feet</p> <p>Square Centimeter = 0.155 square inch</p> <p>Square Kilometer = 0.386 square mile</p> <p>Hectare = 2.471 acres</p>	<p style="text-align: center;">Surface</p> <p>Square Yard = 0.836 square meter Square Foot = 0.092 square meter Square Inch = 6.45 square centimeters Square Mile = 2.590 square kilometers Acre = 0.405 hectare</p>
<p style="text-align: center;">Volume</p> <p>Cubic Meter = 1.308 cubic yards = 35.314 cubic feet</p> <p>Cubic Centimeter = 0.061 cubic inch</p> <p>Stere = 0.275 cord (wood)</p>	<p style="text-align: center;">Volume</p> <p>Cubic Yard = 0.764 cubic meter Cubic Foot = 0.028 cubic meter Cubic Inch = 16.387 cubic centimeters Cord = 3.624 steres</p>
<p style="text-align: center;">Capacity</p> <p>Liter = 0.880 Imperial liquid quart or = 1.056 U.S. liquid quarts = 0.908 dry quart = 0.220 Imperial gallon or = 0.264 U.S. gallon</p> <p>Hectoliter = 2.75 English bushels or = 2.837 U.S. bushels</p>	<p style="text-align: center;">Capacity</p> <p>Imperial Liquid Quart = 0.7883 liter U.S. Liquid Quart = 0.946 liter Dry Quart = 1.111 liters Imperial Gallon = 4.543 liters U.S. Gallon = 3.785 liters English Bushel = 0.363 hectoliter U.S. Bushel = 0.352 hectoliter</p>
<p style="text-align: center;">Weight</p> <p>Gram = 15.432 grains = 0.032 troy ounce = 0.0352 avoirdupois ounce</p> <p>Kilogram = 2.2046 pounds avoirdupois</p> <p>Metric Ton = 2204.62 pounds avoirdupois</p> <p>Carat = 3.08 grains avoirdupois</p>	<p style="text-align: center;">Weight</p> <p>Grain = 0.0648 gram Troy Ounce = 31.103 grams Avoirdupois Ounce = 28.35 grams Pound = 0.4536 kilogram Short Ton = 0.907 metric ton</p>

CONVERSION CONSTANTS

To Change	To.....	Multiply By
Inches	Feet	0.0833
Inches	Millimeters	25.4
Feet.....	Inches.....	12
Feet.....	Yards.....	0.3333
Yards	Feet	3
Square inches	Square feet.....	0.00694
Square feet	Square inches.....	144
Square feet	Square yards	0.11111
Square yards.....	Square feet.....	9
Cubic Inches.....	Cubic feet.....	0.00058
Cubic feet.....	Cubic inches	1728
Cubic feet.....	Cubic yards.....	0.03703
Cubic yards	Cubic feet.....	27
Cubic inches.....	Gallons.....	0.00433
Cubic feet.....	Gallons.....	7.48
Gallons	Cubic inches	231
Gallons	Cubic feet.....	0.1337
Gallons	Pounds of water	8.33
Pounds of water.....	Gallons.....	0.12004
Ounces.....	Pounds	0.0625
Pounds.....	Ounces	16
Inches of water.....	Pounds per square inch.....	0.0361
Inches of water.....	Inches of mercury	0.0735
Inches of water.....	Ounces per square inch.....	0.578
Inches of water.....	Pounds per square foot	5.2
Inches of mercury	Inches of water	13.6
Inches of mercury	Feet of water	1.1333
Inches of mercury	Pounds per square inch.....	0.4914
Ounces per square inch	Inches of mercury	0.127
Ounces per square inch	Inches of water	1.733
Pounds per square inch	Inches of water	27.72
Pounds per square inch	Feet of water.....	2.310
Pounds per square inch	Inches of mercury	2.04
Pounds per square inch	Atmospheres.....	0.0681
Feet of water	Pounds per square inch.....	0.434
Feet of water	Pounds per square foot	62.5
Feet of water	Inches of mercury	0.8824
Atmospheres	Pounds per square inch.....	14.696
Atmospheres	Inches of mercury	29.92
Atmospheres	Feet of water	34
Long tons	Pounds	2240
Short tons	Pounds	2000
Short tons	Long tons.....	0.89285

DECIMAL EQUIVALENTS

Fraction		Decimal	Millimeters
	1/64	.01563	0.397
	1/32	.3125	0.794
	3/64	.4688	1.191
1/16		.0625	1.588
	5/64	.07813	1.984
	3/32	.09375	2.381
	7/64	.10938	2.778
1/8		.125	3.175
	9/64	.14063	3.572
	5/32	.15625	3.969
	11/64	.17188	4.366
3/16		.1875	4.763
	13/64	.20313	5.159
	7/32	.21875	5.556
	15/64	.23438	5.953
1/4		.250	6.350
	17/64	.26563	6.747
	9/32	.28125	7.144
	19/64	.29688	7.541
5/16		.3125	7.938
	21/64	.32813	8.334
	11/32	.34375	8.731
	23/64	.35938	9.128
3/8		.375	9.525
	25/64	.39063	9.922
	13/32	.40625	10.319
	27/64	.42188	10.716
7/16		.4375	11.113
	29/64	.45313	11.509
	15/32	.46875	11.906
	31/64	.48438	12.303
1/2		.500	12.700

DECIMAL EQUIVALENTS

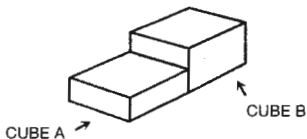
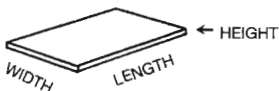
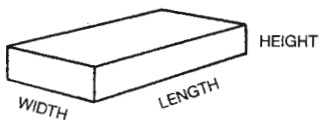
Fraction		Decimal	Millimeters
	33/64	.51563	13.097
	17/32	.53125	13.494
	35/64	.54688	13.891
9/16		.5625	14.288
	37/64	.57813	14.684
	19/32	.59375	15.081
	39/64	.60938	15.478
5/8		.625	15.875
	41/64	.64063	16.272
	21/32	.65625	16.669
	43/64	.67188	17.066
11/16		.6875	17.463
	45/64	.70313	17.859
	23/32	.71875	18.256
	47/64	.73438	18.653
3/4		.750	19.050
	49/64	.76563	19.447
	25/32	.78125	19.844
	51/64	.79688	20.241
13/16		.8125	20.638
	53/64	.82813	21.034
	27/32	.84375	21.431
	55/64	.85938	21.828
7/8		.875	22.225
	57/64	.89063	22.622
	29/32	.90625	23.019
	59/64	.92188	23.416
15/16		.9375	23.813
	61/64	.95313	24.209
	31/32	.96875	24.606
	63/64	.98438	25.003
1		1.00000	25.400

CALCULATING WEIGHTS

PRINCIPLES

CUBES

$$\begin{aligned}\text{WEIGHT} &= \text{volume} \times \text{unit weight} \\ &= \text{length} \times \text{width} \times \text{height} \\ &\quad \times \text{unit weight}\end{aligned}$$



CYLINDERS

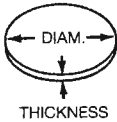
$$\begin{aligned}\text{WEIGHT} &= \text{volume} \times \text{unit weight} \\ &= 3.14 \times \frac{\text{diam.} \times \text{diam.}}{4} \\ &\quad \times \text{length} \times \text{unit weight}\end{aligned}$$



CALCULATING WEIGHTS

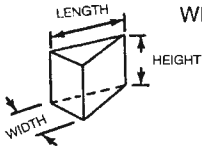
PRINCIPLES (cont.)

ROUND PLATES



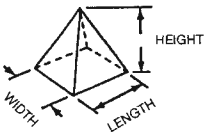
$$\text{WEIGHT} = \frac{3.14 \times \text{diam.} \times \text{diam.}}{4} \times \text{thickness} \times \text{unit weight}$$

WEDGE

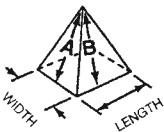


$$\text{WEIGHT} = \frac{\text{width} \times \text{length}}{2} \times \text{height} \times \text{unit weight}$$

PYRAMID



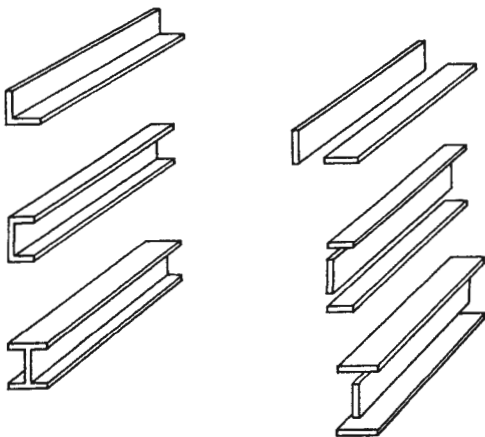
$$\begin{aligned} \text{WEIGHT solid} &= \frac{\text{width} \times \text{length}}{3} \times \text{height} \times \text{unit weight} \end{aligned}$$



$$\begin{aligned} \text{WEIGHT hollow (without a base)} &= (\text{A} \times \text{width} + \text{B} \times \text{length}) \times \text{thickness} \times \text{unit weight} \end{aligned}$$

STRUCTURAL SHAPES

CALCULATE WEIGHT OF EACH PART AND
ADD THEM



OR

OBTAIN WEIGHT PER FOOT FOR ANGLES,
CHANNELS, BEAMS FROM A STEEL HANDBOOK

For reinforcing rods

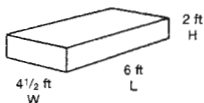
CALCULATE AS A CYLINDER OR
SEE A STEEL HANDBOOK

CALCULATING WEIGHTS

EXAMPLES

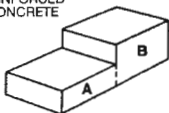
CUBES

WEIGHT



$$\begin{aligned} &= L \times W \times H \times \text{unit weight} \\ &= 6' \times 4\frac{1}{2}' \times 2' \times 150 \text{ lbs} \\ &= 8,100 \text{ lbs} \end{aligned}$$

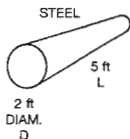
REINFORCED
CONCRETE



Calculate each cube (A&B)
and add.

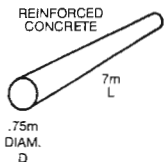
CYLINDERS

WEIGHT



$$\begin{aligned} &= 3.14 \times \frac{D \times D}{4} \times L \times \text{unit weight} \\ &= 3.14 \times \frac{2' \times 2'}{4} \times 5' \times 490 \text{ lbs} \\ &= 7,693 \text{ lbs} \end{aligned}$$

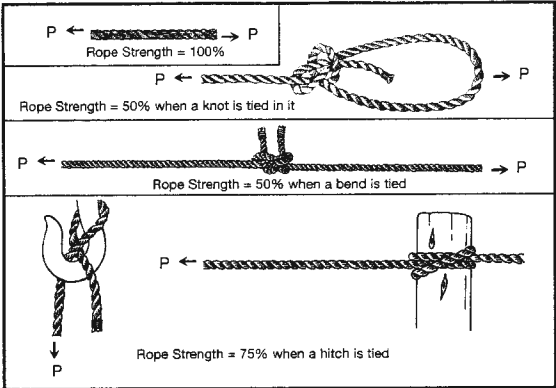
WEIGHT



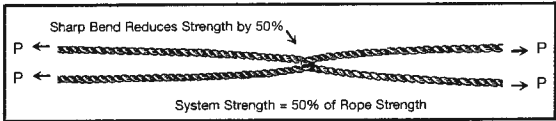
$$\begin{aligned} &= 3.14 \times \frac{D \times D}{4} \times L \times \text{unit weight} \\ &= 3.14 \times \frac{.75\text{m} \times .75\text{m}}{4} \times 7\text{m} \times 2,400 \text{ kgs} \\ &= 7,420 \text{ kgs} \end{aligned}$$

FIBER ROPE KNOTS

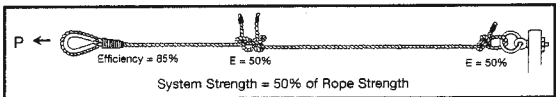
Effect of Knots, Bends and Hitches on Rope Strength



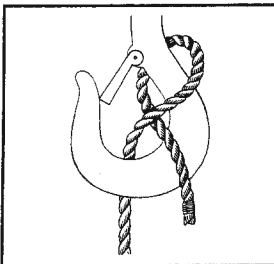
Capacity of 2 Ropes Looped Together



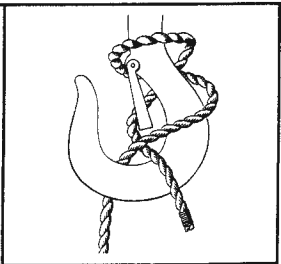
System Strength When a Series of Knots and Splices are Tied



Blackwall Hitch

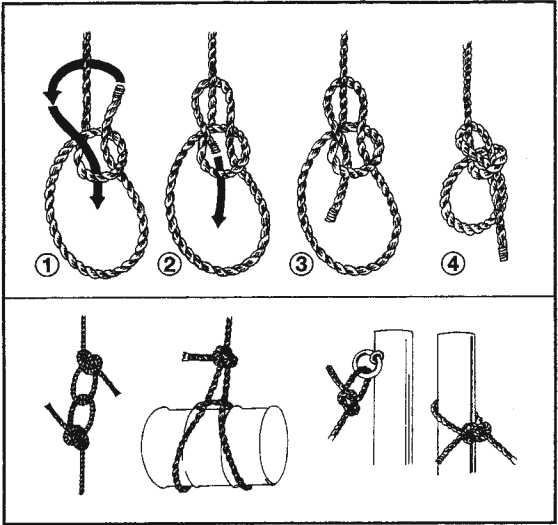


Double Blackwall Hitch

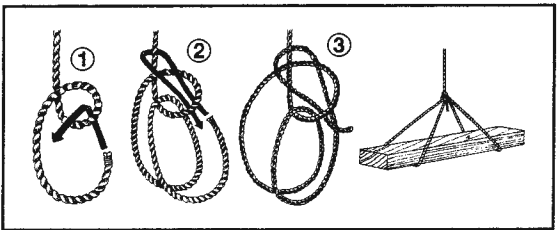


FIBER ROPE KNOTS

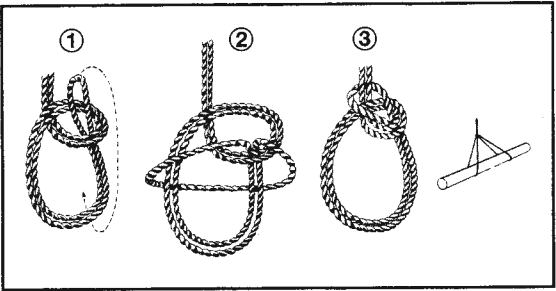
Bowline



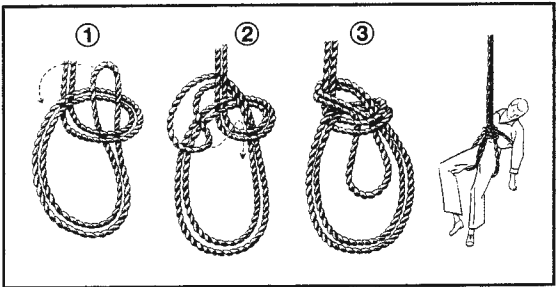
Double Bowline



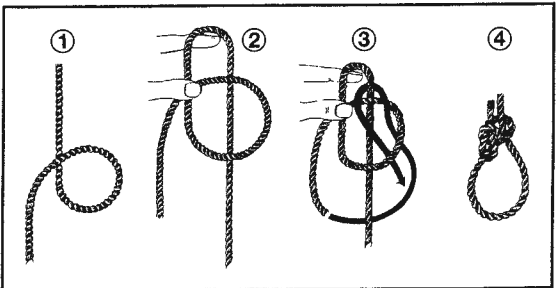
Bowline on the Right



Triple Bowline

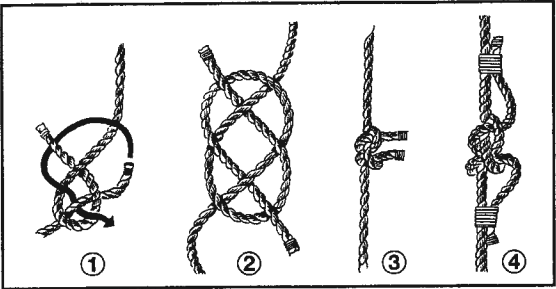


Running Bowline

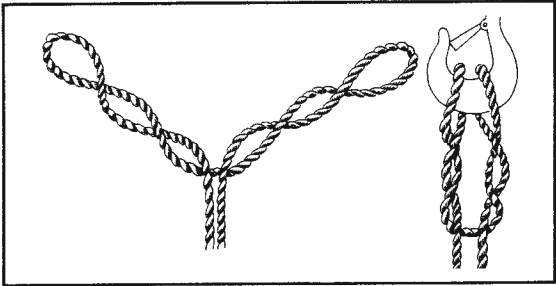


FIBER ROPE KNOTS

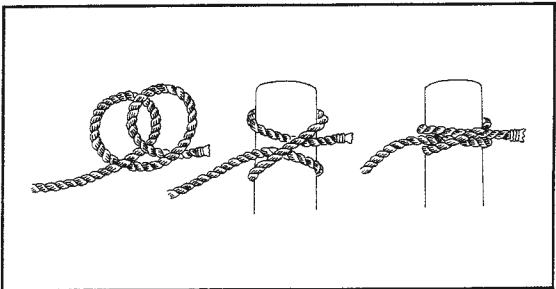
Carrick Bend



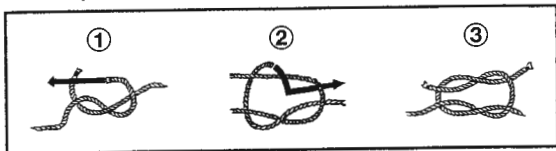
Cat's Paw



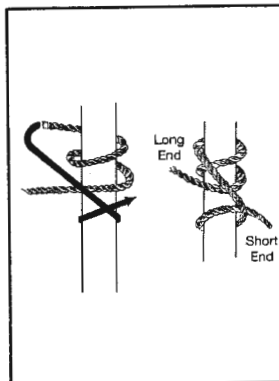
Clove Hitch



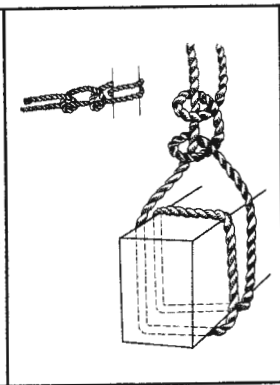
Reef or Square Knot



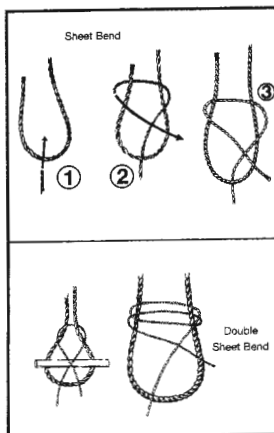
Rolling Hitch



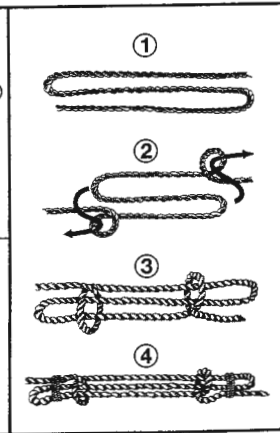
Round Turn & Two Half-Hitches



Sheet Bend

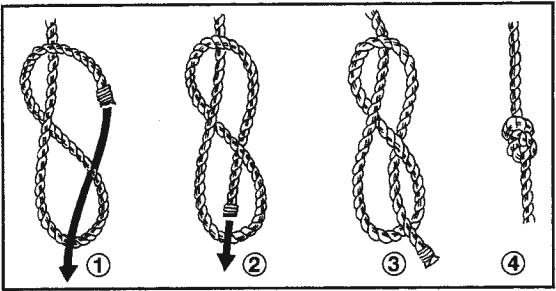


Sheepshank

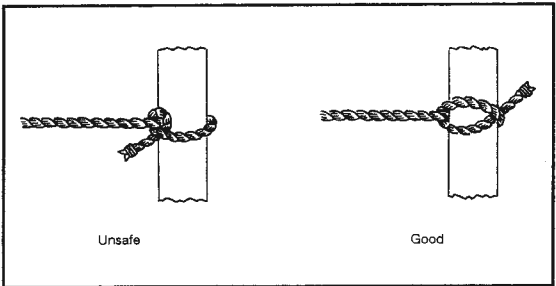


FIBER ROPE KNOTS

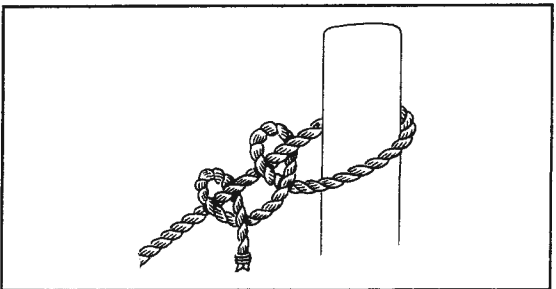
Figure Eight Knot



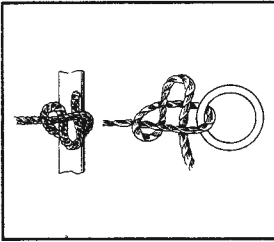
Half-Hitch



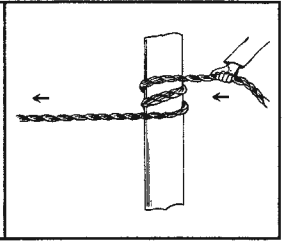
Two Half-Hitches



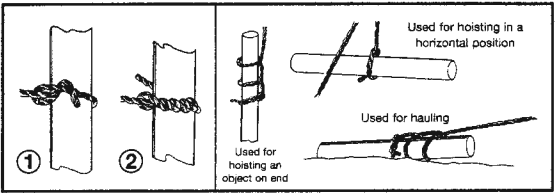
Slippery Hitch



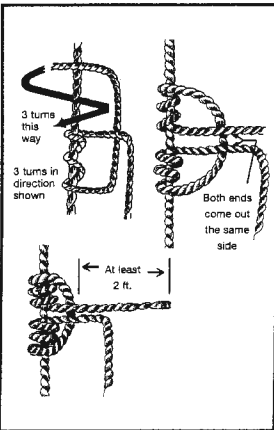
Snubber



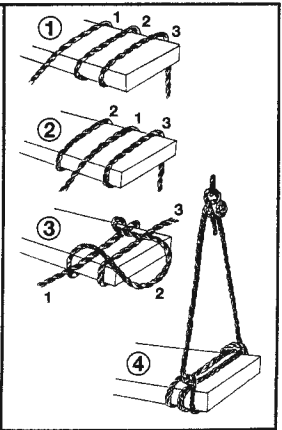
Timber Hitch



Triple Sliding Hitch








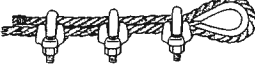
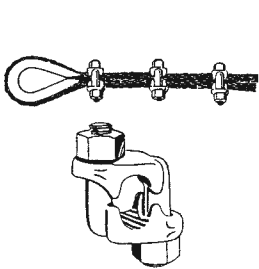
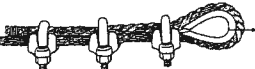
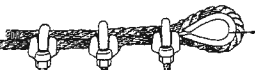
Scaffold Hitch



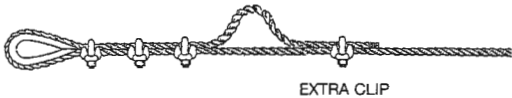
WIRE ROPE INFORMATION

Right and Wrong Ways of Using Cable Clips

Proper Method of Installing Cable Clips

 <p>Correct U-Bolt of all clips on dead end of rope</p>	<p>Step 1</p>  <p>APPLY FIRST CLIP — one base width from dead end of wire rope — U-Bolt over dead end — live end rests in clip saddle. Tighten nuts evenly to recommended torque.</p>
 <p>Incorrect Do not stagger clips</p>	<p>Step 2</p>  <p>APPLY SECOND CLIP — nearest loop as possible — U-Bolt over dead end — turn on nuts firm but DO NOT TIGHTEN.</p>
 <p>Incorrect U-Bolt of all clips on live end of rope</p>	<p>Step 3</p>  <p>ALL OTHER CLIPS — Space equally between first time.</p>
<p>Double Saddle Clips (Fist Grip Clips)</p> 	<p>Step 4</p>  <p>Apply tension and tighten all nuts to recommended torque.</p> <p>Step 5</p>  <p>Recheck nut torque after rope has been in operation.</p>

An extra "warning" safety clip can be added to the splice as shown below. If the loop flattens, the holding clips have slipped.



Number of clips and torque in accordance with the procedures recommended by clip manufacturer.

Wire Rope Splicing Procedures:

The preferred method of splicing two wire ropes together is to use interlocking turnback eyes with thimbles, using the recommended number of clips on each eye (see Figure 1).

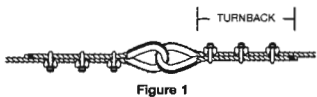


Figure 1

An alternate method is to use twice the number of clips as used for a turnback termination. The rope ends are placed parallel to each other, overlapping by twice the turnback amount shown in the application instructions. The minimum number of clips should be installed on each dead end (see Figure 2). Spacing, installation, torque and other instructions still apply.

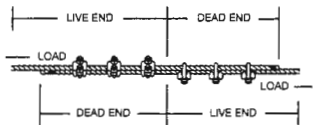
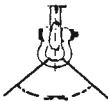



Figure 2

SHACKLES			Quenched and Tempered	
Screw Pin and Bolt Type	Carbon Shackle Design Factor 6/7	Carbon Shackle Design Factor 5/7		
Nominal Size (In) Diameter of Bows	Carbon Maximum Working Load Tons	Alloy Maximum Working Load Tons	Inside Width at Pin (Inches)	Diameter of Pin
3/16	1/3		.38	.25
1/4	1/2		.47	.31
5/16	3/4		.53	.38
3/8	1	2	.66	.44
7/16	1 1/2	2.8	.75	.50
1/2	2	3.3	.81	.63
5/8	3 1/4	5	1.06	.75
3/4	4 3/4	7	1.25	.88
7/8	6 1/2	9.5	1.44	1.00
1	8 1/2	12.5	1.59	1.13
1 1/8	9 1/2	15	1.81	1.25
1 1/4	12	18	2.003	1.38
1 3/8	13 1/2	21	2.25	1.50
1 1/2	17	30	2.38	1.63

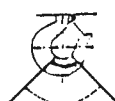


MAXIMUM INCLUDED ANGLE 120 DEGREES


QUIC-CHECK



HOOKS				Quenched and Tempered	
Shank Hook, Swivel Hook, Eye Hook		Design Factor			
Carbon Maximum Working Load Tons	Code	Alloy Maximum Working Load Tons	Code	Throat Opening (Inches)	Deformation Indication A - A
3/4	DC	1	DA	.88	1.50
1	FC	1 1/2	FA	.97	1.50
1 1/2	GC	2	GA	1.00	2.00
2	HC	3	HA	1.12	2.00
3	IC	4 1/2	IA	1.06	2.50
5	JC	7	JA	1.50	3.00
7 1/2	KC	11	KA	1.75	4.00
10	LC	15	LA	1.91	4.00
15	NC	22	NA	2.75	5.00
20	OC	30	OA	3.25	6.50
25	PC	37	PA	3.00	7.00
30	SC	45	SA	3.08	8.00
40	TC	60	TC	4.12	10.00




MAXIMUM INCLUDED ANGLE 90 DEGREES



EYE HOOK

QUIC-CHECK

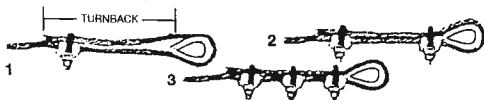


WIRE ROPE CLIPS



Size	Efficiency	Number of Clips	Turnback Length (Inches)	Torque Ft - Lbs.
1/8	80%	2	3 1/4	4.5
3/16	80%	2	3 3/4	7.5
1/4	80%	2	4 3/4	15
5/16	80%	2	5 1/4	30
3/8	80%	2	6 1/2	45
7/16	80%	2	7	65
1/2	80%	3	11 1/2	85
9/16	80%	3	12	95
5/8	80%	3	12	95
3/4	80%	4	18	130
1	90%	5	26	225

- Apply U-Bolt over dead end of the wire rope. • Live end of the rope rests in the saddle.
- A termination is not complete until it has been retorqued a second time.
- **Never saddle a dead horse!**

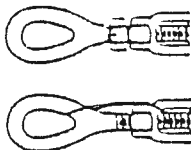


TURNBUCKLE



Size	Working Load Limit — Jaw and Eye Fittings — 5/1 Design Factor	Working Load Limit — Hook End Fitting — 5/1 Design Factor (Lbs.)
1/4	500	400
5/16	800	700
3/8	1200	1000
1/2	2200	1500
5/8	3500	2250
3/4	5200	3000
7/8	7200	4000
1	10000	5000
1 1/4	15200	5000
1 1/2	21400	7500

The use of locknuts or mousing is an effective method of preventing turnbuckles from rotating.



Chain Slings

(Alloy Steel)

MAXIMUM SAFE WORKING LOADS — POUNDS

Chain
Size
(Inches)

Single
Vertical
Hitch



Single
Choker
Hitch



Single
Basket
Hitch
(Vertical
Legs)



2-Leg Bridle Hitch
& Single Basket Hitch
With Legs Inclined



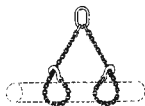
60°

45°

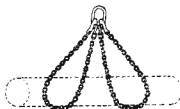
30°

1/4	3,250	2,440	6,500	5,600	4,600	3,250
3/8	6,600	4,950	13,200	11,400	9,300	6,600
1/2	11,250	8,400	22,500	19,500	15,900	11,250
5/8	16,500	12,400	33,000	28,600	23,300	16,500
3/4	23,000	17,200	46,000	39,800	32,500	23,000
7/8	28,750	21,500	57,500	49,800	40,600	28,750
1	38,750	29,000	77,500	67,100	54,800	38,750
1 1/8	44,500	33,400	89,000	77,000	63,000	44,500
1 1/4	57,500	43,000	115,000	99,500	81,000	57,500
1 3/8	67,000	50,000	134,000	116,000	94,500	67,000
1 1/2	80,000	60,000	160,000	138,000	113,000	80,000
1 3/4	100,000	75,000	200,000	173,000	141,000	100,000

If used with Choker Hitch
multiply above values by 3/4.





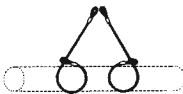



For Double Basket Hitch
multiply above values by 2.



Wire Rope Slings

6 × 37 Classification Group, Improved Plow Steel, Fiber Core









Rope Diameter (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (Safety Factor = 5)					
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined		
						
			60°	45°	30°	
1/4	1,000	750	2,000	1,750	1,400	1,000
5/16	1,600	1,200	3,200	2,750	2,250	1,600
3/8	2,200	1,650	4,400	3,800	3,100	2,200
7/16	3,000	2,250	6,000	5,200	4,250	3,000
1/2	4,000	3,000	8,000	6,900	5,650	4,000
9/16	5,000	3,750	10,000	8,650	7,100	5,000
5/8	6,400	4,800	12,800	11,100	9,050	6,400
3/4	8,900	6,700	17,800	15,400	12,600	8,900
7/8	12,100	9,100	24,200	21,000	17,100	12,100
1	15,800	11,900	31,600	27,400	22,300	15,800
1 1/8	19,600	14,700	39,200	33,900	27,700	19,600
1 1/4	24,400	18,300	48,800	42,300	34,500	24,400
1 3/8	29,800	22,400	59,600	51,600	42,100	29,800
1 1/2	36,000	27,000	72,000	62,400	50,900	36,000
1 5/8	42,200	31,700	84,400	73,100	59,700	42,200
1 3/4	48,400	36,300	96,800	83,800	68,400	48,400
1 7/8	56,800	42,600	113,600	98,400	80,300	56,800
2	62,000	46,500	124,000	107,400	87,700	62,000
2 1/4	80,400	60,300	160,800	139,300	113,700	80,400
2 1/2	98,000	73,500	198,000	169,700	138,600	98,000
2 3/4	117,200	87,900	234,400	203,000	165,700	117,200
				If used with Choker Hitch multiply above values by 3/4.  For Double Basket Hitch multiply above values by 2. 		

Note: Table values are for slings with eyes and thimbles in both ends, Flemish Spliced Eyes and mechanical sleeves.

Hand tucked spliced eyes — reduce loads according to table 1.11, page 47.
 Eyes formed by cable clips — reduce loads by 20%.

Wire Rope Slings

6 × 19 Classification Group, Improved Plow Steel, Fiber Core






Rope Diameter (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (Safety Factor = 5)						
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined			
							
			60°	45°	30°		
3/16	600	450	1,200	1,050	850	600	
1/4	1,100	825	2,200	1,900	1,550	1,100	
5/16	1,650	1,250	3,300	2,850	2,350	1,650	
3/8	2,400	1,800	4,800	4,150	3,400	2,400	
7/16	3,200	2,400	6,400	5,550	4,500	3,200	
1/2	4,400	3,300	8,800	7,600	6,200	4,400	
9/16	5,300	4,000	10,600	9,200	7,500	5,300	
5/8	6,600	4,950	13,200	11,400	9,350	6,600	
3/4	9,500	7,100	19,000	16,500	13,400	9,500	
7/8	12,800	9,600	25,600	22,200	18,100	12,800	
1	16,700	12,500	33,400	28,900	23,600	16,700	
1 1/8	21,200	15,900	42,400	36,700	30,000	21,200	
1 1/4	26,200	19,700	52,400	45,400	37,000	26,200	
1 3/8	32,400	24,300	64,800	56,100	45,800	32,400	
1 1/2	38,400	28,800	76,800	66,500	54,300	38,400	
1 5/8	45,200	33,900	90,400	78,300	63,900	45,200	
1 3/4	52,000	39,000	104,000	90,000	73,500	52,000	
1 7/8	60,800	45,600	121,600	105,300	86,000	60,800	
2	67,600	50,700	135,200	117,100	95,600	67,600	
2 1/4	84,000	63,000	168,000	145,500	118,800	84,000	
2 1/2	104,000	78,000	208,000	180,100	147,000	104,000	
2 3/4	122,000	91,500	244,000	211,300	172,500	122,000	
				If used with Choker Hitch multiply above values by 3/4.			
							
				For Double Basket Hitch multiply above values by 2.			
							

Note: Table values are for slings with eyes and thimbles in both ends, Flemish Spliced Eyes and mechanical sleeves.


Hand tucked spliced eyes — reduce loads according to table 1.11, page 47.
 Eyes formed by cable clips — reduce loads by 20%.

Wire Rope Slings


6 × 19 Classification Group, Improved Plow Steel, IWRC

Rope Diameter (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (Safety Factor = 5)					
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined		
						
			60°	45°	30°	
3/16	650	480	1,300	1,100	900	650
1/4	1,150	860	2,300	2,000	1,600	1,150
5/16	1,750	1,300	3,500	3,000	2,500	1,750
3/8	2,550	1,900	5,100	4,400	3,800	2,550
7/16	3,450	2,600	6,900	6,000	4,900	3,450
1/2	4,700	3,500	9,400	8,150	6,650	4,700
9/16	5,700	4,200	11,400	9,900	8,050	5,700
5/8	7,100	5,300	14,200	12,300	10,000	7,100
3/4	10,200	7,650	20,400	17,700	14,400	10,200
7/8	13,750	10,300	27,500	23,800	19,400	13,750
1	17,950	13,450	35,900	31,100	25,400	17,950
1 1/8	22,750	17,000	45,500	39,400	32,200	22,750
1 1/4	28,200	21,200	56,400	48,800	39,900	28,200
1 3/8	34,800	26,100	69,600	60,300	49,200	34,800
1 1/2	41,300	31,000	82,600	71,500	58,400	41,300
1 5/8	48,600	36,400	97,200	84,200	68,700	48,600
1 3/4	55,900	41,900	111,800	96,800	79,000	55,900
1 7/8	65,400	49,000	130,800	113,300	92,500	65,400
2	72,600	54,500	145,200	125,700	102,700	72,600
2 1/4	90,300	67,600	180,600	156,400	127,700	90,300
2 1/2	111,800	83,700	223,600	193,600	158,100	111,800
2 3/4	131,100	98,200	262,200	227,000	185,400	131,100

If used with Choker Hitch multiply above values by 3/4.



For Double Basket Hitch multiply above values by 2.









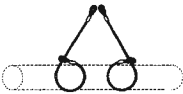
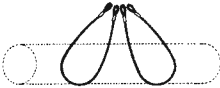
Note: Table values are for slings with eyes and thimbles in both ends, Flemish Spliced Eyes and mechanical sleeves.

Hand tucked spliced eyes — reduce loads according to table 1.11, page 47.

Eyes formed by cable clips — reduce loads by 20%.

Wire Rope Slings

6 × 37 Classification Group, Improved Plow Steel, IWRC









Rope Diameter (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (Safety Factor = 5)						
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined			
							
			60°	45°	30°		
1/4	1,050	800	2,100	1,800	1,500	1,050	
5/16	1,700	1,300	3,400	2,950	2,400	1,700	
3/8	2,350	1,750	4,700	4,100	3,300	2,350	
7/16	3,200	2,400	6,400	5,550	4,500	3,700	
1/2	4,300	3,200	8,600	7,450	6,100	4,300	
9/16	5,350	4,000	10,700	9,250	7,550	5,350	
5/8	6,900	5,200	13,800	11,950	9,750	6,900	
3/4	9,500	7,100	19,000	16,450	13,400	9,500	
7/8	13,000	9,750	26,000	22,500	18,400	13,000	
1	17,000	12,750	34,000	29,450	24,000	17,000	
1 1/8	21,000	15,750	42,000	36,400	29,700	21,000	
1 1/4	26,200	19,650	52,400	45,400	37,000	26,200	
1 3/8	32,000	24,000	64,000	55,400	45,200	32,000	
1 1/2	39,500	29,600	79,000	68,400	55,900	39,500	
1 5/8	45,400	34,000	90,800	78,600	64,200	45,400	
1 3/4	52,000	39,000	104,000	90,000	73,500	52,000	
1 7/8	61,000	45,750	122,000	105,700	86,300	61,000	
2	66,600	49,950	133,200	115,400	94,200	66,600	
2 1/4	86,400	64,800	172,800	149,600	122,200	86,400	
2 1/2	105,300	79,000	210,600	182,400	148,900	105,300	
2 3/4	126,000	94,500	252,000	218,200	178,200	126,000	
<p>If used with Choker Hitch multiply above values by 3/4.</p>  <p>For Double Basket Hitch multiply above values by 2.</p> 							

Note: Table values are for slings with eyes and thimbles in both ends, Flemish Spliced Eyes and mechanical sleeves.

Hand tucked spliced eyes — reduce loads according to table 1.11, page 47.
 Eyes formed by cable clips — reduce loads by 20%.

Braided Wire Rope Slings

6-Part Braided Rope • 6 × 19 Classification Group, Improved Plow Steel





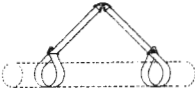

Component Rope Diameter (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (Safety Factor = 5)						
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined			
							
			60°	45°	30°		
3/16	2,600	1,950	5,200	4,500	3,700	2,600	
1/4	4,600	3,450	9,200	7,950	6,500	4,600	
5/16	7,200	5,400	14,400	12,500	10,200	7,200	
3/8	10,200	7,650	20,400	17,700	14,400	10,200	
7/16	13,800	10,400	27,600	23,900	19,500	13,800	
1/2	18,000	13,500	36,000	31,200	25,500	18,000	
9/16	22,000	16,500	44,000	38,100	31,100	22,000	
5/8	28,000	21,000	56,000	48,500	39,600	28,000	
3/4	40,000	30,000	80,000	69,300	56,600	40,000	
7/8	54,000	40,500	108,000	93,500	76,400	54,000	
1	70,000	52,500	140,000	121,200	99,000	70,000	
				If used with Choker Hitch multiply above values by 3/4.			
							
				For Double Basket Hitch multiply above values by 2.			
							

Note: Table values are for braided slings with eyes and thimbles in both ends. Eyes formed by hand tucking ropes and securing with mechanical sleeves.

Nylon Web Slings

(8000 lb/in Material)

MAXIMUM SAFE WORKING LOADS — Pounds (SAFETY FACTOR = 5)
(Eye & Eye, Twisted Eye, Triangle Fittings, Choker Fittings)







Web Width (Inches)	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined		
						
				60°	45°	30°
1	1,600	1,200	3,200	2,770	2,260	1,600
2	3,200	2,400	6,400	5,550	4,520	3,200
3	4,800	3,600	9,600	8,300	6,800	4,800
4	6,400	4,800	12,800	11,100	9,050	6,400
5	8,000	6,000	16,000	13,850	11,300	8,000
6	9,600	7,200	19,200	16,600	13,600	9,600
7	11,200	8,400	22,400	19,400	15,800	11,200
8	12,800	9,600	25,600	22,200	18,100	12,800
9	14,400	10,800	28,800	25,000	20,400	14,400
10	16,000	12,000	32,000	27,700	22,600	16,000
11	17,600	13,200	35,200	30,500	24,900	17,600
12	19,200	14,400	38,400	33,300	27,200	19,200
				<p>If used with Choker Hitch multiply above values by 3/4.</p>  <p>For Double Basket Hitch multiply above values by 2.</p> 		

Note: For safe Working Loads of Endless or Grommet Slings, Multiply Above Values by 2.

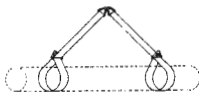
Nylon Web Slings

(6000 lb/in Material)

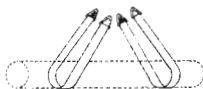
MAXIMUM SAFE WORKING LOADS — Pounds (SAFETY FACTOR = 5)
(Eye & Eye, Twisted Eye, Triangle Fittings, Choker Fittings)

Web Width (Inches)	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined		
						
				60°	45°	30°
1	1,200	900	2,400	2,080	1,700	1,200
2	2,400	1,800	4,800	4,160	3,400	2,400
3	3,600	2,700	7,200	6,240	5,100	3,600
4	4,800	3,600	9,600	8,300	6,800	4,800
5	6,000	4,500	12,000	10,400	8,500	6,000
6	7,200	5,400	14,400	12,500	10,200	7,200
7	8,400	6,300	16,800	14,550	11,900	8,400
8	9,600	7,200	19,200	16,600	13,600	9,600
9	10,800	8,100	21,600	18,700	15,300	10,800
10	12,000	9,000	24,000	20,800	17,000	12,000
11	13,200	9,900	26,400	22,900	18,650	13,200
12	14,400	10,800	28,800	25,000	20,400	14,400

If used with Choker Hitch multiply above values by 3/4.



For Double Basket Hitch multiply above values by 2.



Note: For safe Working Loads of Endless or Grommet Slings, Multiply Above Values by 2.

WRENCH/DRILL SIZES FOR PIPE TAPS/TAP & DRILL SIZES

WRENCH SIZES					
BOLT DIAM	WRENCH SIZE		BOLT DIAM	WRENCH SIZE	
½	7/8		1 5/8	2 9/16	
5/8	1 1/16		1 ¾	2 ¾	
¾	1 ¼		1 7/8	2 15/16	
7/8	1 7/16		2	3 1/8	
1	1 5/8		2 ¼	3 ½	
1 1/8	1 11/16		2 ½	3 7/8	
1 ¼	2		2 ¾	4 ¼	
1 3/8	2 3/16		3	4 5/8	
1 1/2	2 3/8		3 ½	5 3/8	

DRILL SIZES FOR PIPE TAPS						
Size of Tap in Inches	No. of Threads Per Inch	Diam. Of Drill		Size of Tap in Inches	No. of Threads Per Inch	Diam. Of Drill
1/8	27	11/32		2	11 ½	2 3/16
¼	18	7/16		2 ½	8	2 9/16
3/8	18	37/64		3	8	3 3/16
½	14	23/32		3 ½	8	3 11/16
¾	14	59/64		4	8	4 3/16
1	11 ½	1 5/32		4 ½	8	4 ¾
1 ¼	11 ½	1 ½		5	8	5 5/16
1 ½	11 ½	1 49/64		6	8	6 5/16

TAP AND DRILL SIZES (American Standard Coarse)						
Size of Drill	Size of Tap	Threads Per Inch		Size of Drill	Size of Tap	Threads Per Inch
7	¼	20		49/64	7/8	9
F	5/16	18		53/64	15/16	9
15/16	3/8	16		7/8	1	8
U	7/16	14		63/64	1 1/8	7
27/64	½	13		1 7/64	1 ¼	7
31/64	9/16	12		1 13/64	1 3/8	6
17/32	5/8	11		1 11/32	1 1/2	6
19/32	11/16	11		1 29/64	1 5/8	5 ½
21/32	¾	10		1 9/16	1 ¾	5
23/32	13/16	10	1	1 11/16	1 7/8	5
				1 25/32	2	4 ½

SERIES 150 FLANGE

Pipe Size	Flange Bolts		Raised Face				Ring Joint		Ring Gap
			Length		Gasket		Stud Length	Ring No.	
	Qty.	Size	Stud	Mach.	I.D.	O.D.			
½	4	½	2 ¼	1 ¾	5/8	1 7/8			
¾	4	½	2 ¼	2	13/16	2 ¼			
1	4	½	2 ½	2	1	2 5/8	3	R-15	5/32
1 ¼	4	½	2 ½	2 ¼	13	3	3	R-17	-
1 ½	4	½	2 ¾	2 ¼	1 5/8	3 3/8	3 ¾	R-19	-
2	4	5/8	3	2 ¾	2	4 1/8	3 ½	R-22	-
2 ½	4	5/8	3 ¼	3	2 ½	4 7/8	3 ¾	R-28	-
3	4	5/8	3 ½	3	3	5 3/8	4	R-29	-
3 ½	8	5/8	3 ½	3	3 ½	6 3/8	4	R-33	-
4	8	5/8	3 ½	3	4	9 7/8	4	R-36	-
5	8	¾	3 ¾	3 ¼	5	7 ¾	4 ¼	R-40	-
6	8	¾	3 ¾	3 ¼	6	8 ¾	4 ¼	R-43	-
8	8	¾	4	3 ½	8	11	4 ½	R-48	-
10	12	7/8	4 ½	3 ¾	10	13 3/8	5	R-52	-
12	12	7/8	4 ½	4	12	16 1/8	5	R-56	-
14	12	1	5	4 ¼	13 ¼	17 ¾	5 ½	R-59	1/8
16	16	1	5 ¼	4 ½	15 ¼	20 ¼	5 ¾	R-64	-
18	16	1 1/8	5 ¾	4 ¾	17 ¼	21 5/8	6 ¼	R-68	-
20	20	1 1/8	6	5 ¼	19 ¼	23 7/8	6 ¼	R-72	-
22	20	1 ¼	6 ½	5 ½	21 ¼	26	7	R-80	
24	20	1 1/4	6 ¾	5 3/4	23 ¼	26 ¼	7 1/4	R-76	

SERIES 300 FLANGE

Pipe Size	Flange Bolts		Raised Face				Ring Joint		Ring Gap
			Length		Gasket		Stud Length	Ring No.	
	Qty.	Size	Stud	Mach.	I.D.	O.D.			
½	4	½	2 ½	2	5/8	2 ½	3	R-11	1/5
¾	4	5/8	2 ¾	2 ½	13/16	2 5/8	3 ¼	R-13	5/32
1	4	5/8	3	2 ½	1	2 7/8	3 ½	R-16	-
1 ¼	4	5/8	3	2 ¾	1 5/8	3 ¼	3 ½	R-18	-
1 ½	4	¾	3 ½	3	1 5/8	3 ¾	4	R-20	-
2	8	5/8	3 ¼	3	2	4 3	4	R-23	7/32
2 ½	8	¾	3 ¾	3 ¼	2 ½	5 1/8	4 ½	R-26	-
3	8	¾	4	3 ½	3	5 7/5	4 ¾	R-31	-
3 ½	8	¾	4 ¼	3 ¾	3 ½	6 ½	5	R-34	-
4	8	¾	4 ¼	3 ¾	4	7 ½	5	R-37	-
5	8	¾	4 ½	4	5	8 ½	5 ¼	R-41	-
6	12	¾	4 ¾	4 ½	6	9 7/8	5 ½	R-45	-
8	12	7/8	5 ¼	4 ¾	8	12 1/8	6	R-49	-
10	16	1	6	5 ¼	10	14 ¼	6 ¾	R-53	-
12	16	1 1/8	6 ½	5 ¾	12	16 5/8	7 ¼	R-57	-
14	20	1 1/8	6 ¾	6	13 ¼	19 1/8	7 ½	R-61	-
16	20	1 ¼	7 ¼	6 ½	15 ¼	21 ¼	8	R-65	-
18	24	1 ¼	7 ½	6 ¾	17	23 ½	8 ¼	R-69	-
20	24	1 ¼	8	7	19	25 ¾	8 ¾	R-73	-
22	24	1 ½	8 ¾	7 ½	21	27 ¾	9 ¾	R-81	-
24	24	1 ½	9	7 ¾	23	30 1/2	10	R-77	-

SERIES 400 FLANGES

Pipe Size	Flange Bolts		Stud Bolt Length			Ring No.	Ring Gap
	Qty.	Size	Raised Face	Male & Female Tongue & Groove	Ring Joint		
4	8	7/8	5 ¼	5	5 ½	R-37	7/32
5	8	7/8	5 ½	5 ¼	5 ¾	R-41	-
6	12	7/8	5 ¾	5 ½	6	R-45	-
8	12	1	6 ½	6 ¼	6 ¾	R-49	-
10	16	1 1/8	7 ¼	7	7 ½	R-53	-
12	16	1 ¼	7 ¾	7 ½	8	R-57	-
14	20	1 ¼	8	7 ¾	8 ¼	R-61	-
16	20	1 3/8	8 ½	8 ¼	8 ¾	R-65	-
18	24	1 3/8	8 ¾	8 ½	9	R-69	-
20	24	1 ½	9 ½	9 ¼	9 ¾	R-73	-
22	24	1 5/8	10	9 ¾	10 ½	R-81	3/16
24	24	1 3/4	10 ½	10 ¼	11	R-77	1/4

* Series 300, 400 & 600 use same ring numbers.

SERIES 600 FLANGES

Pipe Size	Flange Bolts		Stud Bolt Length			Ring No.	Ring Gap
	Qty.	Size	Raised Face	Male & Female Tongue & Groove	Ring Joint		
½	4	½	3	2 ¾	3	R-11	1/8
¾	4	5/8	3 ¼	3	3 ¼	R-13	5/32
1	4	5/8	3 ½	3 ¼	3 ½	R-16	-
1 ¼	4	5/8	3 ¾	3 ½	3 ¾	R-18	-
1 ½	4	¾	4	3 ¾	4	R-20	-
2	8	5/8	4	3 ¾	4 ½	R-23	1/16
2 ½	8	¾	4 ½	4 ¼	4 ¾	R-26	-
3	8	¾	4 ¾	4 ½	5	R-31	-
3 ½	8	7/8	5 ¼	5	5 ½	R-34	-
4	8	7/8	5 ½	5 ¼	5 ¾	R-37	-
5	8	1	6 ¼	6	6 ½	R-41	-
6	12	1	6 ½	6 ¼	6 ¾	R-45	-
8	12	1 1/8	7 ½	7 ¼	7 ¾	R-49	-
10	16	1 ¼	8 ¼	8	8 ½	R-53	-
12	20	1 ¼	8 ½	8 ¼	8 ¾	R-57	-
14	20	1 3/8	9	8 ¾	9 ¼	R-61	-
16	20	1 ½	9 ¾	9 ½	10	R-65	-
18	20	1 5/8	10 ½	10 ¼	10 ¾	R-69	-
20	24	1 5/8	11 ¼	11	11 ½	R-73	-
22	24	1 ¾	12	11 ¾	12 ½	R-81	-
24	24	1 7/8	12 ¾	12 1/2	13 1/4	R-77	7/32

* Series 300, 400 & 600 use same ring numbers.

SERIES 900 FLANGES

Pipe Size	Flange Bolts		Raised Face	Stud Bolt Length		Ring Joint	Ring No.	Ring Gap
	Qty.	Size		Male & Female Tongue & Groove				
	2	8	7/8	5 ½	5 ¼	5 ¾	R-31	5/32
4	8	1 1/8	6 ½	6 ¼	6 ¾	R-37	-	
5	8	1 ¼	7 ¼	7	7 ½	R-41	-	
6	12	1 1/8	7 ½	7 ¼	7 ½	R-45	-	
8	12	1 3/8	8 ½	8 ¼	8 ¾	R-49	-	
10	16	1 3/8	9	8 ¾	9 ¼	R-53	-	
12	20	1 3/8	9 ¾	9 ½	10	R-57	-	
14	20	1 ½	10 ½	10 ¼	11	R-62	-	
16	20	1 5/8	11	10 ¾	11 ½	R-66	-	
18	20	1 7/8	12 ¾	12 ½	13 ¼	R-70	3/16	
20	20	2	13 ½	13 ¼	14	R-74	-	
24	20	2 1/2	17	16 3/4	17 3/4	R-78	-	

SERIES 1500 FLANGE

Pipe Size	Flange Bolts		Raised Face	Stud Bolt Length		Ring Joint	Ring No.	Ring Gap
	Qty.	Size		Male & Female Tongue & Groove	Ring			
½	4	¾	4	3 ¾	4	R-12	5/32	
¾	4	¾	4 ¼	4	4 ½	R-14	-	
1	4	7/8	4 ¾	4 ½	4 ¾	R-16	-	
1 ¼	4	7/8	4 ¾	4 ½	4 ¾	R-18	-	
1 ½	4	1	5 ¼	5	5 ¼	R-20	-	
2	8	7/8	5 ½	5 ¼	5 ¾	R-24	1/8	
2 ½	8	1	6	5 ¾	6 ¼	R-27	-	
3	8	1 1/8	6 ¾	6 ½	7	R-35	-	
4	8	1 ¼	7 ½	7 ¼	7 ¾	R-39	-	
5	8	1 ½	9 ½	9 ¼	9 ¾	R-44	-	
6	12	1 3/8	10	9 ¾	10 ¼	R-46	-	
8	12	1 5/8	11 ¼	11	11 ¾	R-50	5/32	
10	12	1 7/8	13 ¼	13	13 ½	R-54	-	
12	16	2	14 ¾	14 ½	15 ¼	R-58	3/16	
14	16	2 ¼	16	15 ¾	16 ¾	R-63	5/32	
16	16	2 ½	17 ½	17 ¼	18 ½	R-71	-	
18	16	2 ¾	19 ¼	19	20 ¼	R-71	-	
20	16	3	21	20 ¾	22 ¼	R-75	3	
24	16	3 1/2	24	23 3/4	25 1/2	R.79	7/16	

SERIES 2500 FLANGE

Pipe Size	Flange Bolts		Raised Face	Stud Bolt Length		Ring Joint	Ring No.	Ring Gap
	Qty.	Size		Male & Female Tongue & Groove				
	½	4	¾	4 ¾	4 ½	4 ¾	R-13	5/32
¾	4	¾	4 ¾	4 ½	4 ¾	R-16	-	
1	5	7/8	5 ¼	5	5 ¼	R-18	-	
1 ¼	4		5 ¾	5 ½	6	R-21	1/8	
1 ½	4	1/8	6 ½	6 ¼	6 ¾	R-23	-	
2	8	1	6 ¾	3 ½	7	R-26	-	
2 ½	8	1 1/8	7 ½	7 ¼	7 ¾	R-28	-	
3	8	1 ¼	3 ½	8 ¼	8 ¾	R-32	-	
4	8	1 ½	9 ¾	9 ½	10 ¼	R-38	5/32	
5	8	1 ¾	11 ½	11 ¼	12 ¼	R-42	-	
6	8	2	13 ½	13 ¼	14	R-47	-	
8	12	2	15	14 ¾	15 ½	R-51	3/16	
10	12	2 ½	16	18 ¾	20	R-55	¼	
12	12	2 ¾	21	20 ¾	22	R-60	5/16	

EMERGENCY INFORMATION

Plant Emergency Phone # _____

Plant Signal: _____

All Clear _____

Gas Release _____

Alert _____

Evacuate _____

Timekeeper Phone # _____

Superintendent Phone # _____

Safety Phone # _____

Dr. Phone # _____

Police Phone # _____

Hospital Phone # _____

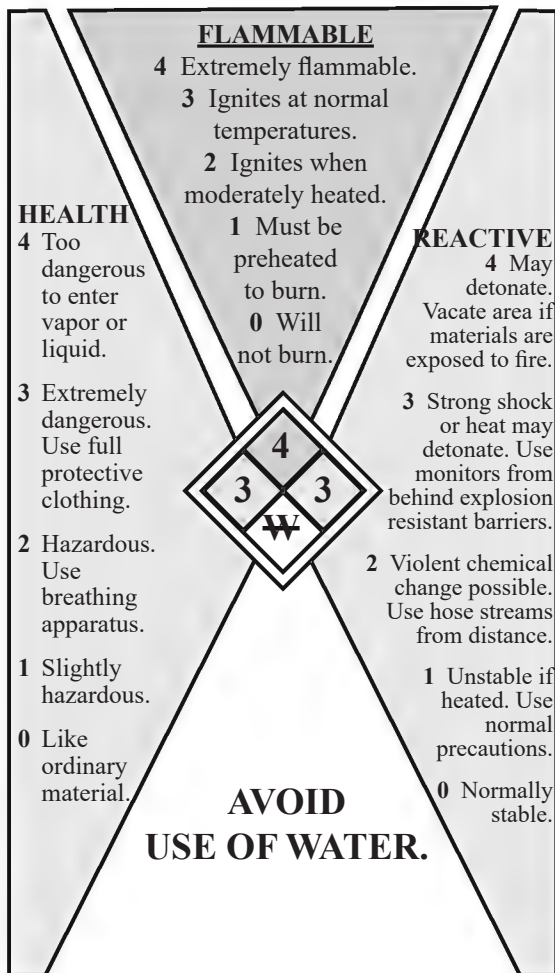
Emergency Evacuation
Center Location _____

Employment Office

Emergency Evacuation
Information # _____

NFPA 704 CODE

Emergency Guide for Hazardous Materials



CERTIFICATION

Certify that I have read and understood all of the safety rules and procedures in The Employee Safety Handbook for Service Specialists, LCC. I further certify that I will observe and obey all the safety rules and procedures. I understand that failure to obey these rules and procedures are cause for disciplinary action or employment termination.

Employee Name (Please Print)

Social Security Number

Date

Employee Signature

Witnessed by:

SERVICE SPECIALISTS, LLC

NOTE SSI SUPERVISION: Remove and return to main office when completed by employee.