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Emergency Phone Numbers - Quick Reference:

All phone numbers listed in this manual that are not within the RFS phone system are listed with the 9 prefix necessary to exit the RFS phone system.

<table>
<thead>
<tr>
<th>Service</th>
<th>Phone Number</th>
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<tr>
<td><strong>RFS POLICE – (EMERGENCY ONLY)</strong></td>
<td>665-3444</td>
</tr>
<tr>
<td>RFS Police – (HQ, Bldg. 190T)</td>
<td>665-3638</td>
</tr>
<tr>
<td>Police Kiosk – (at main gate)</td>
<td>665-3568</td>
</tr>
<tr>
<td><strong>UCPD</strong></td>
<td>665-3401</td>
</tr>
<tr>
<td><strong>CRITICAL EMERGENCIES</strong></td>
<td>9-911</td>
</tr>
<tr>
<td>police – fire – injuries</td>
<td>9-911</td>
</tr>
<tr>
<td>911 dialed from a cell phone routes your call</td>
<td>9-911</td>
</tr>
<tr>
<td>to the California Highway Patrol</td>
<td>911</td>
</tr>
<tr>
<td>9-911 from RFS phones – Richmond PD</td>
<td></td>
</tr>
<tr>
<td>HAZARDOUS MATERIAL SPILL (UCB, EH&amp;S)</td>
<td>642-3073</td>
</tr>
<tr>
<td>-</td>
<td>665-3401</td>
</tr>
<tr>
<td>UC BERKELEY EH&amp;S – (if no answer)</td>
<td>9-1-800-852-7550</td>
</tr>
<tr>
<td>if no answer, call RFS Police @ above numbers</td>
<td></td>
</tr>
<tr>
<td>California Office Of Emergency Services</td>
<td></td>
</tr>
<tr>
<td>(Hazmat Only)</td>
<td></td>
</tr>
<tr>
<td>Utility or Building Emergency – (8AM – 4PM)</td>
<td>665-3401</td>
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In Case of an Injury

A primary purpose of this manual is to provide information on how to avoid injuries. However, if an injury should occur, or if you are assisting someone from another department:

1) **First Aid kits are available in Building 484, rm.114 just outside the laboratory area, and in Building 420 in front of the control room.** Be familiar with their locations.

2) An **emergency eye wash kit** is in the first aid station in building 420 & 484. Know the locations and be familiar with its use in conjunction with exposure to some of the chemicals listed in the chemical (and other) hazards section of this manual.

4) Any and every injury requiring a visit to a physician must be reported to the administrative staff in Building 452. Wesley Neighbour or designated staff will take care of all workers’ compensation documentation.

In Case of Chemical Spill

(A primary purpose of this manual) to provide information on how to avoid spills. *(re-plumbing hydraulic lines is a fundamental necessity at PEER/NEES, Berkeley, thus, planning provisions and the protocol, to capture oil, are well established).* If there is a spill:

1) Small spills that do not immediately threaten waterways, wildlife, or humans, should be contained by PEER staff. A spill of a known substance that can be wiped up with one rag or paper towel is ok to handle on your own. For anything bigger call your supervisor. No chemical waste (including oily rags) can go in the trash or sink.

2) Larger spills should be viewed with caution. Take care to warn others in the immediate area of the danger. **Contain the spill,** if possible, using spill absorbent pads, booms and powders stored on the shelves in Bldg. 484, rm. 115 or Bldg.420 main bay (rm. 1) and call the appropriate number listed above.
3) For further information refer to the “Spill prevention & emergency provision plan”
Safety Program Administration

Safety program effectiveness hinges on cooperation, participation and coordination

A. The manager is responsible for implementing and maintaining the safety program.

B. The supervisor is responsible for implementing and maintaining the safety program for areas under the supervisor’s control.

C. OSHA INSPECTION – The procedure for responding to an OSHA inspection is the following:
   1. Welcome them to the conference room in building 484 and have them wait for a representative from EH&S
   2. Call Jim Gilson, Assistant Director, EH&S. Phone 510 643-9575

The Critical Elements

Proper planning to avoid production loss through incurred through property damage, environmental damage and personal injury.

Early Detection and Timely Correction of safety issues, conditions and unsafe practices.

Safety Education Programs stimulate and maintain interest and participation through the following:

1. Safety meetings and communications including appropriate signage etc.
2. Work procedures, personal protection, equipment and mechanical guards
3. Individual health and safety instructions and group safety training programs
4. Keep equipment training certifications current
5. Conduct weekly “tailgate safety meetings”
6. Potential safety-incident investigation and reporting to determine cause and corrective action
7. Waste disposal and emission control procedures
8. Provide protection adequate to ensure the safety of the public and the environment.
9. Communicate the relevant provisions of this manual that apply to contractors and subcontractors
10. Use this Safety Manual as a tool to help recognize, evaluate and control hazardous activities and conditions within your area of responsibility; to help define how the program will be administered; to identify responsibilities and to outline how to ensure control of work area safety.
NEES & PEER  Important General Information

Working in the Structural and Earthquake Simulator Labs is a potentially hazardous experience. While it is inherently safe, it can be completely unforgiving of some mistakes.

With the right precautions, it is possible to manage hazards and avoid injuries.

The first and most important rule is to educate yourself concerning risks associated with what you are doing and thus DEVELOP a ‘common sense’.

Rely only on professional lab staff, with expert experience, to teach you how to use tools, equipment and perform operations *sign a training log*. Be really sure you are using tools and equipment correctly, if you arrive to the labs with experience you must still read and sign a “training log”... this is a proof-positive confirmation that you have read the appropriate UC Berkeley “JSA” (Job Safety Analysis) form for each tool and piece of equipment that you need to use.

It is your responsibility to inform your coworkers when performing hazardous tasks and assist your coworkers in gathering the necessary protective equipment if they are to remain in your work area.

Secure the work area to prevent any injury to visitors, observers or tour groups. Keep visitors a safe distance from the work area.

Upon your arrival to your jobsite............ STOP: assess your surroundings;

LOOK: for hazards and hazard conditions;

LISTEN: investigate sounds that are not typical to your jobsite.

Come to work well rested, in research and new unforeseen situations may arise every day.

Always ask: “Where are the danger zones?” and “Is this the safest way to do this?”.

- Safety measures are not fool-proof and we are all fools-

Learn how to properly inspect your tools, equipment, safety gear and work areas, this critical to the safety and health for all. In general (for power tools) if it smokes, whistles, whines, or excessively vibrates SHUT IT OFF.

With rigging and safety gear: when in doubt find out. Often, damaged safety gear or rigging must be disabled and discarded.

When receiving products and/or chemicals (even if you are familiar with them): REREAD the package labels and MSDS - EACH TIME ingredients cautions and warnings change. When ordering chemicals: 1. You shall get approval of lab staff and David MacLam 2. You shall get an MSDS with each order

Not all situations can be described for each facet of the information provided, nor can every possible cross reference be made.

Therefore, read the manual, develop and exercise educated common sense in using the information provided. DO NOT GAMBLE: gain certain knowledge regarding the safety of your job and jobsite. Give your work your undivided attention.
Safety Principals

By necessity, safety principals are generalized and focused on safety issues that cut across a wide range of processes, tools and procedures...

In the NEES/PEER Labs, we create unique and often one-of-a-kind situations, therefore, the dangers we are exposed to are not uniform.

Human errors can and often do arise from inductive inference and generalization of experience (Reductio Ad Absurdum): all of our lives, we have only seen black crows, yet all crows are not black and to claim they are is absurd to those who know otherwise and absurd to ourselves once we realize the truth.

BEWARE! always question your assumptions – we derive our general truths from specific instances of experience and often blind faith. To use only inductive inference can quickly jeopardize your safety.

What to do... NOW THAT YOU HAVE IDENTIFIED A HAZARD: (in order of priority)

1. try to eliminate risk/hazard – (cover the hole)
2. use safeguarding applications – (barricade the hole)
3. use signage to warn others – (post a sign stating “beware of hole”)
4. perform safety training – (teach everyone about the hole and its relative dangers)
5. use personal protection – (always wear a parachute and carry a grappling hook tied to a rope.)

Regardless of all attempts to eliminate dangers – every engineered system or product must balance three components: safety cost and function. In general... hazard identification and consequences is essential where the failure to do so will lead to illness or injuries.
Definitions and Acronyms Used in this Manual
(definitions from OSHA.Gov, UC Berkeley dept. of EH&S, NIOSH and site-specific terms)

SHALL – means mandatory
SHOULD – means recommended

ANSI – American National Standards Institute

APPROVED – sanctioned, endorsed, accredited, certified or accepted as satisfactory by a duly constituted and nationally recognized authority or agency.

AUTHORIZED PERSON – a person approved or assigned by the employer to perform a specific type of duty at a specific location or jobsite.

ASSEMBLY AREA – pre-determined location to assemble and conduct a roll call in case of an emergency or evacuation

CFR – Code of Federal Regulations

COMPETENT PERSON – one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them.

DEFECT – any characteristic or condition which tends to weaken or reduce the strength of the tool, object or structure of which it is a part.

DESIGNATED PERSON – “authorized person” as defined above

DOT – Department Of Transportation

EH&S – (For the purposes of this manual only, University of California) Department of Environmental Health and Safety

EPA – Environmental Protection Agency

ERC – Emergency Response Coordinator

HAZARD COMMUNICATION PROGRAM – a comprehensive program to ensure that hazards are evaluated and that information pertaining to these hazards is communicated to contractors and employees

HAZARDOUS SUBSTANCE – is explosive, flammable, poisonous, corrosive, oxidizing, irritating or otherwise harmful, is likely to cause death or injury.

HAZARDOUS WASTE – is a biological, chemical or radioactive waste which may pose a hazard to people or the environment

IIPP – Illness and Injury Prevention Program

JOBSITE – general area where work is performed

JSA – for the purposes of this manual... JSA is a UC Berkeley “Job Safety Analysis” compliant with our EH&S department

MSDS – Material Safety Data Sheet

NIOSH – National Institute of Occupational Safety and Health – provides national and world leadership to prevent work-related illness and injuries – sets standards for safety equipment and personal protection (PPE)equipment
NON-PUBLIC AREA – any area with posted requirements for personal protective equipment, special training or other precautions necessary for entry (includes construction areas, mechanical rooms, above ceiling areas and confined spaces)

PUBLIC AREAS – an area where the general public operates: offices, observation and assembly areas, cafeterias and conference areas

QUALIFIED – anyone who by possession of a recognized degree, certificate, or professional standing or who by extensive knowledge, training and experience, has successfully demonstrated their ability to solve or resolve problems relating to the subject matter, the work or the project.

RECORDABLES – occupational injuries or illnesses as defined in OSHA 1904.12

RFS – Richmond Field Station – a satellite campus of UC Berkeley

SAFETY FACTOR – is the ratio of the ultimate breaking strength of a member or piece of material or equipment to the actual working stress or safe load when in use.

SUTIABLE – is that which fits and has the qualities or qualifications to meet a given purpose, occasion, condition, function or circumstance.

TAILGATE SAFETY MEETINGS – are brief safety meetings that discuss a broad spectrum of safety issues though they tend to primarily focus on current projects. Meetings are conducted weekly, are documented and the participants sign the subject cards which are then complied.

UL – Underwriters Laboratory (electrical safety certification)

WORK AREA – specific site or location where work is performed
Organization of This Manual

This Manual is organized into four main sections and has an appendix with some useful information, forms, practices and some basic essentials designed to act as a fundamental starting point for much of what you may be doing here.

Lockout/Tagout Procedures for Controlling Hazardous Energy

Locking and tagging out equipment safeguards those working on the equipment from being injured by its being unexpectedly energized or releasing stored energy. This document describes the acceptable procedures on the UC Berkeley campus for locking and tagging out equipment. It summarizes the applicable regulatory requirements for lockout/tagout procedures and is intended to help campus departments comply with applicable Cal/OSHA regulations, including Title 8 of the California Code of Regulations, sections 2320.2 through 2320.6, and 3314.

Protection

Describes: in general terms, the importance of personal protection and the responsibilities of the employee regarding personal protection.

Outlines: various protective devices available and briefly describes the situations in which they are used. Often, there is specific training and certification required to use various kind of protection.

Chemical Hazards

Describes: in general terms, the training available, who to contact in an emergency and the location of Material Safety Data Sheets (MSDS).

Outlines: various potential chemical hazards found in and around the lab, what protection must be worn in conjunction with the particular hazard, and what precautions are necessary to avoid hazards or crisis situations.

Physical Hazards

Describes: in general terms, who to contact and how to identify hazards; the responsibilities of employees to train others properly; the responsibilities to identify damaged tools and/or equipment and proper procedures for shutting down or disposing of damaged items.

Outlines: various potential physical hazards found in and around the lab, what protection must be worn in conjunction with the particular hazard, and what precautions are necessary to avoid crisis situations.

Appendix A: - the essential utilitarian lab-worker’s information resource

24--------PEER non-permit Confined Space Entry Log
26--------Job Safety Analysis Template
27--------New Employee Safety Training Record
28--------Confidential Incident Log
29--------Occupational Accident Injury or Illness Investigation Report
30---------Report of Unsafe Condition or Hazard
31---------UCB, EH&S General Self-Inspection Form For Administrative Areas
35---------Safety Training Attendance Record
36---------Downloadable IIPP Template & Forms
39---------UCB, EH&S Staff Directory
40---------Fork Truck Inspection Form
41---------General Rigging Accessories Safety Information
42---------Weight of Common Materials
43---------Wire Rope Requirements and Ratios
45---------Load Balancing
46---------Rigging Illustrated Practice
48---------Sling Hook Rating Chart
49---------Shackle General Requirements
50---------Shackle Illustrated Use and Inspection
51---------Eye-Bolt General Requirements
53---------Eye-Bolt Safety Illustration
54---------Eye-Bolt Working Angles
55---------Turnbuckle Design Requirements
56---------Turnbuckle Visual Inspection Requirements
58---------Swivel Hoist Ring Requirements and Illustrations
59---------Rigging Accessories Inspection
60---------Synthetic-Web Sling Requirements
62---------Sling Types
63---------Sling Angle Effects
65---------Load Capacity of Synthetic Web Slings
66---------Load Capacity of Synthetic Round Slings
67---------Operations Using Synthetic Round Slings
71---------Load Capacity of Wire-Rope Slings
72---------Wire-Rope Inspection
74---------Rigging Tackle Inspection
75---------Ten Rules of Layout and Design
76---------Student Agreement Form
77---------Daily Clean-up Checklist
Safety Information Storage Location

Building 484 room #113 in the file cabinet — to find room 113, follow the map posted on the wall across from the main entrance to the offices on the north side of building 484.

*UCB EH&S - Hazard Communication Flip Chart*
*Tool Manuals*
*Safety Manual*
*MSDS book*
*EH&S “Fact – Sheets”*
*Inspection Forms*
*JSA training forms*
Safety Training

*Required Basic Training for all employees*

*Volunteers are considered “Uncompensated Employees”*

If you need to train anyone who works in the labs the following are the first basic requirements.

**STUDENT / EMPLOYEE DATA FORM** – *complete and check ID*

**MSDS** – what is it, where does it live, why is it important…. this discussion introduces chemical responsibility. All chemical purchases must be approved by core lab staff.

**IIPP** – what is it, where does it live, why is it important *(read and sign document)*

**HAZARD COMMUNICATION** – *(orange flip chart)* what is it, where does it live

why is it important *(read and sign document)* after document is signed, ask some questions re. contents… a good place to start is to review the information on the “controlling exposures” page (we have “particularly hazardous materials” and there is a good review of “Required Personal Protective Equipment”. Also review information on the “chemical hazard communication” page... “hazardous non-routine tasks” & “informing contractors and contract workers”.

**EH&S “WORKING AT THE RICHMOND FIELD STATION”** (“...REQUIRED ON-LINE TRAINING...”)-- discuss why this is important and review the “shelter in place”) siren, review when the siren test occurs and what it sounds like. *Reveal the number of actual incidents* (there have been 5, that I know of, in the last 8 years).

**RESTRICTED AREAS** – where they are and why they are restricted. Here is where you will introduce “confined space” if the employee is not going to be working in the confined spaces at PEER they still need to know where it is and what it is.

**HOUSEKEEPING REQUIREMENTS** – Discuss cleaning and organization of work area in its proper context…. it is not a just a courtesy it is an *OSHA requirement*.

- **Disposal of debris.** Dust should be considered toxic. Sweep up using floor sweep compound.
- **Recycling.** Use bins for metals, paper, cardboard etc.
- **Oil and OILY rags.** Use the designated barrels for waste oil or oily debris and always keep barrels covered.
- **Tools and tool training.** All tools need to be returned to tool boxes or storage area after each use. We reserve the right to deny access to tools. Most tools have formal training and required EH&S Job Safety Analysis forms to complete in order to fulfill training requirements.

**GENERAL COURTESY.** Working in proximity to other persons requires that you be careful and observant – if you need any “personal protective equipment” then the people around you need it as well... provide for those around you before you energize your tools.

**HIGH HAZARD AREAS.** The shops and lab floor areas (and outside areas in use for construction) are considered “High Hazard Areas” you may be required to obtain and use steel toed shoes hard hats safety glasses and other protective gear and equipment to work in these areas. Use of all heavy equipment requires special training. If you hear back up alarms on equipment be sure the drivers sees you and if not get out of the way. Continually reevaluate your work area and the hazards or your particular project.
Check-in by asking: “Where are the danger zones?” and “Is this the safest way to do this?”

**TRIPPING HAZARDS.** Do not create tripping hazards. Use road cones, physical barriers or use caution tape as needed. Never leave an uncovered trench without barricades. Do not leave threaded rods lying on the floor etc. etc.

**GENERAL HAZARDS.** Do not create any possibility of a hazardous situation. When open and close doors use proper and specially designated handles to do so. Pay attention to safety signs in the lab. If you are not sure about certain things ask lab staff on proper handling. Never rush to accomplish the task, keep your mind clear and alert.

**HYDRAULIC LINES.** Even if your project does not require the installation of hydraulic lines you will continually encounter them throughout the labs. If you see an oil leak notify lab core staff immediately. Spill response materials are staged throughout the labs, know where they are and how to deploy them.

**FIRE EXTINGUISHERS** – identify locations, preserve a 3’ free access zone.

**ELECTRICAL PANNELS** – identify locations, preserve a 3’ free access zone.

**FIRST AID KITS** – identify locations...
Lockout/Tagout: Procedures for Controlling Hazardous Energy

Introduction

Locking and tagging out equipment safeguards those working on the equipment from being injured by its being unexpectedly energized or releasing stored energy. This document describes the acceptable procedures on the UC Berkeley campus for locking and tagging out equipment. It summarizes the applicable regulatory requirements for lockout/tagout procedures and is intended to help campus departments comply with applicable Cal/OSHA regulations, including Title 8 of the California Code of Regulations, sections 2320.2 through 2320.6, and 3314.

What these guidelines cover

These procedures apply to all work on the Berkeley campus involving the installation, service, maintenance, adjustment, or other handling of machines, powered equipment, or utility systems where the unexpected energizing of the equipment or a release of stored energy could cause injury or death. Types of potentially hazardous energy covered by these guidelines include electrical, mechanical, hydraulic, pneumatic, chemical, and thermal. Work on or around powered equipment is covered by these procedures if:

- A person may contact electrified or otherwise energized components while performing the work.
- A person is required to remove or bypass any guard, interlock, or other safety device (including equipment covers) to perform the work.
- A person is required to place any part of his or her body into an area on the machinery or piece of equipment where work is performed during the equipment's operation.

Examples of activities covered by these procedures include removing stock from a jammed machine, adjusting the internal electronics of a laser, and changing the fan on an air handling unit.

Work not covered

These procedures do not apply to:

- Minor tool changes and adjustments and other minor service activities that take place during normal operations if they are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternate measures that provide effective protection. (An example of this would be changing a drill bit on a drill press.)

- Work on electrical equipment that is connected by a cord and plug, where the hazard of the equipment being accidentally turned on or releasing stored energy is eliminated by unplugging the equipment. The person working on the equipment must have exclusive control over the plug.

- Work on equipment that cannot be shut down, provided that (1) department management demonstrates that continuity of service is essential, (2) shutdown of the system is impractical, and (3) special equipment is provided or special protective procedures are documented and followed that will provide effective protection for personnel. (Examples include work on certain
Following these guidelines

All UC faculty, staff, and students who install, adjust, service, or maintain machines, powered equipment, or utility systems must comply with the procedures in this Fact Sheet or face disciplinary measures in accordance with the applicable personnel policy, labor contract, or code of conduct. Contractors are also required to adhere to these procedures for work on UC-owned equipment. The contractor’s equivalent procedures may be applied to work on their own equipment.

Authorization to work on energized equipment

Supervisors and Principal Investigators who oversee work on equipment with hazardous energy are responsible for reading and understanding these procedures. University staff and students may oversee or perform work on energized equipment, such as described in this document, only after obtaining authorization from their supervisor or Principal Investigator. Supervisors and Principal Investigators may authorize only those staff and students who have completed training in identifying and controlling hazardous energies (see Section IX, “Training”).

General rules for lockout/tagout

All work on equipment that might cause injury if the equipment were unexpectedly turned on must be performed with the equipment properly de-energized or physically disconnected from all power sources. Any stored energy must also be released or blocked. If a supervisor or Principal Investigator determines that the equipment or system must remain energized during the work, EH&S should be contacted to assist in developing adequate alternative control measures such as the use of suitable temporary barriers. Wherever possible, use locks to prevent the inadvertent energizing of the equipment. A tag must also be placed next to each lock. Only where this is not physically possible may other energy control methods (such as accident prevention tags) be used. It is the department’s responsibility to identify situations that require lockout/tagout, arrange for adequate training, and provide materials (such as padlocks and tags) to departmental personnel performing this work. EH&S is available to provide training on these procedures and information on materials that are suitable for the planned work.

Procedures for lockout and tagout

1. **Identify All Energy Sources.** An initial survey must be made to identify all the equipment’s sources of power or energy (including stored energy sources such as electrical capacitors or elevated movable components) so that each energy source can be isolated.

2. **Notify People Affected.** Everyone who would normally use the equipment being serviced must be informed of the lockout/tagout procedures being used and told not to attempt to start or energize the equipment.

3. **Shut Down the Equipment.** Using appropriate equipment shutdown procedures, turn off all operating controls or return them to the neutral position.

4. **Lock Out Equipment.** Locking out is required except when the equipment and its energy supply cannot accept a lock. Apply locks to isolate each power source and prevent the operation of the
equipment controls. Apply one individually keyed lock for each person working on the equipment (special hasps are available to allow multiple locks at each location), so that removal of one worker’s lock does not put the other workers in jeopardy. Equipment connected by plug and cord with few or no lockable controls can be isolated by disconnecting the power cord and locking the plug in a special device. (Contact EH&S for information on various lockout devices available.) Another acceptable alternative is locking out the appropriate circuit breaker. Some examples of lockout/tagout equipment are shown below.

5. **Examples of Lockout/Tagout Devices.**

- Lockout of a switch
- Devices for locking out power cords
- Lockout of multiple controls
- Tools for locking out fuses
- Multiple lock hasps for a valve
- Hasps for use with multiple locks
- Lockout of a valve
- Multiple lock hasps for a valve

6. **Apply Accident Prevention Tag.** Wherever a lock-controlling hazardous energy is applied, a tag must also be applied to identify the lock as a safety feature rather than a simple security measure. If a lock is not present at the normal control panel, a tag should be placed there as well. Tags must indicate the reason the lock is there, the name and telephone number of the person who put on the lock, and the date the lock was put on. Tags must be attached by strong, durable, non-reusable, self-locking cords that can be attached by hand.

7. **Release or Block any Stored Energy or Movable Parts.** Safely release any stored energy that may remain in the system. This may include draining charge from a capacitor, bleeding down a steam line, or lowering elevated components that may fall. Equipment components that may move and injure someone must be physically blocked in place. Where components must remain movable to perform the work, special extension tools and training should be provided to prevent injury.

8. **Verify the Lockout.** Determine if the energy sources have been effectively controlled by first checking that no one is exposed. Then attempt to operate the equipment using the normal controls. RETURN OPERATING CONTROLS TO NEUTRAL OR “OFF” AFTER THIS TEST. Use appropriate test equipment and/or visual inspection to verify that the stored energy sources have been effectively isolated. If there is a possibility that stored energy could re accumulate to a hazardous level, continue to verify the lockout until work is completed or until the possibility of such re accumulation no longer exists.

9. **Conduct the Desired Work on Equipment**

10. **Certify the Equipment is Safe for Reenergizing.** Before energy is restored to the equipment, visually inspect it to ensure that everyone is safely clear of the operating area; that equipment components, covers, and guards are in place; that tools or debris are removed; and that controls are off or in neutral.

11. **Remove Lockout and Tagout Device(s)** Each lock and tag must be removed by the person who placed it. If an employee has left for the day without removing his or her lock, the supervisor or Principal Investigator may remove it after personally verifying that the employee is safely away from the equipment and the equipment is safe to reenergize. The person whose lock is removed should be informed of this before he or she returns to the work area.

12. **Notify Affected Personnel.** Notify others that the work has been completed and that the
equipment may be safely used.

**Special lockout/tagout considerations**

**Lockout/Tagout Interruption.** In situations where the energy sources are locked and tagged and there is a need for temporary reenergizing to test or reposition the equipment, follow these steps:

1. Clear all personnel and any tools or debris.
2. Remove the locks and tags as described in 11 above.
3. Proceed with testing or repositioning.
4. De-energize all systems, and relock and retag energy sources as described above.

**Protecting More Than One Worker.** When more than one person works on the same equipment, individually keyed multiple lockout devices must be used. Each authorized person must put a personal lock on the multiple lockout device and remove it when he or she stops working on the equipment. Only when all locks are removed can the equipment be reenergized.

**Transfer of Lockout/Tagout.** When multiple shifts work on the same equipment, it is the responsibility of the current shift’s supervisor to ensure that the arriving shift has put locks and tags on the energy sources before the earlier shift’s locks and tags are removed.

Training All UC Berkeley faculty, staff, and students who will work on equipment that presents a hazard from associated energy sources must receive documented training on these guidelines. The training must include information on recognizing hazardous energy sources and appropriate techniques for isolation of these energy sources. EH&S can assist in or provide this training. Contact EH&S at 642-3073 for more information. Field evaluations of program effectiveness EH&S staff are responsible for auditing and verifying the effective implementation of this program through random field evaluations of a sample of activities requiring the control of hazardous energies. Department Safety Coordinators and other campus safety personnel are encouraged to perform and document similar audits and to discuss their findings with EH&S staff to determine appropriate corrective actions.

**LOTO: lock-out tag-out**

The LOTO program is a critical component of safety in the structures and earthquake simulator labs. Stored energy is found in prestress tendons, hydraulic lines, actuators and test specimens, power tools, torque wrenches, spring-loaded devices and more. Proper planning and care must be given to each test setup. Physical barriers and “do not enter” or “caution” tape must be used to help keep danger zones safe. Communication and cooperation are essential to understand the dangers presented by each unique test setup.
Protection

Overview
When engineering controls (for example barriers, guards, inter-locks) are not enough, wearing protective equipment is an additional way to avoid injury and illness in the lab. It’s important that personal protection equipment be correctly sized and properly worn.

Your supervisor or other competent person, will tell you what equipment you need and help you to locate what will work for you. Some protective equipment is quite costly and should be treated with the appropriate care. This means returning communal equipment to the proper storage places as well as performing required inspections for wear which may render a device useless. All employees shall be responsible for inspection proper disposal as well as informing someone who can purchase a new replacement or shall notify the authorized person(s).

Gloves

Overview
Gloves are essential to many tasks in the laboratory. They can protect the hands from cuts, heat, chemicals, and abrasion. There are three main types of gloves used in the PEER Labs: Leather or canvas work gloves, impermeable nitrile gloves and heavy lined rubberized gloves

Leather or Canvas Work Gloves
Leather gloves are worn when performing tasks requiring the use of a shovel or broom or similar tool, material handling, rigging, driving the forklift, and a variety of other tasks. They will prevent cuts, blisters, abrasion and reduce pinching of the hands. Be careful to select a pair that fits properly and is durable enough for the task. Many employees use leather gloves for hot applications, when the temperature is not so hot as to require heat gloves, e.g. welding, cutting, heat-treating, etc.

Nitrile Gloves
Nitrile Gloves are chemically resistant as well as impermeable to water. They are absolutely required when there is a chance of skin coming in contact with acetone, xylene, kerosene, oils and other hydrocarbon based liquids or strain gauging chemicals. They may also provide comfort when wet cutting and grinding, as well as mixing or using cement products Many employees like to wear a pair of Nitrile Gloves under a pair of Leather Gloves when seeking protection from abrasion and cold water.

Heat Gloves
Heat Gloves are necessary when handling extremely hot steel or other hot materials. They provide excellent insulation from hot, dry surfaces, but provide very poor protection from liquids, abrasion and greatly limit dexterity.

Respiratory Protection

Overview
RESPIRATORS SERVE TO REDUCE EXPOSURE TO SPECIFIC HAZARDS, THEY DO NOT ELIMINATE THEM: (respirator use entails specific individual training and testing by UCB-EH&S)
There are three basic types of respiratory protection used in the Labs: Dust Mask, Particulate Respirator, and Organic Vapor Respirator. Dust masks are used voluntarily when performing some tasks. Situations which require the use of a disposable particulate respirator include grinding and mixing grout or concrete. The organic vapor respirator is used voluntarily for comfort when using chemicals with offensive odors. If a respirator is essential to your work, you must get fitted and tested by EH&S personnel... a respirator is an mask with a NIOSH rating

**Dust Mask**
A dust, or “nuisance” mask is a passive filter which traps dust particles by the wearer’s breathing action. It is effective only in low-hazard situations. It is not effective against any chemical mists or fumes nor will it provide any protection from ultra fine dusts.

**Particulate Respirator**
The particulate respirator is a more snug version of the dust mask constructed of better filtering materials. Use this one when sweeping or working with cement, grout or fly ash, or when the dust mask is insufficient. These masks all must be sized and fitted to your face; they all have a NIOSH rating printed on the straps and/or the mask. Look for a “N or P95” or better.

**Organic Vapor Respirator**
The organic vapor respirator contains particulate pre-filter for specified dusts and mists and a charcoal filter (other types are also specified) to clean the air you breathe. Primarily, it is used to filter fumes from hydrocarbon-based solvents (such as mineral spirits etc.) and while gluing with non-water-based glues or when using many paints esp. spray paints.

**Hearing Protection**

**Overview**
There are many situations for which hearing protection is recommended in the lab. Much of our equipment and tools make enough noise to require hearing protection. Many variables, such as an individual’s ear shape or the type of noise being protected against, can lower the actual protection offered by a device by as much as 8dB. There are two basic types of hearing protection: in the earplugs; and over-the-ear muffs.

**Plugs**
Plugs are rolled into a narrow cylinder and then inserted into the ear. Take care that your hands are clean and do not re-use earplugs more than for a day or two to prevent ear infection. The advantages of earplugs are that they permit the employee to wear other protection such as glasses, a hat, or a dust mask easily whereas earmuffs do not. In addition, they generally provide more hearing protection in terms of their NRR (Noise Reduction Rating) than do earmuffs. They can, however, cause some wearers discomfort.

**Muffs**
Ear muffs are useful when the employee cannot use plugs and/or where other protection is not necessary, for instance, going to get someone for a phone call or to answer a question. They are not generally recommended for longer term use. If you only use muffs, be sure you know the rating and proper use.

**Architectural/Physical**
The final type of hearing protection is to use a physical barrier in between the employee and a noise generating device (for instance, the control room adjacent to the lab’s main floor). Whenever
possible, utilize this form of hearing protection. This means: stay in a quiet area when your job allows it.

**Eye/Face Protection**

**Overview**

Eye and face protection is necessary when using compressed air devices, any power tools, any cutting tools, hammers, and anywhere else where objects might be flying or chipping. There are three types of protection discussed here: safety glasses, safety goggles, and face mask.

**Safety Glasses**

Safety Glasses are plastic glasses with shatter resistant lenses. They must be stamped with a “Z87” mark to be NIOSH compliant. Safety glasses are worn for many of our operations at the lab. Prescription glasses are not sufficient to protect against injury from flying objects and are not considered adequate protection unless they have the Z87 stamp and the side shields have not been removed. If your work requires use of safety glasses, be sure others in your vicinity are also protected.

**Safety Goggles**

The protection safety goggles provide surpasses that of safety glasses. Safety goggles fit close to the face and have a plastic flange to form a seal around the eyes. Many goggles will protect against wet debris or chemicals splashing into the eyes. Some workers, especially those with prescription glasses, should choose to use goggles instead of safety glasses because of their comfort and efficiency. *A NIOSH “Z87” stamp must be on the goggles used in the labs.*

**Face Shield**

A Face Shield is a shatter resistant lens that covers the whole face much like a welder’s visor in shape. It is useful for sawing and essential for some grinding applications and should be used along with safety glasses or goggles. Safety glasses/goggles are primary protection, a *face shield is secondary—protection to be worn over the primary protection.*

**Coveralls**

**Overview**

Coveralls are a helpful personal protection device. They are not required for any operation, although it is required that employees wear long sleeves and pants when working with hot materials grinding or wet concrete, and coveralls are the most convenient way to do this without ruining personal clothing. They may also give limited protection against chemical splashes.

**Foot, Head & Knee Protection**

**Overview**

- Rubber boots are can be made available in the lab for wet or oily operations such as cutting, hydraulic plumbing, washing tools, or mixing concrete. Generally, the heavier the work, the heavier the shoe. Leather, *steel toed boots or shoes are recommended for most lab work and required for some.* Special protectors can be purchased for welding, cutting or to provide metatarsal protection.
• Hardhats are always worn in any environment where anyone is working above you and when you are performing any kind of work that could result in a head injury from falling debris, tools rigging etc.

• Knee protection is very important if you will be kneeling for extended periods of time or for activities like tying steel.
Chemical Hazards

Overview

Chemical Hazards are of utmost concern at the PEER Labs, both in terms of the health of the employee and the preservation of the environment. A minor spill such as a very small quantity of hydraulic oil should be contained and then reported to your supervisor. \textit{Containment includes installation of appropriate barricades to prevent slip-and-fall injuries.} Inform other employees so that they are not at risk from exposure to the spill. Be familiar with the location of absorbent materials available in the lab to aid in containing minor spills. \textit{DO NOT ORDER OR BRING ANY CHEMICAL into the lab} without first consulting with David or Wes. You will need to get a copy of the MSDS for our review prior to ordering. Getting rid of unwanted chemicals is very expensive, difficult and time consuming this is a burden you will be responsible for.

Protection

Always wear the appropriate protection for the material you are working with.

Material Safety Data Sheet

Material Safety Data Sheets (MSDS) for all of the chemicals in use are stored in Building 484, room 100 - inside the covered bookcase. Your supervisor can review the MSDS with you and help answer questions. Become familiar with the hazards for each chemical: exposure limits, symptoms of exposure, and necessary protective equipment for use when handling the particular chemical. Only partial information is given below for each chemical in use at the lab. Your supervisor may specify additional protection for your specific applications. The MSDS should be review with each new shipment of chemicals.

Monitoring and Prevention

A trained permanent employee is appointed monitor the general conditions and usage. His/Her job is to check for problems. Inform your supervisor of any problems, or in a situation which requires it, call the UC Campus Environmental Health & Safety at 9-643-8676.

Understanding Your Limits

No employee shall ever use equipment or materials with which he/she is not comfortable.

This includes knowing when you are too tired or otherwise impaired to use a chemical which requires careful attention.

This also means paying attention to your own body and taking symptoms of any exposure seriously.

Report any symptoms-of-exposure (from any lab chemicals) to the person in charge and promptly discontinue work with suspect chemicals. If symptoms start after work hours, seek medical attention and notify Wesley Neighbour or Veronica Rodriguez the next day.

No amount of research is worth sacrificing the health and safety of an employee.
Solvents, Flammables, Combustibles

Overview
Solvents, Flammables, and Combustibles all present inhalation hazards as well as flammability hazards. All flammables (higher risk of explosion than combustibles) should be stored in the steel cabinet in building 484, room 119. All solvents and combustibles should be purchased in small enough quantities to be easily and properly stored.

Acetone
Acetone is used to clean steel before gauging. It is extremely volatile, meaning it generates fumes that are both toxic and may impair mental faculties. It can also be absorbed through the skin. Advise other employees in the area when using acetone. Keep cap on the can when not actually pouring the chemical. Return can to the proper cabinet after use.

Protection
- Nitrile gloves required
- Adequate ventilation required
- Organic vapor respirator recommended
- Safety glasses or goggles are always required

Propane
Propane (forklift fuel) is a flammable compressed with explosive properties. Assure the valve is closed when not in use. Use with caution and keep away from an ignition source. When propane is burned, carbon monoxide is produced.

Protection
- Adequate ventilation required

Hydrocarbon based solvents
Solvents used to clean steel and other equipment at the lab. Consult with lab staff before you purchase and use this class of solvents. Fumes are toxic. As always, Read the MSDS.

Protection
- Nitrile gloves required
- Organic vapor respirator recommended
- Safety glasses are required

Oils and Lubricants

Overview
Lubricants are necessary to keep equipment in safe operating condition. In particular, we use motor oil, common grease, hydraulic oil, and special weight oils and anti-seize oils for tools and equipment. The most important thing is to avoid spills and excessive contact with skin. There is a drum for recycling used motor and hydraulic oil. Contact your supervisor for an explanation of how to use this resource. Read the labeling.
Protection
- Nitrile gloves recommended.
- Safety glasses are required

Cement & Grout

Overview
Unmixed cement and grout are corrosive fine powers. They are most corrosive when in contact with water. Most often when dealing with cement and grout you will use a bagged, pre-mixed product. Cement products can irritate respiratory tissues when inhaled. It is crucial that you wear your particulate respirator while batching and mixing. Dry powder or wet grout and cement can burn your skin (chronic and acute exposure can be very damaging to your skin and respiratory tract). For this reason it is important that you have adequate coverage – coveralls, rubber boots and nitrile gloves and particulate respirator. Please note that latex gloves do not protect against cement. The cured mix poses greatly reduced health risks. Extended handling of cured cement products, debris, blocks etc is corrosive as well as abrasive to unprotected hands. NEVER STORE POWERS ABOVE FACE LEVEL (bags, bins, boxes and tubs can be stacked up to a height of 4 feet above the ground).

Protection
- Nitrile gloves or leather gloves as required for the job
- Long-sleeved clothing (coveralls) required
- Particulate respirator required
- Safety goggles required

Other Special Concerns
Environmental: Wet grout and wet concrete are hazardous wastes. Clean up concrete-soiled equipment only in the designated outdoor area. Never dump or clean up mixed or un-mixed materials into a sink or outside drain. As well as contaminating the water draining into the bay, cement products will damage pipes. Once concrete is dry it has no safety of environmental hazards and can be discarded as ordinary trash.

Admixtures

Overview
Admixtures are naturally- or chemically-produced additives to cement mixes. Some of the admixtures cause the cement hardening process to speed up or slow down and others cause the cement to set harder or softer than what would result from a normal mix. Many of the admixtures are not toxic, but care should be taken when dealing with them. Some admixtures are corrosive and can cause respiratory irritation if inhaled and skin and eyes irritation if there is contact. Also avoid getting the materials on your clothes. Wear particulate mask, safety goggles and nitrile gloves. If you have questions about these materials please contact a lab staff person and read the MSDS.

Protection
- Nitrile gloves required
- Long-sleeved clothing (coveralls) required
- Particulate respirator required
- Safety goggles required
**Epoxy**

**Overview**

We use a variety of thermo-plastics for the gluing of instrumentation as well as in some structural applications. Nitrile gloves and safety glasses should be worn at all times when using this material. Also provide adequate ventilation. Epoxy purchased from a hardware store is commonly listed as a skin sensitizer and eye irritant. However, there many industrial types of epoxy ALWAYS read labels. In case of contact with skin, wash thoroughly with water and soap. Contact your physician if irritation or rash develops. Consult MSDS for further information.

Even if you are familiar with a particular product, manufacturers periodically change the labeling: READ the package and consult the appropriate MSDS. Watch for changes.

**Protection**

- Nitrile gloves required
- Safety glasses recommended

**Laboratory Dust**

**Overview**

Although Lab Dust is largely seen as a nuisance, significant problems may arise with short and long-term exposure. Over the short term, exposure may cause dry eyes, sneezing, and other similar dust-related problems. Over the long term, lung problems can arise such as silicosis, a lung disease linked to the intake of rock dust (silica) into the lungs. The proper way to avoid these hazards is to wear particulate respirator.

**Protection**

- Particulate respirator recommended
- Always use a floor sweeping compound when floor sweeping

**Grinder wheels, Abrasives & Diamond blades**

**Overview**

Although it may not seem like it, diamond blades and bits, cut-off wheels and grinding wheels are a chemical hazard and as such are supplied with an MSDS. The main concern is the matrix used to hold the blades together or to bond the abrasives to the blade. When cutting or grinding, a potentially hazardous dust is created. If possible, use a wet cutting method, meaning that water is used to cool the blade and in addition minimize the amount of dust created.

**Protection**

Wear a dust mask or particulate respirator when cutting or grinding metals and concrete or cleaning grout in addition to the other protection equipment listed in the physical hazards section of this manual. Cutting and grinding is to be done outside whenever possible. It is important to cover your skin to prevent grinding particles from embedding in your skin. Always wear Safety Glasses and hearing protection.
**Blood Borne Pathogens**

**Overview**

Although any contact with human or animal body fluid is a very unlikely event in the course of normal laboratory operations care must be taken if such a circumstance should arise. It should be assumed that the potential for the contraction of a life threatening disease exists through exposure to any human or animal body fluid.

**Protection**

Dust mask, eye protection and gloves are recommended along with immediate washing of any exposed areas.

**Physical Hazards / Physical Operations**

**Overview**

Physical Hazards are another big concern at the PEER Labs. There are numerous pieces of equipment and tasks which may constitute a physical hazard. *Never operate any equipment or perform any task with which you are not trained and familiar.*

**Protection**

Always wear the appropriate protection for the equipment you are working with.

**Training**

*No employee is permitted to operate any piece of equipment without having received the appropriate training.* Training in the use of equipment and certain tasks is, for the most part, given by your supervisor. There is a Job Safety Analysis and record of training to be signed by the trainer and trainee. Every operation you perform should be included on this sheet and you are to initial the space next to each task listed as you receive training.

**Understanding Your Limits**

*No employee (or student volunteer) is permitted to use equipment or materials without training and appropriate documentation. Do not exceed your individual comfort level, if you are unsure of yourself or are not certain of the hazards and proper procedures associated with your tasks – get help from a qualified person... this includes knowing when you are too tired or otherwise impaired to use equipment tools or to have sufficient level awareness.* Virtually all lab tools and equipment require careful attention.

To minimize possibility of an injury, stretch yourself and do a warm-up exercise prior to starting any work in the lab and use power tools as much as possible. To avoid ergonomic related incidents use power tools to minimize harmful repetitive motions.

**Drilling**

**Overview**

Drilling is a safe operation when certain guidelines are followed. For hand-held and portable drills before each use inspect the electrical cords for unbroken insulation and insure that a grounding plug
is in place. Double insulated tools will have no grounding plug. Cords must be kept out of water and must be the correct gauge for the tool and length used. Check the MSDS on cutting materials for chemical hazard information. It is essential to the success of your operation to learn to identify cutting tool defects: the bits must be properly sharpened with the correct geometry for the material you wish to machine.

**Protection**

- Safety glasses
- Leather gloves are removed for metals and required for concrete
- Hearing protection recommended
- Dust mask is optional for metals.
- With dry drilling nonmetals, a particulate respirator is recommended.
- Appropriate boots and clothing for the task and conditions

**Special Concerns**

**Large Percussion/Demolition Drill**

This is an extremely versatile tool for drilling and chipping concrete and scrapping. It is a high torque, heavy tool. Match the speed to the task. Start with a slow speed to center the bit. Bits can and will bind when they hit rebar BE SURE the tool is properly braced to avoid injury to your limbs. Do not attempt to force the bit through rebar, if you cannot reposition the hole, you must use a special rebar cutter. This tool has a service light: stop work if this comes on. Use grease on the shank of the bits before inserting them into the tool.

**Right Angle Drill**

This drill will allow you to drill in places you cannot fit the ‘straight body’ drills. It is also the only drill you should use with a mixing wand for mixing grout. Always select the slow speed setting. Be sure to properly protect the drill body and controls from the grout mix. Always thoroughly clean after each use.

**Magnetic Drills**

The magnetic drill has a large motor and care should be taken to avoid injury as a result of its torque. Always use the safety chain. Do not allow a long chip to form. Use plenty of coolant. There a vast number of drill bits, hole-saws and coring-bits available. Be sure of the feed and speed rates. There is a wealth of information available to you to figure this out. Be sure to use electrical cords of a gauge appropriate for the tool and distance.

**Stationary Drill Press & Radial Arm Drill Press**

Proper speed and feed rates are important. It is essential to properly secure your work piece with jigs, fixtures and clamping. Be sure vibration cannot loosen you clamping fixtures. As you are drilling, break the chip well before it is long enough to contact your hands. Compensate for backlash when you are positioning the cutter. Always use coolant for cutting metals.

**Saw Cutting**

**Overview**

Cutting can be a physically hazardous operation at the lab. Yet, it is safe when you are trained and certain guidelines are followed. For all saws except the stationary saws, electrical cords must be inspected to verify unbroken insulation and proper grounding before use. Also insure that cords are kept out of reach of water. Be sure to use appropriate extension cord gauge for the tool and the
distance. Inspect all saws and blades before using. Look for proper functioning and placement of guards and make sure blades are not bent or chipped. If cutting generates dust, wear a particulate respirator. Check the MSDS to answer questions regarding the materials to be cut and dust generated by the cutting blades or wheels.

**Protection**

- Safety glasses required
- Leather gloves removed for stationary saws; required for all others.
- Hearing protection recommended
- Dust mask is recommended, if dust is generated a particulate respirator is required.
- Determine and wear appropriate weight shoe or boot and proper clothing

**Special Concerns**

**Stationary Band Saws (JET & DO-All)**

Before operation: roll sleeves to elbow, remove loose clothing, remove watches, confine long hair, do not wear gloves. Make sure all guards are in place. Unplug machine from power source when making adjustments. Maintain a balanced stance. Keep floor area around your work and tools clean and dry.

JET: this saw uses water soluble oil as a coolant. Never hand hold materials to be cut with this saw. Keep this saw and coolant tray clean. Keep the wire brush in contact with the blade. Properly support the unclamped portions of your work. Some of your cuts may require additional accessory clamping and soft jaws. DOALL: this saw uses no coolant. Keep your hands and fingers 6" away from the blade at all times. Use a feather board, push stick or push pad to feed your work. Be sure the blade guides and rollers are in good condition. Use a fence for your material if needed. Select the correct blade and blade speed for your material and the type of cut you wish to make.

**Worm Drive - Circular Saw**

Be sure your work is held in such a manner as to not pinch the blade with the cut-off. The blade depth should be 1/8" below your work (for materials thinner than the maximum blade depth). Use a splitter if necessary. NEVER pin the guards up. ALWAYS position yourself to safely absorb any ‘kick-back’. Use the correct type of blade i.e. demolition blades for nail embedded material. This saw has an oil reservoir that needs to be periodically checked and refilled. Use the proper gauge electrical cord.

**Reciprocating Saw**

There are a huge variety of blade types and configurations for this tool. The blade may be reversed to allow difficult access cuts. Jig-saw type blades are available for this saw. Cuts with this saw can get extremely hot. It is very easy to pinch the blade with this tool. Be ready for this saw to kick-back, correctly position your hands and elbows to safely absorb this motion.

**Portable band saw**

Be sure your work piece will not bind the blade. Properly position the guards and be sure the keys are removed. Check to be sure the tool is turned off before you plug it in.

**Abrasive Chop Saw**

Do not use this saw inside the lab. Sparks form your cut can fly 30 feet take the appropriate measures. Be sure your work is properly clamped. This is the saw of choice for cutting: rebar, all-thread and steel cables. Protect your self from the noise, dust and sparks. Check the abrasive wheel for damage or cracks: replace damaged wheels. When you trigger this tool stay to the
side of the abrasive wheel until the wheel comes up to speed. Follow this rule for using ANY tool that uses abrasive wheels of any type.

**Lathes & Mills**

**Overview**

To master the use of these tools requires professional vocational school and usually an apprenticeship of some kind. Both lathes and mills have many functions and moving parts usually with three ranges of motion: the X, Y, & Z axis. The power to these machines is turned off when setting up and fixing the work and when changing cutters. These machines need to be kept clean and the work area needs to be kept clean and dry.

**Protection**

- Proper Shoes and clothing required
- Use the same "special concerns" as used for the stationary band saws and drill presses
- Safety glasses required
- Hearing protection recommended

**Cement & Grout Mixing**

**Overview**

Cement mixing and grouting includes: batching, mixing, pouring, finishing, filling molds, curing, and de-molding. Batching is the weighing or measuring and assembling of the dry ingredients. This is a dusty activity. Mixing is a short but intense process. In most cases there is very little time to remove the mix (from the mixer or from the container or bucket) before it sets. Work crews must work very quickly while shoveling, pouring or troweling the wet mix. Always be aware of your body mechanics. Choose tools that fit your hand and shovels that match your height and arm length. Do not lift things that are too heavy for you; instead, get help from co-workers. Whenever possible use carts for transporting buckets or containers, take breaks as needed, and remember to bend from the knees.

Grouting and cement mixing is a messy process. The bagged mix is extremely fine grained and irritating to your eyes, nose, mouth, throat and lungs; you'll need to wear a particular respirator. The rocks and sand in aggregate based mixes are also very dusty. Since wet concrete is corrosive take care to avoid touching it or getting it on your skin or in your eyes. Always wear nitrile gloves, goggles, and coveralls. Wet cement and grout are harmful and dangerous to the environment. There are specific cleanup procedures to prevent concrete and grout from flowing into sinks or drains. Be sure to do all washing outside at waste water collection tubs or create a berm using sandbags to prevent any mix from going into any storm drains. It is illegal and irresponsible to allow discharge into storm drains. Once concrete or grout is completely dry, it is no longer considered hazardous and thrown away as regular trash. Unused materials must never be stored above face height.

**Protection**

- Nitrile or leather gloves required as per job
- Particulate mask is required when batching and mixing
- Safety goggles required when mixing and pouring
- Hearing protection recommended as per job
• Hard Hat recommended as per job conditions

Special Concerns

Concrete Mixers
Only those who are experience and authorized should operate a concrete mixer. One person should be standing at the controller at all times. This is to insure that someone will be able to shut down the mixer in case of emergency. Do NOT touch the controller box unless instructed to do so by the mixer operator. Hard hats, nitrile gloves and ear protection are required at all times. Watch for moving parts and never attempt to catch falling barrels when they are full. When the mixing and placing is complete, clean the mixer, tools, containers and return them to their proper stations.

Batching & mixing small quantities
All the materials begin on the ground. Be aware of the dusty nature of all the materials. The cement and grout bags have a certain weight, (if used sand and aggregates will have to be weighed or measured) and liquid ingredients are measured proportional to your mix quantities. Be fully cognizant of your capabilities and proper physical mechanics when lifting, mixing, pouring, shoveling and trowelling. When making smaller batches, you may not necessarily use an entire grout or cement bag, so make sure that you properly open the bag so that it is easily resealed. Make every effort to minimize the dust. Once your pour is complete, you should immediately begin your clean up. It is critical clean up when your mix still in a plastic or at least uncured state so that you can minimize dust in or around the lab. Use water as needed taking note of the previous cautions. Unused materials must be restocked and NEVER stored above face height.

Oxygen Acetylene Cutting & Welding

Overview
Only professionally trained personal should ever use these tools and equipment. These tools require proper vocational education for safe, efficient operation. This means you must demonstrate a working knowledge of safety and operation to use these tools. Compressed gasses, carbon monoxide, material handling, fire protection, leak detection and many more all are health and safety issues hazard. Acetylene bottles are to remain in the upright position. When transporting compressed gasses, all hoses and gauges must be removed from bottles or tanks.

Learn The Professional Vocational Protocol to make use of these tools.

Protection
Safety glasses are required as Primary Protection, Under #5 or better lens goggles for torch work Special clothing and shoes required Leather heat-gloves required
Determine what type of respirator (and if this protection is needed) for the material or conditions

Special Concerns
Whenever possible, mechanically extract fumes and dust. Discontinue use if you develop any signs of carbon monoxide exposure such as headache, nausea or light headedness. Have a fire watch if needed. NEVER attempt to use these tools in confined space with out the proper permits and protocol.
Operator

It is a basic requirement to purge the lines and gauges after use and to stand to one side (of the gauges) when pressurizing. Fuel gasses will never be stored with accelerants (empty or full). Bottles will be secured with two chains (empty or full) and tagged ‘E’ or ‘F’ with chalk.

Be sure the area of operations is properly secured at all times when. Never begin without proper and appropriate communication with other employees and others in your area.

Assistant(s)

Be sure to establish your role and how you will communicate or respond (for fire watch etc)
Establish and stand clear of the danger zones.

Pre-stressing Tendons

Overview

The process of pre-stressing (steel cable, rods or “tendons”) develops forces sometimes exceeding 100kips per rod. If a tendon breaks with these forces fully applied (vertically) the tendon will likely shoot through the roof of the lab or it will hit the bridge crane or framing members of the lab. This has happened here. Extreme caution is used during this process. The tendons are to be examined for defects if they are new or used. Be sure that no one is in the line of force when pre-stressing. Double check the calculations for the size rod you are using and be sure you are well within the safety factors. Be sure you are using the appropriately sized jack and that the hydraulic lines and fittings are in good condition. The jack pressures can reach 10,000psi. If oil is ever gets injected under your skin: this is a MEDICAL EMERGENCY: seek critical care. Be 100% confident that you have received enough training and have signed off on the appropriate training forms. The tools and jack must be properly supported when you are working overhead. Remember to stay out of the line of force when pre-stressing the tendons. Use appropriate lubricants and tools to tighten and loosen the nuts when stressing and un-stressing. Watch for pinch points. Be sure the chair is bearing fully on the plate.

Protection

- Hardhats required
- Safety glasses required
- Steel toed shoes required
- Hearing protection recommended

Special Concerns

In this lab, the two types of pre-stressing tendons are Williams and Fox Hollow. Fox Hollow rods are fast becoming obsolete. Be careful to carefully match the sleeve and nut size for the rod size you wish to use. Both types require the use of hardened steel washers. Always leave plenty of room for the jack to extend before engaging the jacking nut.

Welding & welding machines

Overview

To master the use of these tools requires professional vocational school and usually some sort of apprenticeship program. In general: use a fire-watch if necessary, be sure the smoke and fumes you generate are properly extracted, safety glasses are your primary protection and your helmet is
secondary. Safety glasses also provide a measure of flash protection. Appropriate respiratory protection may need to be worn. If you are in a hardhat area be sure to use welders hardhat. Never get between the arc and the ground i.e. if you are welding on top of a large plate, you must insulate yourself from the plate. Never weld in a confined space without a permit. Welding in a non-permit space automatically turns it into a permit-required space. Always erect arc protection in your work area. Never weld on top of drums.

**Protection**
- Welders gloves, clothing, helmet, shoes, safety glasses, respirator
- extensive skills training required.

### Static Press

**Overview**
The static press, sometimes referred to as the “Baldwin,” can exert loads in the range of 200,000 lbs. Great care should be used with this machine. The design is old and there are no safety switches. The controls are out of reach of the platen area. This means that if an operator is working with a specimen and fingers get caught, the machine cannot be stopped from that position. As with all equipment in the lab, specific training is required. Training forms must be signed.

**Protection**
- Safety Glasses required
- Leather gloves recommended
- Other protection as necessary for particular materials.

### Hydraulic Wrench & Torque Multiplier

**Overview**
The training for the hydraulic wrench is to protect both the operator as well as this very expensive tool. Use the same cautions as for the pre-stressing jacks. Before the hands on training you will read the manual. The head of the wrench articulates in several directions and the danger of being caught in a pinch-point is therefore increased: stay alert and vigilant. Be sure the socket is fully engaged with the fastener after each cycle.

**Protection**
- Safety glasses required
- Gloves recommended

### Special Concerns

**Torque multiplier**
This gear driven tool is actuated using a calibrated torque wrench and has a reaction bar that must be securely placed so as not to slip and injure the operator or damage the tool. The operating instructions will be read prior to the hands on training. If the square drive should fail (as it may do by design at maximum levels) be sure another one gets ordered BEFORE you install the spare and continue. To prevent a potentially serious injury: review the warnings in the manual each time you use this tool.
Torque wrench
This tool is for accurate loading and is not a general purpose wrench. You will only use this tool after you have been trained and only for setting torque values. Use of socket extensions and angle adaptors will change your torque values. !?!

Testing Machines & Construction of Specimens

Overview
Most of the testing equipment at the lab requires extensive training in the software and hardware involved. They operate on programs with servo-hydraulic actuators (this means they can kill you without warning if you are not careful). Take care that hands and body parts are never in the direct path of any active component. The computer could malfunction and cause a serious injury. When more than one person is working with a particular machine, one person is in charge and keeps the other employees aware of the machine’s state. Everyone must know where the others are in relation to the danger zones.

Construction trades and builders safety should be specifically addressed as part of the planning process of each project. The degree of your involvement will determine the requisite training protocol. One of the leading causes of serious injuries on the job are falls from ladders, scaffolds and platforms, followed closely by material handling injuries and injuries from falling objects, sharp objects and slips and trips (very often caused by dirty and disorganized job sites). Efficiency is greatly increased and the incidence of injuries is greatly reduced, by keeping the site clean and organized on a daily basis. There are many reasons why excuses are made for the lack of safety (ranging from ‘I’ve ben-do’en it this-a-way for 20 years and ain’t been hurt yet’. –to- ‘We don’t have time to clean and organize now. We will take care of it tomorrow.’ –and- ‘I didn’t make that mess, why should I have to clean it up?’). What ever the reasons and excuses are, they are not acceptable here. An injury can ruin a worker for an hour, a day or a lifetime.

Protection
The type of protection you will need is completely dependant on the test or type of construction. Awareness of your surroundings and good communication with the lab staff and students and contractors is necessary. If you have not communicated with test participants prior the start of testing and construction involving cranes fork lifts etc., you should avoid the area.

Special Concerns

Pre-stressed concrete blocks
Loading the specimens often requires the use of pre-made concrete blocks. The weight is marked on the side of these blocks. The condition of the rigging anchors needs to be determined before moving the blocks with the crane. Rigging will be done only by trained/skilled and experienced employees. The reaction wall blocks in Bldg 484 all weigh 21,500 # and require special rigging.

Lead
Loading the specimens often requires the use of lead ingots, bars and billets. Lead handling requires EH&S training as per university requirements in addition to the material handling training received in the lab.
**Scaffolding**

It shall be the responsibility of all users to read and comply with the following common sense guidelines which are designed to promote safety in the erecting, dismantling and use of scaffolds. These guidelines do not purport to be all-inclusive nor to supplant or replace other additional safety and precautionary measures to cover usual or unusual conditions. If these guidelines in any way conflict with any state, local, federal or other government statute or regulation, said statute or regulation shall supersede these guidelines and it shall be the responsibility of each user to comply therewith.

Any landing, stair platform, or balcony more than 48” above a surface must have guard rails 36” high, and intermediate rail and a toe rail.

The scaffold base must be set on an adequate sill or pad to prevent slipping or sinking and fixed thereto where required. Any part of a building or structure used to support the scaffold shall be capable of supporting the maximum intended load to be applied.

Do not work on scaffolds if your physical condition is such that you feel dizzy or unsteady in any way.

Use adjusting screws or other approved methods instead of blocking to adjust to uneven grade conditions.

Post these scaffolding safety guidelines in a conspicuous place and be sure that all persons who erect, dismantle or use scaffolding are aware of them.

Plumb and level all scaffolds as the erection proceeds. Do not force frames or braces to fit. Level the scaffold until proper fit can easily be made.

Inspect all equipment before using. Never use any equipment that is damaged or defective in any way. Remove it from the job site.

Do not erect, dismantle or alter a scaffold unless under the supervision of a qualified person.

Erected scaffolds should be continually inspected by users to be sure that they are maintained in safe condition. Report any unsafe condition to your supervisor.

Never use equipment for purposes or in ways not intended.

Never take chances if in doubt regarding the safety or use of the scaffold.

---

**Powered platforms and vehicle mounted work platforms**

**Overview**

This section applies to Scissor lifts, Boom lifts and Forklifts. Only trained persons shall operate personnel lifts as per University policy.

All equipment must be inspected the first time it is used on any day.

Inspection pads are located on each equipment item. Be sure you and the personal you are working with always have in place the following three elements when using personnel and/or material handling lifts.

1. Have a clear understanding of the operations to be done.
2. Have a clear understanding of signals.
3. Understand and review emergency rescue procedures.
4. Use the appropriate personnel protective equipment for the work to be done.
5. Observe fall protection requirements.

Always review the previous day's entries to alert you to any changed conditions. Be sure to shut off the gas each time after you operate the Forklift. Inspect the visible hydraulic lines and fittings. Refer to the appendix for the inspection form. If you are approved for using a lift basket, you will need to wear fall protection equipment. When changing the gas you will need to secure the gas bottles with a chain and be sure we do not run out of propane. When operating the lift inside the labs, open the doors and windows, as needed, to minimize exposure to carbon monoxide and to prevent any build up of carbon monoxide gases in the confined space areas.

**Fall Protection**

**General Requirements**

This Fact Sheet is an overview of the Cal/OSHA fall protection requirements related to construction, renovation, and maintenance operations on campus. It describes the platform and ladder equipment normally used by departments on campus. The Fact Sheet does not cover heavy construction activities such as structural steel connection and vertical rebar tying. Cal/OSHA standards are different for those activities. For definitions of the types of fall protection equipment mentioned in this Fact Sheet, see the EH&S Fact Sheet, “Fall Protection Equipment and Inspections.”

To whom the regulations apply

The regulations apply to anyone who is performing maintenance or construction activities and is working on an unprotected platform or ladder at least 7 1/2 feet from the floor.

**General fall protection requirements**

The regulatory requirements come from Cal/OSHA, the equipment manufacturers, and the American National Standards Institute (ANSI).

**Ladders**

Ladders are most often used for access to another level such as a roof or a tree. When work is to be performed from a ladder more than 7 1/2 feet from the ground, some form of fall protection, like a harness and lanyard, has to be used during the work. Working from a ladder is particularly hazardous because workers can't hold on to the ladder with both hands. In addition, workers may reach or carry tools that upset the center of balance. Defective ladders will be repaired or thrown away. In general, an extension ladder should be extended 3' above the landing point (such as the top edge of a test specimen) and then secured tightly to the landing area. Only one person is permitted on a ladder at a time.

**Mobile Work Platform or Ladder Stands**

Railings on a platform are sufficient fall protection if they meet standard guardrail requirements of Cal/OSHA. A harness and lanyard, correctly attached to the platform or other secure structure, are
necessary if the railing is not used or is less than 39 inches tall. The harness needs to conform to the Cal/OSHA attachment point load requirement. Contact EH&S for details.

**Elevated Aerial Device**
This category includes boom lifts with attached baskets and equipment with telescoping or articulating arms. The operator must wear fall protection or positioning personal protection equipment (PPE). Guardrails alone are not enough with this type of lift because, when the operator stands within the basket and uses the controls there to move the lift, he could make the basket bounce, and this could catapult him right out of the basket.

**Roofing Operations**
Special rules apply for any activities performed on roofs. Refer to the EH&S Fact Sheet “Fall Protection for Activities on Roofs.”

**Elevated Locations**
Guardrails or other forms of fall protection must be provided for unenclosed, elevated work locations such as
- roof openings
- open or glazed sides of landings
- balconies or porches
- platforms
- runways
- ramps
- working levels more than 30 inches above the floor, ground, or other
- working areas of a building

**Housekeeping**
Debris and equipment that could cause a slip, trip, or fall must be cleared from working areas.

**Unusual fall protection situations**
The Berkeley campus may conduct research involving unusual or one-of-a-kind equipment, structures, or machines. Campus employees, including graduate students, are often required to perform maintenance to upgrade or renovate these devices. All of the Cal/OSHA requirements apply to this kind of work. Purchase and modification of commercially available access equipment (ladders or scaffolds) may be required. Contact EH&S for assistance with access and equipment modifications in order to insure Cal/OSHA compliance and the safety of the people doing the work. For more specific information regarding fall protection requirements, see the following EH&S Fact Sheets:
- Fall Protection Equipment and Inspection
- Ladder Safety
- Roof Operations and Fall Protection
- Aerial Lift Fall Protection

**Air Compressors / air tools**

**Overview**
The various air tools and the use of high pressure compressed air presents potential hazards. Check the pressure rating of tools prior to use. Check to ensure all fittings, hoses, tanks, and quick
disconnects are in good order. Be sure you know where the emergency shut off is. When using ¾” or larger hoses, many connectors require a pin to secure the connections (some must be lashed together) be sure you know how to properly connect the style you are using. Understand how to properly oil and inspect tools and lines for damage or malfunction. Be sure you have signed off on the JSA training form prior to use of any tool.

**Protection**

- Safety Glasses required
- Hearing Protection recommended/required as per job
- Gloves and clothing recommended/required as per job
- Respirator recommended/required as per job

**Special Concerns**

**Air guns**

There are two types of air gun. The Saf-T-Air that maintains a maximum of 30 psi at the nozzle, and a standard model that discharges the full rate of the air supply.

**Saf-T-Air**

This is the gun shaped type and is used for air-voiding and other applications. Use this type whenever possible.

**Standard**

The standard type of air gun delivers more pressure than the Saf-T-Air type. It is necessary for some applications. Take care not to endanger yourself other employees with flying particles.

**Impact air guns**

The use of Impact Air Guns greatly speeds the assembly and disassembly process. These tools all need to be properly oiled and many operate at a lower maximum air-psi than our typical system pressure. You may need to use a portable pressure regulator valve to step-down our house air pressure. Impact guns use only specially designed accessories, sockets etc. (Non impact tooling can explode violently and cause severe shrapnel injuries). The accessories and tools need to be properly fastened to the gun as well as to each other.

**House Air**

The House air system is quite powerful. The water drains and oil filters are maintained by RFS facilities professionals. The emergency shut-off breaker is labeled and located in the compressor room (in building 484) in the far northeast corner of the building. Connections are located throughout the labs and most have shut off valves.

**Air hoses**

All air hoses must not leak and must have undamaged fittings. If you cannot release or connect hoses by hand, find someone who is more familiar with the type of fittings being used to assist you. Never use pliers or wrenches with these connections. When setting up your job, always lay out your hoses in a manner that minimizes tripping hazards. After each use (and absolutely at the end of each day) carefully wrap up the hoses into 6’ coils and hang them up (keep them off the ground).

**Die grinders and high speed air tools**

These tools require lower pressure than our system pressure: always use regulator to step down the line pressure. These tools operate at 10-50,000rpm thus, can be very hazardous if damaged.
Always inspect the tool housing and tooling for any sign of damage and to be sure fittings and connections are secure. If seals are ruptured, housings cracked etc. Do Not Use. Tag all damaged tools and notify the person who can initiate the repair/replacement process.

**Hydraulic Actuators**

**Overview**

The hydraulic actuators in the labs come in many sizes. The plumbing is sophisticated and the installation is seldom easy or straight forward. Experienced professional lab personnel will direct the installation, service, plumbing and operation. The installation lead persons will most often need experience and expertise in many aspects of the lab operations.

**Overhead Cranes**

**Overview**

Only trained personnel shall ever operate a crane as per University policy. Daily inspections are required. Rigging must be inspected prior to use. Never leave a load suspended form the crane. Tags must be in place and replaced if damaged. Be sure that there are replacement batteries (for the remote control) on top of the switch box (bldg. 484). Be sure the hook bail is in good condition and lock and tag out the crane if it is not. Shut off power to the crane when you are through using it. Know where the danger zones are and keep everyone clear. Use tag lines. Use crane operators hand signals. Always use safety blocks if you need to get into the danger zones with any part or all of your body. The labs have two bridge cranes, two chain drive hoists, one stationary hoist on the UTM.

**Protection**

The protection you will primarily need is leather gloves, a hard hat and safety glasses.

**Special concerns: Plate clamps**

We have two types of Plate clamps: one type for lifting vertically; one type for lifting horizontally. Check the clamping surface for signs of excessive wear. Never exceed the rated capacity and load angle. Always use a shackle to connect the clamps to cables or slings. Never choke the sling directly to the lifting eye.

**Special concerns: Lever chain puller/hoists**

This equipment is designed for lifting, lowering and pulling. The labs have four of these, be sure to use the one rated for your work load. All have three-position controls and free-wheeling for rapid chain adjustment. Be sure to keep the chain and mechanism properly lubricated to prevent jamming and excessive wear. Be aware of the pinch points where the chain feeds in and out. Never use a hook without a bail. Be sure the bail is in good condition.

**Pry bars & Sledgehammers**

**Overview**

Pry bars and sledgehammers are used to both assemble and disassemble, for alignment as well as for demolition. Inspect the integrity of their blades and handle-head connections before use. Their misuse can hurt other employees and can cause chips to fly into the eyes. You will be instructed on how to move your body correctly when you swing a heavy hammer to prevent the hammer from ever deflecting into your body or legs.
Protection

- Safety Glasses required
- Leather Gloves recommended

Appendix A

Confined Space

Overview

There are three Non-Permit confined spaces in the labs: one is under the earthquake simulator in building 420, one is under the Universal Testing Machine in building 484, one is inside the reaction wall blocks in building 484 on the main test floor. The training for entry and occupation is designed to prevent the tragedy of confined space accidents: (confined space accidents typically take the life of one original victim and one or two would-be rescuers). The policies and procedures have been well established to eliminate the possibility of this preventable accident. It is important to remember that if non-permit conditions change during the job, the space will be immediately evacuated and reclassified as a permit-required confined space; or, conditions shall be returned to non-permit conditions and again certified as such by the entry supervisor. Special training required as per EH&S, OSHA, Dept. of Labor.

Protection/Procedure Required

- Isolate the space
- Ventilation of the space (4 air changes per hour) required from a fresh air source
- Evaluate the space (test atmosphere, assure justification conditions are met)
- Conduct a safety meeting (complete entry log)
- Enter the space (proceed with work while monitoring conditions)

PEER non permit Confined Space Entry Log

Bldg. 420, Shaking Table Pit Area:
Ventilation is 1000 cfm and should to be run a minimum of 10 minutes prior to entry.

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<th>Acceptable Levels</th>
<th>Oxygen</th>
<th>Combustible Gases</th>
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<td>10% LEL or less</td>
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<th>Time</th>
<th>Oxygen Reading</th>
<th>Combustible Gas Reading</th>
<th>Your Name</th>
<th>Purpose of Entry</th>
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**Job Safety Analysis**

Safety Information for the University of California, Berkeley

## PEER/NEES

### Title of Job or Task

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<tr>
<th>TASK</th>
<th>HAZARDS</th>
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**Required Training:**

**Required Personal Protective Equipment (PPE)**

See (insert link) for more information on (insert titles of linked documents)

Department: Working Job Title, Individual’s Name; Working Job Title, Individual’s Name

Month Year

(EH&S will insert number here, if applicable)

For more information about this JSA, contact the Office of Environment, Health and Safety at UC Berkeley, 317 University Hall #1150, Berkeley, CA 94720-1150

(510) 642-3073 • [http://www.ehs.berkeley.edu](http://www.ehs.berkeley.edu)

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**Injury & Illness Prevention Program**

**NEW EMPLOYEE SAFETY TRAINING RECORD**
This completed form should be retained in the individual's personnel file as evidence of initial training required under the Injury and Illness Prevention Program.

Employee Name: ________________________________

Please Print)

O New Hire       O Transfer       O Other: ________________________________

Date of Hire / New Assignment: ________________________________

I, ________________________________, hereby certify that this employee has

(Instructor)

been trained on the following: (Check appropriate boxes.)

I. □ Initial Training on Department’s IIPP, Including: Date: ______________
   • My right to ask any question, or report any safety hazards, either directly or anonymously without any fear of reprisal.
   • The location of departmental safety bulleitns and required safety postings (i.e., summary of occupational injuries and illnesses, and Safety and Health Protection Poster).
   • Disciplinary procedures that may be used to ensure compliance with safe work practices.
   • Reporting safety concerns.
   • Accessing the department safety committee.
   • Reporting occupational injuries and illnesses.

II. □ Hazard Communication Training Date: ______________
   • The potential occupational hazards in the work area associated with my job assignment.
   • The safe work practices and personal protective equipment required for my job title.
   • The location and availability of Material Safety Data Sheets (MSDS).
   • The hazards of any chemicals to which I may be exposed, and my right to the information contained on MSDSs for those chemicals.

III. □ Building Emergency Plan (BEP) Date: ______________
   • Emergency escape routes and procedures and Emergency Assembly Area (EAA)
   • How to report a fire and other emergencies
   • Names or regular job titles of persons to be contacted for further information.

III. □ Other: ________________________________ Date: ______________

Employee Signature: ________________________________ Date: ______________

IIPP - Form 7
Rev. 10/02/01  Completed copies of this form must be kept in Department files for at least one year.
Name:___________________________________________________________________________

Phone Number: _________________________ e-mail address:_________________________________

Department:____________________________ Supervisor:_________________________________

Union / Bargaining Unit: __________________________

Incident Details: Date: ________________ Time: __________ Location: __________________________

Description of Incident (related to occupational health, safety, and/or management/supervision: threats, retaliation, etc.):

Physical Symptoms or Injuries (if any):

Reported to:

- Supervisor
- Union / Rep
- UCB Environmental Health & Safety
- Other

Action taken

- by your supervisor:
- by you:
- by others:

Have you gone to see the doctor? ______________

Date:_________________ City:_______________ Type of doctor: ____________________________________

Diagnosis:

Have you made a Workers’ Comp claim, or did the doctor fill out a Workers’ Comp form?

Any other worker(s) experienced the same problem?

Name(s):
Injury & Illness Prevention Program

OCCUPATIONAL ACCIDENT, INJURY OR ILLNESS INVESTIGATION REPORT

Department: ________________________________
Supervisor's Name/Phone: __________________________
Person(s) involved: (include titles)

Location: ________________________________  Time: _________  Date: __________
Task being performed when accident occurred:

NOTE: This form is intended to serve only as a local record of the investigation conducted within the department. Should an injury or illness occur, required forms must be submitted to the Department of Workers Compensation (DWC) as outlined in the Workers’ Compensation Manual for Supervisors. Call 643-7921 if copies are not available in your department. Also, an IIPP Form 4, "Hazard Correction Report" must be completed in conjunction with any accident, injury or illness.

Describe the accident, illness, or injury and the probable root cause(s) of the incident. Include the nature of the injury or illness, any eyewitness accounts, and any property damage which may have occurred. Be sure to include the names and phone numbers of any witnesses. Attach a separate sheet if necessary.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Describe what corrective actions need to be taken to ensure this type of incident does not recur. Also, include the name(s) and phone number(s) of those who will ensure that these corrective actions are done in a timely manner.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Signature of Supervisor Conducting Investigation  ________________________________  Date: __________

Signature of Department Safety Coordinator  ________________________________  Date: __________

(Do not sign until a thorough review of the incident by the Safety Committee is complete and corrective actions are in place.)

IIPP—Form 5  Completed copies of this form must be routed to the Safety Committee and kept on file for at least one year.

Rev. 10/02/01  

Injury & Illness Prevention Program
## REPORT OF UNSAFE CONDITION OR HAZARD

Department: ____________________________

### I. Unsafe Condition or Hazard

<table>
<thead>
<tr>
<th>Name: (optional)</th>
<th>________________</th>
<th>Job:</th>
<th>________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Location of Hazard:**

- **Building:** ___________
- **Floor:** ___________
- **Room:** ___________

**Date and time the condition or hazard was observed:** ________________

**Description of unsafe condition or hazard:**

________________________________________________________________________

________________________________________________________________________

**What changes would you recommend to correct the condition or hazard?**

________________________________________________________________________

________________________________________________________________________

**Employee Signature:** (optional) ________________

**Date:** ________________

### II. Management/Safety Committee Investigation

**Name of person investigating unsafe condition or hazard:**

________________________________________________________________________

**Results of investigation (What was found? Was condition unsafe or a hazard?):** (Attach additional sheets if necessary.)

________________________________________________________________________

________________________________________________________________________

**Proposed action to be taken to correct hazard or unsafe condition:** (Complete and attach a Hazard Correction Report, IIPP Form 4)

________________________________________________________________________

________________________________________________________________________

**Signature of Investigating Party:** ________________

**Date:** ________________

---

*IIPP - Form 1  Rev. 10/02/01*  Completed copies of this form should be routed to the appropriate supervisor and department Safety Committee, and must be maintained in department files for at least one year.
University of California, Berkeley

GENERAL SELF-INSPECTION FORM
for Administrative Areas

This self-inspection form should be used to document safety inspections in large office suites, areas with multiple cubicles, copy rooms, coffee rooms, and other common work areas. It should not be used for individual offices, nor for non-administrative areas such as shops, laboratories, and areas containing any hazardous materials. (See www.ehs.berkeley.edu for Office, Shop, and Laboratory forms.)

The university is required to perform and document self-inspections of all campus workspaces annually as part of Cal/OSHA’s requirement for an effective Injury and Illness Prevention Program (IIPP). Each department must inspect its administrative workspaces annually using this GENERAL/ADMINISTRATIVE SELF-INSPECTION FORM or an equivalent. This form can assist you in identifying and correcting many unsafe practices and conditions. The unsafe practices and conditions identified on this form are prohibited by state laws or campus policies, or are generally considered to be unsafe workplace practices.

After completing the self-inspection form, share the results with your supervisor and Department Safety Committee. Correct identified deficiencies as soon as possible and document correction on the form by entering the “Date Completed.” If you need assistance correcting conditions, or if you have any questions or concerns about safety in the workplace, contact your Department Safety Coordinator or the Office of Environment, Health & Safety (EH&S) at 642-3073. Keep the original self-inspection form on file in your department, so that it will be available should Cal/OSHA or campus oversight committees request it. EH&S will periodically check that your department has performed and documented general (administrative area) self-inspections.

This form was designed to help ensure compliance with Cal/OSHA regulations that require documented periodic inspections of all work areas as part of an effective IIPP. However, completion of this form and correction of any findings noted herein does not ensure that Cal/OSHA will not issue citations.
GENERAL SELF-INSPECTION FORM
for Administrative Areas

Area Location (Rm/Bldg) ___________________________ Type of Area ___________________________
Department ___________________________ Date of Inspection ___________________________
Inspector’s Name (print) ___________________________ Signature ___________________________
Supervisor’s Name (print) ___________________________ Signature ___________________________

- Is the Cal/OSHA poster “Safety and Health Protection on the Job” displayed in the building and accessible to all employees?
  
  O Yes (Satisfactory)  O No (Needs Correction) Date Corrected: ____________  O N/A
  Corrective Action: Contact EH&S (642-3073) to obtain posters.

- Is documentation of safety training, workplace self-inspections, and hazard corrections maintained and accessible where indicated in your department’s IIPP?
  
  O Yes (Satisfactory)  O No (Needs Correction) Date Corrected: ____________  O N/A
  Corrective Action: Confirm location listed in the IIPP and ensure that records are stored there.

- Have employees in the area been trained on the applicable Building Emergency Plan (BEP)?
  
  O Yes (Satisfactory)  O No (Needs Correction) Date Corrected: ____________  O N/A
  Corrective Action: Contact your Department Safety Coordinator to obtain the BEP, or contact your Building Coordinator if a BEP is not available.

- Are evacuation diagrams posted?
  
  O Yes (Satisfactory)  O No (Needs Correction) Date Corrected: ____________  O N/A
  Corrective Action: Contact your Department Safety Coordinator, Building Coordinator, or EH&S (642-3073) for assistance in preparing diagrams as required by the BEP.

- Are fire alarm pull boxes clearly identifiable and unobstructed?
  
  O Yes (Satisfactory)  O No (Needs Correction) Date Corrected: ____________  O N/A
Corrective Action: Clear area of obstructions.

- Are fire hose stations and/or portable extinguishers clearly identifiable and unobstructed?
  - Yes (Satisfactory)  
  - No (Needs Correction)  
  - N/A

Corrective Action: Label fire-fighting equipment and clear area of obstructions.

- Are fire extinguishers tagged with inspections at least annually?
  - Yes (Satisfactory)  
  - No (Needs Correction)  
  - N/A

Corrective Action: Contact your Building Coordinator to arrange for a fire extinguisher inspection by PP-CS. Ensure that the extinguisher is properly tagged after the inspection.

- Do self-closing devices and door latches on fire-rated doors (doors that open into corridors or stairwells) work properly? (Doorstops are not permitted.)
  - Yes (Satisfactory)  
  - No (Needs Correction)  
  - N/A

Corrective Action: Contact your Department Safety Coordinator to arrange for door repairs.

- Are there at least 18 inches (47 cm) of vertical clearance maintained between all stored items and any ceiling equipped with fire sprinklers?
  - Yes (Satisfactory)  
  - No (Needs Correction)  
  - N/A

Corrective Action: Remove stored items that do not meet the above criteria.

- Are electrical panels accessible and circuit breakers clearly identified?
  - Yes (Satisfactory)  
  - No (Needs Correction)  
  - N/A

Corrective Action: Label circuit breakers as to their function, and clear area in front of electrical panels by 36 inches.

- Are aisles, exits, and adjoining hallways maintained free of obstructions so that the area can be easily evacuated or accessed in case of an emergency?
  - Yes (Satisfactory)  
  - No (Needs Correction)  
  - N/A

Corrective Action: Remove obstructions from aisles, exits, and adjoining hallways. Contact your Department Safety Coordinator if help is needed cleaning adjoining hallways.
• Has all electrical equipment that is required to be grounded (e.g., copiers and computers) been grounded? (Ensure that the grounding pin has not been removed and that 3-pin to 2-pin adapters are not used.)

  O Yes (Satisfactory)  O No (Needs Correction)  Date Corrected: ______________  O N/A

  **Corrective Action:** Contact your supervisor or Department Safety Coordinator to arrange for installation of appropriate outlets and plugs.

• Are extension cords in good condition (e.g., no breaks or exposed wiring), used only as temporary wiring (less than 30 days), and not connected in series?

  O Yes (Satisfactory)  O No (Needs Correction)  Date Corrected: ______________  O N/A

  **Corrective Action:** Do not connect extension cords in series. Dispose of or repair all electrical cords that are not in good condition, and replace those in use more than 30 days with permanent wiring.

• Has all broken, unguarded, or otherwise dangerous equipment and furniture been repaired or removed? (Example: A papercutter without a guard to keep fingers away from the blade.)

  O Yes (Satisfactory)  O No (Needs Correction)  Date Corrected: ______________  O N/A

  **Corrective Action:** Contact your supervisor or Department Safety Coordinator to arrange for removal or repair of equipment or furniture.

• Are floor surfaces kept dry and/or made slip-resistant?

  O Yes (Satisfactory)  O No (Needs Correction)  Date Corrected: ______________  O N/A

  **Corrective Action:** Work with your supervisor, Department Safety Coordinator, or Safety Committee to address this issue.

• Is furniture and equipment over four feet tall braced to prevent tipping in an earthquake?

  O Yes (Satisfactory)  O No (Needs Correction)  Date Corrected: ______________  O N/A

  **Corrective Action:** Contact your supervisor or Department Safety Coordinator for assistance in installing seismic restraints, or remove items in question.

• Are all work areas adequately illuminated?

  O Yes (Satisfactory)  O No (Needs Correction)  Date Corrected: ______________  O N/A
Corrective Action: Contact your supervisor or Department Safety Coordinator for assistance in obtaining additional lighting.

- Have computer workstations been ergonomically evaluated for all employees who spend four or more hours at their computer each day?
  
  O Yes (Satisfactory)  O No (Needs Correction)  Date Corrected: ____________  O N/A

  Corrective Action: Contact your supervisor or Department Safety Coordinator to have a trained workstation evaluator assess the workstation. If your department does not have an evaluator, contact University Health Services, Ergonomics@Work Program (642-8410).
SAFETY TRAINING ATTENDANCE RECORD

Department: ____________________________________________________________

Topic of Training Session: ____________________________________________
(attach a copy of the training session curriculum)

<table>
<thead>
<tr>
<th>Instructor(s):</th>
<th>Location:</th>
<th>Date:</th>
<th>Time:</th>
<th>Length:</th>
</tr>
</thead>
</table>

We are legally required to maintain records regarding our safety training activities. Please assist us by providing the information indicated below to document your attendance. Thank you.

<table>
<thead>
<tr>
<th>Name (Please Print)</th>
<th>Department</th>
<th>Campus Phone</th>
<th>Employee I.D. (if available)</th>
<th>Official Payroll Title</th>
<th>Signature</th>
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IIPP - Form 6
Rev. 10/02/01

Completed copies of this form must be kept in the department files for at least one year.
University of California, Berkeley's Injury and Illness Prevention Program (IIPP) Template and Forms

Departments at the University of California, Berkeley can use the template and forms (including self-inspection forms) listed below to create a written Injury & Illness Prevention Program (IIPP) that meets the requirements of state law. (Each department at UC Berkeley is required to have its own IIPP.) The template and forms help your department document its safety activities, an important part of implementing your IIPP. Putting the written program into action will help to ensure a healthful and safe workplace for department employees. If you have comments or suggestions on the IIPP template or forms, contact Ave Tolentino at 643-5734. The next step is to put the program into action. An IIPP’s benefits will be realized only through effective implementation.

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Word File</th>
<th>PDF</th>
<th>View Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIPP</td>
<td>IIPP Template (does not include forms)</td>
<td>Word file - 80K</td>
<td>PDF - 32K</td>
<td>IIPP Template</td>
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<tr>
<td>Form 1</td>
<td>Report of Unsafe Condition or Hazard</td>
<td>Word file - 32K</td>
<td>PDF - 4K</td>
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<td>Form 2</td>
<td>Safety Committee Meeting Documentation</td>
<td>Word file - 28K</td>
<td>PDF - 8K</td>
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<tr>
<td>Form 3-Lab</td>
<td>Laboratory Safety Self-Inspection</td>
<td>Word file - 76K</td>
<td>PDF - 152K</td>
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<tr>
<td>For DSCs Only</td>
<td>2006 Laboratory and Shop Self-Inspection Program Summary Form (for 11/09/06 submissions)</td>
<td>Word file - 44K</td>
<td>PDF - 92K</td>
<td>Laboratory and Shop Self-Inspection Program Summary Form</td>
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<td>General Safety Self-Inspection</td>
<td>Word file - 50K</td>
<td>PDF - 16K</td>
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<td>Form 3-Office</td>
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<td>Word file - 37K</td>
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<td>Form 3-Shop</td>
<td>Shop Safety Self-Inspection</td>
<td>Word file - 52K</td>
<td>PDF - 152K</td>
<td>Shop Safety Self-Inspection</td>
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<tr>
<td>For DSCs Only</td>
<td>2006 Laboratory and Shop Self-Inspection Program Summary Form (for 11/09/06 submissions)</td>
<td>Word file - 44K</td>
<td>PDF - 92K</td>
<td>Laboratory and Shop Self-Inspection Program Summary Form</td>
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<tr>
<td>Form 4</td>
<td>Hazard Correction Report</td>
<td>Word file - 28K</td>
<td>PDF - 8K</td>
<td>Hazard Correction Report</td>
</tr>
<tr>
<td>Form 5</td>
<td>Occupational Accident, Injury or Illness Investigation Report</td>
<td>Word file - 28K</td>
<td>PDF - 8K</td>
<td>Occupational Accident, Injury or Illness Investigation Report</td>
</tr>
</tbody>
</table>
To use the IIPP Template
To use the IIPP template, first download it and the applicable forms. (See "Downloading Tips" below.) Once the template is open on your own workstation, read through the entire document and fill in the blanks found on the first two pages with your department's specific information. Print copies of the forms for your department's use. (The forms are generic and do not require any changes.) When you're done, send a copy to the Office of Environment, Health & Safety (EH&S) at 317 University Hall #1150 for review. (You may also send it as an email attachment to ehs@berkeley.edu. EH&S will review the draft against applicable legal requirements.

To use the Forms
There are three ways to view and use the forms:
1) **Word File** - Download a Word file if you want to have the form on your computer. With a Word file you are able to open the file and add or change the content before printing it out.
2) **PDF** - Download a PDF (Portable Document Format) file if you want a formatted document that you can print out to your local printer. With a PDF file you will not be able to make changes to the document.
3) **View Online** - Click on link to view document on the web.

Related Links
**Injury & Illness Prevention Program Page** - Provides program overview, resources and assistance.

Downloading Tips
The documents you will be downloading were created in Microsoft Word. They can be downloaded by Macintoshes, PCs, and Unix systems. Downloading them will be easiest if your browser's preferences for helper applications are properly set. You can set helper application preferences to launch your word processing application upon receiving the documents or to save them to any location you choose.

If your downloading results in a plain document icon, start your word processing application, then use its "Open" command to open the file. Macintosh users should note that the IIPP file is too big to open through Simple Text.

If you'd like technical assistance in downloading these files, contact Cheryl Reinman of EH&S by email or telephone at 642-1978.
## EH&S Staff Directory

<table>
<thead>
<tr>
<th>Alphabetical by Last Name</th>
<th>Working Title</th>
<th>Email Address</th>
<th>Campus Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baldridge, Ian</td>
<td>Radiation Safety Technician</td>
<td><a href="mailto:iandb@berkeley.edu">iandb@berkeley.edu</a></td>
<td>643-3152</td>
</tr>
<tr>
<td>Bayne, Gary</td>
<td>Construction Health &amp; Safety Specialist</td>
<td><a href="mailto:g_bayne@berkeley.edu">g_bayne@berkeley.edu</a></td>
<td>643-9476</td>
</tr>
<tr>
<td>Bean, Tim</td>
<td>EH&amp;S Training Manager</td>
<td><a href="mailto:mtbean@berkeley.edu">mtbean@berkeley.edu</a></td>
<td>643-3482</td>
</tr>
<tr>
<td>Bias, Judy</td>
<td>Facilities/Equipment Coordinator</td>
<td><a href="mailto:judybias@berkeley.edu">judybias@berkeley.edu</a></td>
<td>642-3074</td>
</tr>
<tr>
<td>Chen, Amy</td>
<td>Deputy Fire Marshal</td>
<td><a href="mailto:awchen@berkeley.edu">awchen@berkeley.edu</a></td>
<td>643-8576</td>
</tr>
<tr>
<td>Ciprazo, Eddie</td>
<td>Laser Safety Officer</td>
<td><a href="mailto:racerx@berkeley.edu">racerx@berkeley.edu</a></td>
<td>643-9243</td>
</tr>
<tr>
<td>DeFrancisi, Brandon</td>
<td>Associate Director, Health &amp; Safety</td>
<td><a href="mailto:defran@berkeley.edu">defran@berkeley.edu</a></td>
<td>643-6394</td>
</tr>
<tr>
<td>DeMille, Joyce</td>
<td>Deputy Fire Marshal</td>
<td><a href="mailto:jdemille@berkeley.edu">jdemille@berkeley.edu</a></td>
<td>642-5995</td>
</tr>
<tr>
<td>Diacan, Cornelio (Nel)</td>
<td>Hazardous Materials Technician</td>
<td><a href="mailto:diacan@berkeley.edu">diacan@berkeley.edu</a></td>
<td>642-5982</td>
</tr>
<tr>
<td>Durant, Cindy</td>
<td>Human Resources &amp; Strategic Planning Manager</td>
<td><a href="mailto:cdurant@berkeley.edu">cdurant@berkeley.edu</a></td>
<td>642-6165</td>
</tr>
<tr>
<td>Etherington, Kelley</td>
<td>Hazardous Materials Specialist</td>
<td><a href="mailto:kelley_e@berkeley.edu">kelley_e@berkeley.edu</a></td>
<td>643-7195</td>
</tr>
<tr>
<td>Feld, James (Jim)</td>
<td>Senior Deputy Fire Marshal</td>
<td><a href="mailto:jfeld@berkeley.edu">jfeld@berkeley.edu</a></td>
<td>642-6552</td>
</tr>
<tr>
<td>Field, Hank</td>
<td>EH&amp;S Construction Coordinator</td>
<td><a href="mailto:hfield@berkeley.edu">hfield@berkeley.edu</a></td>
<td>642-0359</td>
</tr>
<tr>
<td>Freiberg, Mark</td>
<td>Director</td>
<td><a href="mailto:freiberg@berkeley.edu">freiberg@berkeley.edu</a></td>
<td>643-8676</td>
</tr>
<tr>
<td>Goff, Patrick (Pat)</td>
<td>Associate Director, Hazardous Materials &amp; Radiation Safety</td>
<td><a href="mailto:ptgoff@berkeley.edu">ptgoff@berkeley.edu</a></td>
<td>642-1925</td>
</tr>
<tr>
<td>Haet, Greg</td>
<td>Associate Director, Environmental Protection</td>
<td><a href="mailto:gjhaet@berkeley.edu">gjhaet@berkeley.edu</a></td>
<td>642-4848</td>
</tr>
<tr>
<td>Hans, Karl</td>
<td>Senior Environmental Specialist</td>
<td><a href="mailto:khaens@berkeley.edu">khaens@berkeley.edu</a></td>
<td>643-9574</td>
</tr>
<tr>
<td>Hayes, Philip</td>
<td>Hazardous Materials Technician</td>
<td><a href="mailto:phayes@berkeley.edu">phayes@berkeley.edu</a></td>
<td></td>
</tr>
<tr>
<td>Hendricks, Jesse</td>
<td>Principal Radiation Safety Technician</td>
<td><a href="mailto:jhendricks@berkeley.edu">jhendricks@berkeley.edu</a></td>
<td>643-3010</td>
</tr>
<tr>
<td>Ho, Sally</td>
<td>Radiation Safety Specialist</td>
<td><a href="mailto:sallyho@berkeley.edu">sallyho@berkeley.edu</a></td>
<td>643-8776</td>
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<tr>
<td>Kruse, Phil</td>
<td>Hazardous Materials Specialist</td>
<td><a href="mailto:pkruke@berkeley.edu">pkruke@berkeley.edu</a></td>
<td>643-6384</td>
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<tr>
<td>Kaulback, Patrick</td>
<td>Registered Environmental Health Specialist</td>
<td><a href="mailto:pkaulback@berkeley.edu">pkaulback@berkeley.edu</a></td>
<td>642-1977</td>
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<tr>
<td>Lazaroff, Allen</td>
<td>Business &amp; Financial Manager</td>
<td><a href="mailto:alawyn@berkeley.edu">alawyn@berkeley.edu</a></td>
<td>643-8468</td>
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*Campus Phone Number (Add area code (510) if calling from out of the area)*
<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Email</th>
<th>Phone</th>
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<tbody>
<tr>
<td>Lee, Carol</td>
<td>Human Resources &amp; Director's Assistant</td>
<td><a href="mailto:fainlee@berkeley.edu">fainlee@berkeley.edu</a></td>
<td>642-9177</td>
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<td>Lee, Grace</td>
<td>Radiation Safety Technician</td>
<td><a href="mailto:na_lee@berkeley.edu">na_lee@berkeley.edu</a></td>
<td>643-8272</td>
</tr>
<tr>
<td>Marazana, Steve</td>
<td>Assistant Manager, Training, Emergency Response &amp; Audit</td>
<td><a href="mailto:stevemar@berkeley.edu">stevemar@berkeley.edu</a></td>
<td>643-1208</td>
</tr>
<tr>
<td>Maynard, Phil</td>
<td>Laboratory Safety Specialist</td>
<td><a href="mailto:pmaynard@berkeley.edu">pmaynard@berkeley.edu</a></td>
<td>643-7699</td>
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<tr>
<td>Miller, Kim</td>
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<td>Porter, Deb</td>
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<td>Reese, Donna</td>
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<td><a href="mailto:dreese@berkeley.edu">dreese@berkeley.edu</a></td>
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<tr>
<td>Reinman, Cheryl</td>
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<tr>
<td>Rosenberger, Sonia</td>
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<tr>
<td>RSO</td>
<td>Radiation Safety Officer</td>
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<tr>
<td>Ryan, Julia</td>
<td>Hazardous Materials Specialist</td>
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<tr>
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<tr>
<td>Siegel, Nancy</td>
<td>Administrative Operations Supervisor</td>
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<td>Smith, Jason</td>
<td>Radiation Safety Specialist</td>
<td><a href="mailto:tguncle@berkeley.edu">tguncle@berkeley.edu</a></td>
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<td>Souza, Sara</td>
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<td><a href="mailto:sarasouza@berkeley.edu">sarasouza@berkeley.edu</a></td>
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<td>Taylor, Charisse</td>
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<td><a href="mailto:charisse@berkeley.edu">charisse@berkeley.edu</a></td>
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<td>Thomas, Sandra</td>
<td>Office Assistant</td>
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<td>643-6387</td>
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<tr>
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<td>643-5734</td>
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<tr>
<td>Valencia, Alma</td>
<td>EH&amp;S Associate Director</td>
<td><a href="mailto:alma_v@berkeley.edu">alma_v@berkeley.edu</a></td>
<td>643-5973</td>
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<tr>
<td>VanValkenburgh, Mark</td>
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<td><a href="mailto:jordan52@berkeley.edu">jordan52@berkeley.edu</a></td>
<td>643-8976</td>
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<tr>
<td>Waller, Roy</td>
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<td>642-4409</td>
</tr>
</tbody>
</table>
Operator’s Pre-shift Inspection (Gas, LP or Diesel Forklift)

Date: ______________ Vehicle No.: ________________ Shift: ___________
Type and Model: ______________________ Hour Meter: ________________

**OK NA VISUAL CHECKS**

Maintenance Needed – Reported to:
Fluid Levels – Oil, Radiator, .................................................................
Hydraulic..............................................................................................
Leaks – Hydraulic Oil, Battery, Fuel...................................................
Tires – Condition and pressure............................................................
Forks, Top Clip retaining pin and heel – Condition..............................
Load Backrest Extension – solid attachment........................................
Hydraulic hoses, Mast chains & Stops................................................
Finger guards – attached..................................................................
Safety warnings – attached and legible..............................................
Operators manual – Located on truck and legible..............................
Capacity Plate – attached; information matches...................................
Model & Serial Nos. and attachments................................................
Seat Belt – Buckle and retractor working smoothly................................

**OPERATIONAL CHECKS – Unusual Noises Must be Reported Immediately**

Accelerator Linkage...............................................................................
Parking Brake.....................................................................................
Steering..............................................................................................
Drive Control – Forward and Reverse................................................
Tilt Control – Forward and Back..........................................................
Hoist & Lowering Control.................................................................
Attachment Control...........................................................................
Horn.....................................................................................................
Lights..................................................................................................
Back-Up Alarm...................................................................................
Hour Meter..........................................................................................

Inspected by: ________________________
Custodian: ______________________
date: _________________________

Daily Pre-Shift Inspections are an OSHA requirement. We recommend that you document that these inspections have been made.
General Rigging Accessories Safety Information
(from the U.S. Department Of Energy (DOE))

Rigging Accessories

a. The information presented in this chapter provides guidance for safely handling lifted loads. Diagrams are used to illustrate hoisting and rigging principles and good and bad rigging practices. **This is not a rigging textbook;** the information should be applied only by qualified riggers.

b. Rigging accessories that have been damaged or removed from service shall be made unusable for hoisting and rigging operations before being discarded.

c. Load tables are representative only and are not exact for all materials or all manufacturers.

d. Determine the weight of the load:
   1. From markings on the load.
   2. By weighing, if the load is still on the truck or railroad car.
   3. From drawings or other documentation.
   4. By calculation, using the load dimensions and the weights of common materials.

e. Determine the center of gravity of the load as accurately as possible:
   1. From drawings or other documentation.
   2. From markings on the load.
   3. By calculation.

f. Determine the best method to attach the load and select the lifting devices (e.g., eyebolts or shackles etc.).

12.1.1 INSPECTIONS

a. The operator or other designated person shall visually inspect rigging accessories at the beginning of each work shift or prior to use for the following (records not required):
   1. Wear.
   2. Corrosion.
   3. Cracks.
   4. Nicks and gouges.
   5. Distortion such as bending or twisting.
   6. Evidence of heat damage from any cause.

b. A designated person shall determine whether conditions found during the inspection constitute a hazard and whether a more detailed inspection is required.

c. Rigging accessories having any of the following conditions shall be removed from service:
   1. Cracks.
   2. Distortion or deformation exceeding 15 percent of new conditions.
   3. Any sign of incipient failure in shear for shackle pins.
   4. Wear exceeding 10 percent of original dimensions.
   5. Excessive corrosion.
   6. Shackles not marked according to Section 12.3, “Shackles.”
   7. Heat damage.

d. A designated person shall perform nondestructive examinations according to applicable ASTM standards when needed by the responsible line manager or that person’s authorized representative.

e. A sample load test and inspection form is included as Exhibit I at the end of this chapter. This form is a sample only and is not intended to be mandatory.
<table>
<thead>
<tr>
<th>Name of Metal</th>
<th>Weight (lb/ft³)</th>
<th>Name of Metal</th>
<th>Weight (lb/ft³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>166</td>
<td>Bluestone</td>
<td>160</td>
</tr>
<tr>
<td>Antimony</td>
<td>418</td>
<td>Brick, pressed</td>
<td>150</td>
</tr>
<tr>
<td>Bismuth</td>
<td>613</td>
<td>Brick, common</td>
<td>125</td>
</tr>
<tr>
<td>Brass, cast</td>
<td>504</td>
<td>Cement, Portland (packed)</td>
<td>100-120</td>
</tr>
<tr>
<td>Brass, rolled</td>
<td>523</td>
<td>Cement, Portland (loose)</td>
<td>70-90</td>
</tr>
<tr>
<td>Copper, cast</td>
<td>550</td>
<td>Cement, slag (packed)</td>
<td>80-100</td>
</tr>
<tr>
<td>Copper, rolled</td>
<td>555</td>
<td>Cement, slag (loose)</td>
<td>55-75</td>
</tr>
<tr>
<td>Gold, 24-carat</td>
<td>1,204</td>
<td>Chalk</td>
<td>156</td>
</tr>
<tr>
<td>Iron, Cast</td>
<td>450</td>
<td>Charcoal</td>
<td>15-34</td>
</tr>
<tr>
<td>Iron, wrought</td>
<td>480</td>
<td>Cinder concrete</td>
<td>110</td>
</tr>
<tr>
<td>Lead, commercial</td>
<td>712</td>
<td>Clay, ordinary</td>
<td>120-150</td>
</tr>
<tr>
<td>Mercury, 60 degrees F</td>
<td>846</td>
<td>Coal, hard, solid</td>
<td>93.5</td>
</tr>
<tr>
<td>Silver</td>
<td>655</td>
<td>Coal, hard, broken</td>
<td>54</td>
</tr>
<tr>
<td>Steel</td>
<td>490</td>
<td>Coal, soft, solid</td>
<td>84</td>
</tr>
<tr>
<td>Tin, cast</td>
<td>458</td>
<td>Coal, soft, broken</td>
<td>54</td>
</tr>
<tr>
<td>Uranium</td>
<td>1,163</td>
<td>Coke, loose</td>
<td>23-32</td>
</tr>
<tr>
<td>Zinc</td>
<td>437</td>
<td>Concrete r stone</td>
<td>140-155</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Earth, rammed</td>
<td>90-100</td>
</tr>
<tr>
<td><strong>Name of wood</strong></td>
<td></td>
<td>Granite</td>
<td>165-170</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gravel</td>
<td>117-125</td>
</tr>
<tr>
<td>Ash</td>
<td>35</td>
<td>Lime, quick (ground loose)</td>
<td>53</td>
</tr>
<tr>
<td>Beech</td>
<td>37</td>
<td>Limestone</td>
<td>170</td>
</tr>
<tr>
<td>Birch</td>
<td>40</td>
<td>Marble</td>
<td>164</td>
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<tr>
<td>Cedar</td>
<td>22</td>
<td>Plaster of paris (cast)</td>
<td>80</td>
</tr>
<tr>
<td>Cherry</td>
<td>30</td>
<td>Sand</td>
<td>90-106</td>
</tr>
<tr>
<td>Chestnut</td>
<td>26</td>
<td>Sandstone</td>
<td>151</td>
</tr>
<tr>
<td>Cork</td>
<td>15</td>
<td>Shale</td>
<td>162</td>
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<tr>
<td>Cypress</td>
<td>27</td>
<td>Slate</td>
<td>160-180</td>
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<tr>
<td>Ebony</td>
<td>71</td>
<td>Terra-cotta</td>
<td>110</td>
</tr>
<tr>
<td>Elm</td>
<td>30</td>
<td>Traprock</td>
<td>170</td>
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<tr>
<td>Fir, Balsam</td>
<td>22</td>
<td>Water</td>
<td>65</td>
</tr>
<tr>
<td>Hemlock</td>
<td>31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maple, Oak</td>
<td>62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine, Poplar</td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 11-1. Efficiency of wire rope when bent and statically loaded to destruction over sheaves and pins of various diameters.
11.2.1 WIRE-ROPE LAYS

a. In a right-lay rope, the strands twist to the right around the core like a conventional screw thread; in a left-lay rope, the strands twist to the left.

b. A rope has a lang lay when the strands and the individual wires have the same lay direction. When the strands and the wires have an opposite lay direction, the rope has a regular lay.

c. A standard wire rope, unless otherwise stated, is understood to be right regular lay. With few exceptions, all wire rope is made right lay. Left-lay rope is a special-purpose rope.

d. Figure 11-2 shows ropes with right and left lays combined with regular and lang lays.

e. Lay length is the lengthwise distance measured along a wire rope in which a strand makes one complete revolution about the rope’s axis.

11.2.2 WIRE-ROPE CORES

a. Wire rope consists of multistrand metal wires wrapped around a suitable core material. Wire-rope cores are carefully designed and must be precisely manufactured to close tolerances to ensure a perfect fit in the rope. The most common types of cores include the following (see Figure 11-3):

1. Fiber Core (FC) or Sisal Core – Sisalanna is the most common fiber that is used in the manufacture of wire-rope cores. In smaller ropes, cotton and jute are sometimes used for the core.

2. Independent Wire-Rope Core (IWRC) – The primary function of the core is to provide adequate support for the strands. As the name implies, an IWRC is a separate small-diameter wire rope that is used as the core for a larger wire rope. When severe crushing or flattening of the rope is encountered, an IWRC is usually specified.

3. Strand Core – This type of core has a single strand used as the core. This type is generally confined to the smaller ropes as a substitute for IWRC. The strand core may or may not have the same cross section as the surrounding strands.

![Right Regular Lay](image1)

![Left Regular Lay](image2)

![Right Lang Lay](image3)

![Left Lang Lay](image4)

Figure 11-2. Wire-Rope lays.

![Fiber or Sisal Core](image5)

![Independent Wire-Rope Core](image6)

![Stand Core](image7)

Figure 11-3. Wire-rope cores.

11.2.3 WIRE ROPE FOR GENERAL PURPOSES

11.2.3.1 6 x 19 Classification

a. Most applications can use a rope from this classification; it is the most versatile of all ropes made. Figure 11-4 shows four varieties of 6 x 19 wire ropes with FCs and IWRCs. Table 11-2 provides breaking strengths for 6 x 19 wire ropes with FC and IWRC cores.
Figure 11-5. Balancing Loads

Figure 11-7. Relationship of load angle and lifting efficiency.
## GOOD AND BAD RIGGING PRACTICES

<table>
<thead>
<tr>
<th>Use of Chokers</th>
<th>Hook Slings</th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="Good - No cutting action on running lines" /></td>
<td><img src="image" alt="Good - Hooks are turned out" /></td>
</tr>
<tr>
<td><img src="image" alt="Bad - Bolt on running line can work loose" /></td>
<td><img src="image" alt="Bad - Hook openings are turned in" /></td>
</tr>
<tr>
<td><img src="image" alt="Bad - Because of cutting action of eye splice on running line" /></td>
<td><img src="image" alt="Double slings shall be used when hoisting two or more pieces of material over 12 ft long" /></td>
</tr>
<tr>
<td><strong>Suspending Needle Beams or Scaffolds</strong></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Good - Sharp corners padded" /></td>
<td><img src="image" alt="Right - Load over 12 ft" /></td>
</tr>
<tr>
<td><img src="image" alt="Bad - Steel can cut rope" /></td>
<td><img src="image" alt="Wrong - Load over 12 ft" /></td>
</tr>
</tbody>
</table>

**Figure 12-1.** Good and bad rigging practices.
GOOD AND BAD RIGGING PRACTICES

Eyebolts

Good practice — vertical lift on eyebolt

Hoisting Structural Steel

Good — Use space blocks and pad corners
Bad — Can bend flanges and cut rope

Eye Splices

Good practice — Note use of thimble in eye splice

Bad practice — Wire rope knot with clip. Efficiency 50% or less

Bad practice — Thimble should be used to increase strength of eye and reduce wear on rope

Figure 12-1. (continued).
Table 12-2. Strength of standard sling hooks.

<table>
<thead>
<tr>
<th>Standard Hook Number</th>
<th>Inside diameter of Eye A (in.)</th>
<th>Throat Opening B (in.)</th>
<th>Rated capacity (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>¾</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>23</td>
<td>7/8</td>
<td>1 1/16</td>
<td>0.6</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>1 1/8</td>
<td>0.7</td>
</tr>
<tr>
<td>25</td>
<td>1 1/8</td>
<td>1 1/4</td>
<td>1.2</td>
</tr>
<tr>
<td>26</td>
<td>1 ¼</td>
<td>1 3/8</td>
<td>1.7</td>
</tr>
<tr>
<td>27</td>
<td>1 3/8</td>
<td>1 ½</td>
<td>2.1</td>
</tr>
<tr>
<td>28</td>
<td>1 ½</td>
<td>1 ¾</td>
<td>2.5</td>
</tr>
<tr>
<td>29</td>
<td>1 5/8</td>
<td>1 7/8</td>
<td>3.0</td>
</tr>
<tr>
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<td>1 3/4</td>
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<td>2 ¼</td>
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</tr>
<tr>
<td>34&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>3 5/8</td>
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<td>3 1/2</td>
<td>4</td>
<td>11.0</td>
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<tr>
<td>38</td>
<td>4 1/2</td>
<td>5</td>
<td>30.0</td>
</tr>
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</table>

NOTES:

a. The above values are for "Yulcan" and similarly designed standard hooks.

b. The capacity can be found by the diameter of the hole in the eye of the hook. If the throat opening of any hook exceeds the dimension given above the corresponding diameter of the eye, the hook has been over strained and must not be used.
12.3 SHACKLES

12.3.1 GENERAL

a. Shackles are made of drop-forged steel bent into shape. They are strong, closed attachments that will not come unhooked. The size is specified by the diameter of the body. Avoid side pulls on the shackle body.

b. Shackle pins should fit free without binding. Do not substitute a bolt for the shackle pin. Figure 12-2 shows shackles and provides examples of good and bad practices and inspection points.

c. Each shackle body shall be permanently and legible marked by the manufacturer. Raised or stamped letters on the side of the bow shall be used to show:

1. Manufacturer’s name or trademark.
2. Size.
3. Rated capacity.

d. Shackles that are not properly marked shall be permanently removed from service.

e. When shackles are used at load angles other than 90 degrees, the safe-load rating shall be reduced accordingly.

12.3.2 CRITICAL LIFTS


a. Shackles used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test weights shall be accurate to within −5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the shackle(s) shall be proof tested before being used to make a critical lift.
Typical shackles

- Screw pin anchor shackle
- Round pin anchor shackle
- Safety type anchor shackle
- Screw pin chain shackle
- Round pin chain shackle
- Safety type chain shackle

Shackle inspection areas

- Check for wear
- Check for wear and straightness
- Check that pin is always seated
- Check that shackle is not opening up

Replacing shackle pins

Never replace a shackle pin with a bolt

The load will bend the bolt

Eccentric shackle loads

Poor Practice
Never allow shackle to be pulled at an angle — the legs will open up

Good Practice
Pack the pin with washers to centralize the shackle

If the load shifts, the sling will unscrew the shackle pin
12.4 EYEBOLTS

12.4.1 GENERAL

a. This section specifies requirements for eyebolts that are used as rigging hardware during normal hoisting and rigging activities. Eyebolts designed for and permanently installed on existing engineered equipment are considered part of the engineered equipment, and they may not meet all requirements specified for rigging hardware. Eyebolts permanently installed on engineered equipment are acceptable for their intended use so long as they pass normal visual inspection before use. It is important to know how the manufacturer or engineered equipment intends permanently installed eyebolts to be used. In some cases the intended use is obvious to an experienced craftsman in other cases engineering review of vendor information may be necessary.

CAUTION: Eyebolts installed by the manufacturer to lift only parts of the engineered equipment are not suitable for lifting the complete piece of equipment. When questions arise regarding the use of manufactured-installed eyebolts, the equipment custodian or cognizant engineer shall be consulted.

b. Eyebolts used for hoisting shall be fabricated from forged carbon or alloy steel.

c. Eyebolt marking:

1. Carbon Steel Eyebolts shall have the manufacturer’s name or identification trademark forged in raised characters on the surface of the eyebolt.

2. Alloy Steel Eyebolts shall have the symbol “A” (denoting alloy steel) and the manufacturer’s name or identification mark forged in raised characters on the surface of the eyebolt.

d. Eyebolts shall have a minimum design factor of 5:1.

e. To obtain rated capacities, the minimum thread shank length engagement shall be as follows:

1. Steel: One nominal thread diameter

2. Cast Iron, Brass, Bronze: 1.5 nominal thread diameters

3. Aluminum, Magnesium, Zinc, Plastic: 2 nominal thread diameters

f. The following shall apply to eyebolt users:

1. Use shouldered eyebolts for all applications, except where it is not possible due to the configuration of the item to be lifted. See Figure 12-3. When unshouldered eyebolts are used, do not use nuts, washers, and drilled plated to make shouldered eyebolts.

2. Do not use wire-type or welded eyebolts in DOE-lifting operations.

3. Ensure shoulders seat snugly against the surface on which they bear.

4. Spacers may be used, if necessary, to ensure proper seating of the eyebolt. Use a flat spacer no thicker than 1/16 of the outside diameter, and approximately the same diameter as the maximum axis of the eyebolt shoulder with the smallest inside diameter that will fit the eyebolt shank.

5. Spot-face or slightly counterbore the surface of the item to which the eyebolt is fastened to the minimum depth needed for cleanup of the surface and complete bearing of the shoulder or spacer on the bearing surface.

6. Carefully inspect each eyebolt before use. Visually inspect the hole to ensure that there has been no deformation. Check the condition of the threads in the hole to ensure that
the eyebolt will secure and the shoulder can be brought down snug. Destroy eyebolts that are cracked, bent, or have damaged threads.

Ensure that the shank of the eyebolt is not undercut and is smoothly radiused into the plane of the shoulder or the contour of the ring for nonshouldered eyebolts.

When more than one eyebolt is used in conjunction with multiple-leg rigging, spreader bars, lifting yokes, or lifting beams should be used to eliminate angular lifting. However, where spreaders, yokes, or beams cannot be used, eyebolts may be used for angular lifting, provided that the limiting conditions in Table 12-3 are considered. An angular lift is any lift in which the lifting force is applied at any angle to the centerline of the shank of the eyebolt.

9. Where nonshouldered eyebolts must be used for a critical lift, ensure that an engineering analysis of the loading and load vectors is made and approved before use. Minimize the angle between the sling and the eyebolt axis. In no case shall the eyebolt loading exceed the values shown in Table 12-3.

12.4.2 CRITICAL LIFTS


a. Eyebolts used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test weights shall be accurate to within -5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the eyebolts shall be proof tested before being used to make a critical lift.
• Shouldered
• Unshouldered

Unsafe (bent)
Unsafe (no shoulder and open hook)

• Safe (Shoulder is seated snugly against surface)
• Unsafe (Shoulder is not sealed snugly against surface)
### EYEBOLTS
- Shoulder Type Only
- Forged Carbon Steel

<table>
<thead>
<tr>
<th>Stock Diameter (in.)</th>
<th>SAFE WORKING LOADS CORRESPONDING TO ANGLE OF PULL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vertical</td>
</tr>
<tr>
<td>¼</td>
<td>600</td>
</tr>
<tr>
<td>5/16</td>
<td>1,200</td>
</tr>
<tr>
<td>3/8</td>
<td>2,200</td>
</tr>
<tr>
<td>½</td>
<td>3,500</td>
</tr>
<tr>
<td>⅞</td>
<td>5,200</td>
</tr>
<tr>
<td>1</td>
<td>7,200</td>
</tr>
<tr>
<td>1 ¼</td>
<td>10,000</td>
</tr>
<tr>
<td>1 ½</td>
<td>15,200</td>
</tr>
</tbody>
</table>

Note: The safe working loads for plain (shoulder-less) eyebolts is the same as for shoulder bolts under vertical load. Angular loading is not recommended.
12.5 TURNBUCKLES

12.5.1 GENERAL

a. Turnbuckles may be used in sling systems provided that they are engineered, designed, and approved as a part of the sling system. Approved turnbuckles shall be marked and identified for use with the sling set for which they were designed and shall be load-tested as part of the sling set. Before each use, turnbuckles shall be inspected for damage. Damaged threads, jamb nuts, or bent frame members make the unit unsuitable for use.

b. Jamb nuts or locking devices must be tightened or locked before making lifts with turnbuckles. See Figure 12-4 for safe working load information and turnbuckle inspection areas.

c. Turnbuckles shall be fabricated from forged alloy steel and shall have a minimum design factor of 5:1.

d. Turnbuckles used in applications where there is vibration shall be secured to the frame with locks, pins, or wires to prevent turning or loosening.

12.5.2 CRITICAL LIFTS


a. Turnbuckles used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test weights shall be accurate to within ±5 percent, ±0 percent of stipulated values. If proof testing cannot be verified, the turnbuckles shall be proof tested before being used to make a critical lift.
DOE-STD-1090-2004

**Turnbuckle Inspection Areas**

- Check for cracks and bends
- Check for thread damage and bent rods
- Check for cracks and bends
- Check for thread damage and bent rods
- Check for cracks and bends
- Check for thread damage and bent rods
- Check for cracks and deformation

**Turnbuckles**

- Weldless Construction
- Forged Alloy Steel

<table>
<thead>
<tr>
<th>End fitting, stock diameter (in.)</th>
<th>Safe working load (SWL) of any combination of jaw end fittings, eye end fittings, and stub end fittings (lb)</th>
<th>SWL of any turnbuckle having a hook end fitting (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4</td>
<td>500</td>
<td>400</td>
</tr>
<tr>
<td>5/16</td>
<td>800</td>
<td>700</td>
</tr>
<tr>
<td>3/8</td>
<td>1,200</td>
<td>1,000</td>
</tr>
<tr>
<td>1/2</td>
<td>2,200</td>
<td>1,500</td>
</tr>
<tr>
<td>5/8</td>
<td>3,500</td>
<td>2,250</td>
</tr>
<tr>
<td>3/4</td>
<td>5,200</td>
<td>3,000</td>
</tr>
<tr>
<td>7/8</td>
<td>7,200</td>
<td>4,000</td>
</tr>
<tr>
<td>1</td>
<td>13,000</td>
<td>5,000</td>
</tr>
<tr>
<td>1 1/4</td>
<td>15,200</td>
<td>5,000</td>
</tr>
<tr>
<td>1 1/2</td>
<td>21,400</td>
<td>7,500</td>
</tr>
<tr>
<td>1 3/4</td>
<td>29,000</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>37,000</td>
<td>—</td>
</tr>
<tr>
<td>2 1/2</td>
<td>60,000</td>
<td>—</td>
</tr>
<tr>
<td>2 3/4</td>
<td>75,000</td>
<td>—</td>
</tr>
</tbody>
</table>

**Turnbuckle and fittings**

- Eye
- Jaw
- Stub
- Hook (has reduced capacity)

**Jaw and Eye combination**

**Jaw and Jaw combination**

**Hook and Hook combination**

**Hook and Eye combination**
12.7 SWIVEL HOIST RINGS

12.7.1 GENERAL

a. The following shall apply when using swivel hoist rings for hoisting:

1. They shall be fabricated from forged carbon or alloy steel.

2. Have a minimum design factor of 5:1.

3. The working load limit shall be forged, stamped, or inscribed into each swivel hoist ring by the manufacturer.

4. Permanently attached metal tag bearing the same information may also be used.

5. Have a class II fit and have a minimum thread engagement as recommended by the manufacturer.

6. When installed with a retention nut, follow the manufacturer recommendations.

b. The following shall apply to swivel hoist ring users:

1. Never use spacers between bushing flange and mounting surface.

2. Install hoist ring to recommended torque with a calibrated torque wrench making sure the bushing flange meets the load (work piece) surface.

3. Unless specific torque requirements are specified for the load (work piece) being lifted, the minimum recommended torque shall be as specified by the hoist ring manufacturer.

4. Maximum recommended torque requirements specified by the manufacturer should not be exceeded.

5. When load is applied to the hoist ring, there should be no interference between the load (work piece) and the hoisting ring (see Figure 12-6).

6. The hoist ring should be able to swing or rotate freely under load (see Figure 12-6).

7. Attach lifting device ensuring free fit to the hoist ring bail (see Figure 12-6).

8. Carefully inspect each swivel hoist ring before use (see Figure 12-6). Visually inspect the hole to ensure that there has been no deformation.

9. Check the condition of the threads in the hole to ensure that the hoist ring will secure and the bushing can be brought down snug.

10. Destroy hoist rings that are cracked, bent, have damaged threads, or do not operate freely.

11. Permanently installed hoist rings shall be inspected before each use to ensure free movement of bail and swivel. Refer to specific requirements for load (work piece) with permanently installed hoist rings, before checking or re-torquing.

12.7.2 CRITICAL LIFTS


a. Swivel hoist rings used for critical-lift service shall have an initial proof load test of 200 percent of the rated capacity. Test weights shall be accurate to within ±5 percent, +0 percent of stipulated values. If proof testing cannot be verified, the swivel hoist rings shall be proof tested before being used to make a critical lift.
sample form only – to be used to define the general inspection requirements to remove rigging from service – contact EH&S for specific legal requirements.

RIGGING ACCESSORIES LOAD TEST AND INSPECTION
(HOOKS, SHACKLES, RINGS, ETC.)

INSPECTOR:_________________________ INSPECTION DATE:_______________

NOTES: 1. Proof test to 200% of rated capacity for critical life service to certify new equipment procured without manufacturer’s certification. Test loads shall be accurate to within -5%, +0% of the stipulated values.
_____ 2. Qualified inspector shall witness all steps below.
_____ 3. Accept/reject data should be to manufacturer’s specifications. Hooks, shackles, rings, and the like, shall be removed from service and discarded if any of the following conditions are present that would cause doubt of the integrity of the accessories:
   A. Corrosion, damage, or undue wear
   B. Cracks, twists, or significant change in openings
      (1) 15% more than normal opening
      (2) 10% twist more than normal from the plane of the unbent hook
      (3) 10% wear
      (4) 5% elongation of the hook shank.
   C. Heat damage.
4. Shackles, rings, etc.
   A. Wear, corrosion, spreading, and deformation
      (1) 15% deformation of their new condition
      (2) Shackles pins – any sign of incipient failure in shear.

Type_________________ Size_______________ Rated Capacity (SWL)__________________
Tested to_________________________
Serial Numbers__________________________
Qualified inspector shall perform a nondestructive test by visual examination, liquid penetrant examination, or magnetic particle examination.
Acceptance: No cracks, linear indications, laps, or seams.
QUALIFIED INSPECTOR VERIFY___________________________
DATE__________________
SYNTHETIC-WEB SLINGS

a. Synthetic web shall possess the following qualities:
   1. Be of sufficient strength to meet the sling manufacturer’s requirements.
   2. Have uniform thickness and width.
   3. Have selvage edges and not be split from its woven width.

b. The thread used in the manufacture of a synthetic-web sling shall be of the same type of material as the web.

c. Fitting shall be:
   1. Of sufficient strength to sustain twice the rated capacity without permanent deformation.
   2. Of a minimum breaking strength equal to that of the sling.
   3. Free of all sharp edges that would in any way damage the mesh.

d. The stitching in all load-bearing splices shall be of sufficient strength to maintain the sling design factor.

e. Synthetic-web slings may be coated with elastomers or other suitable material that will provide characteristics such as abrasion resistance, sealing of pores, and increased coefficient of friction.

f. The design factor for synthetic-web slings shall be a minimum of 5:1 based upon breaking strength.

g. Rated capacities are affected by the type of hitch used and by the angle from the vertical when used as multi-legged slings or in basket hitches. The sling manufacturer shall supply data on these effects.

h. Synthetic-web slings are available in a number of configurations as follows:
   1. *Endless or Grommet Sling* – Both ends of one piece of webbing are lapped and sewn to form a continuous piece. They can be used as vertical hitches, bridle hitches, in choker arrangements, or as basket slings. Because load contact points can be shifted with every lift, wear is evenly distributed and sling life is extended.

   2. *Standard Eye and Eye* – Webbing is assembled and sewn to form a flat-body sling with an eye at each end and the eye openings in the same plane as the sling body. The eyes may either be full web width or may be tapered by being folded and sewn to a width narrower than the webbing width.

   3. *Twisted Eye* – An eye-and-eye type that has twisted terminations at both ends. The eye openings are at 90 degrees to the plane of the sling body. This configuration is also available with either full-width or tapered eyes.

   i. In place of the sewn eyes, synthetic-web slings are also available with metal end fittings (see Figure 11-18). The most common are triangle and choker hardware. Combination hardware consists of a triangle for one end of the sling and a triangle/rectangle choker attachment for the other end. With this arrangement, both choker and basket hitches, as well as straight hitches, may be rigged. They help reduce wear in the sling eyes and thus lengthen sling life.

j. Despite their inherent toughness, synthetic web slings can be cut by repeated use around sharp-cornered objects. They eventually show signs of abrasion when they are repeatedly used to hoist rough-surfaced products. There are, however, protective devices offered by most sling manufacturers that minimize these effects (see Figure 11-19). Other protective devices include:
   1. Buffer strips of leather, nylon, or other materials that are sewn on the body of a sling protect against wear. Leather pads are the most resistant to wear and cutting, but are subject to
weathering and gradual deterioration. They are not recommended in lengths over 6 ft due to the different stretching characteristics of the leather and webbing. On the other hand, nylon-web wear pads are more resistant to weathering, oils, grease, and most alkalis; and they stretch in the same ratio as the sling body.

2. Edge guards consist of strips of webbing or leather sewn around each edge of the sling. This is necessary for certain applications where the sling edges are subject to damage.

3. Sleeve- or sliding-tube-type wear pads are available for slings used to handle material having sharp edges. They can be positioned on the sling where required, do not move when the sling stretches, adjust to the load, and cover both sides of the sling.

4. Reinforcing strips that double or triple the eye’s thickness and greatly increase its life and safety can be sewn into the sling eyes.

5. Coatings can be applied to provide added resistance to abrasion and chemical damage. These treatments also increase the coefficient of friction, affording a better grip when loads with slippery surfaces are to be handled. These coatings can be brightly colored for safety or load-rating purposes.

6. Cotton-faced nylon webbing can be used for hoisting rough-surfaced material.

k. The synthetic-web sling capacities listed in Tables 11-14 and 11-15 are approximate only and are based on nylon webbing having breaking strengths between 6,000 and 9,000 lb/in. of webbing width. The capacities are also based on a 5:1 design factor and assume that the end fittings are of adequate strength.
Endless or grommet slings

Standard eye-and-eye slings

Twisted-eye slings
l. Although safe working loads for bridle hitches in the choker or double-basket configuration are provided, they should be used only with extreme caution because, as the sling angle decreases, one edge of the web will take all the load, producing a risk of tearing (see Figure 11-20).

m. Synthetic-web slings, other than those described in this section [i.e., polyester round and kevlar fiber (yarn) slings], shall be used in accordance with the sling manufacturer's recommendation.

n. Conventional three-strand natural or synthetic fiber rope slings are NOT recommended for lifting service, and should be used only if conventional sling types are not suitable for a unique application. The requirements of ASME B 30.9 ("Slings"). Section 9-4. and 29 CFR 1910.184(l) shall be followed.

CAUTION: Tiedown and/or ratchet strap shall not be used as synthetic-web slings. Only synthetic-web slings constructed from webbing approved for sling construction by the manufacturer or other qualified person shall be used at DOE locations.

11.3.5.1 Inspections

a. Users of synthetic-web sling shall visually inspect all slings before each use.

b. Annual inspection shall be made by a qualified inspector, and inspection records shall be kept on file and readily available.

c. Slings shall be removed from service if any of the following defects are visible:

1. Acid or caustic burns.
2. Melting or charring of any part of the surface.
3. Snags, punctures, tears, or cuts.
4. Broken or worn stitches.
5. Wear or elongation exceeding the amount recommended by the manufacturer.
6. Distortion of fittings.
8. Missing or illegible sling identification.

A sample periodic inspection form is included as Exhibit III at the end of this section. This form is intended to be a sample only and is not intended to be mandatory.

11.3.5.2 Proof-Testing

a. When specified by the purchaser, web slings of all types shall be certified as having been proof-tested prior to initial use.

1. The proof load for single-leg slings and endless slings shall be 200 percent of the vertical rated capacity.

2. The proof load for multiple-leg bridle slings shall be applied to the individual legs and shall be 200 percent of the vertical rated capacity of a single-leg sling. Master links to which multiple-leg slings are connected shall be proof-loaded to 200 percent times the force applied by the combined legs.

b. Test loads shall be accurate to within ±5 percent, ±0 percent of stipulated values. Either certification by the manufacturer or a pull test certified by a qualified person is acceptable.

sling angle effects & bridal hitches – use extreme caution
REGULAR. This is the type of edge protection that is sewn on to give fixed protection at expected wear points. They can be sewn anywhere on the sling, at any length on one side, or on both sides.

EDGEGUARD. A strip of webbing or leather is sewn around each edge of the sling. This is necessary for certain applications where the sling edges are subject to damage.

SLEEVE. Sometimes called sleeve or sliding-tube type wear pads, these pads are ideal for handling material with sharp edges because the sleeve does not move when the sling stretches and adjusts to the load. Sleeves cover both sides of the sling and can be shifted to points of expected maximum wear.

Figure 11-19. Web and edge protectors.
Table 11-14. Load capacity of synthetic web slings in pounds. Design Factor + 5:1 (eye and eye, twisted eye, triangle fittings, choker fittings)

<table>
<thead>
<tr>
<th>Web width (in.)</th>
<th>Vertical</th>
<th>Choker</th>
<th>Basket or two legs</th>
<th>Web width (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,200</td>
<td>900</td>
<td>2,400</td>
<td>1,700</td>
</tr>
<tr>
<td>2</td>
<td>2,400</td>
<td>1,800</td>
<td>4,800</td>
<td>4,160</td>
</tr>
<tr>
<td>3</td>
<td>3,600</td>
<td>2,700</td>
<td>7,200</td>
<td>6,240</td>
</tr>
<tr>
<td>4</td>
<td>4,800</td>
<td>3,600</td>
<td>9,600</td>
<td>8,300</td>
</tr>
<tr>
<td>5</td>
<td>6,000</td>
<td>4,500</td>
<td>12,000</td>
<td>10,400</td>
</tr>
<tr>
<td>6</td>
<td>7,200</td>
<td>5,400</td>
<td>14,400</td>
<td>12,500</td>
</tr>
</tbody>
</table>

Nylon Single Ply Web Slings (6,000 lb/in. material)

<table>
<thead>
<tr>
<th>Web width (in.)</th>
<th>1,200</th>
<th>1,700</th>
<th>1,200</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2,400</td>
<td>3,400</td>
<td>2,400</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3,600</td>
<td>5,100</td>
<td>3,600</td>
<td>3</td>
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<td>4</td>
<td>4,800</td>
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<td>4</td>
</tr>
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</tr>
<tr>
<td>6</td>
<td>7,200</td>
<td>10,200</td>
<td>7,200</td>
<td>6</td>
</tr>
</tbody>
</table>

Nylon Double Ply Web slings (6,000 lb/in. material)

<table>
<thead>
<tr>
<th>Web width (in.)</th>
<th>2,400</th>
<th>3,400</th>
<th>2,400</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>4,800</td>
<td>6,800</td>
<td>4,800</td>
<td>2</td>
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<tr>
<td>3</td>
<td>7,200</td>
<td>10,200</td>
<td>7,200</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>9,600</td>
<td>13,600</td>
<td>9,600</td>
<td>4</td>
</tr>
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<td>5</td>
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</tr>
<tr>
<td>6</td>
<td>14,400</td>
<td>20,400</td>
<td>14,400</td>
<td>6</td>
</tr>
</tbody>
</table>

(CFR 1910.184/ANSI/ASME B30.1)

1. For an endless sling with vertical hitch carrying a load of such size as to throw the legs more than 5 degrees off vertical use rated load data for eye and eye sling, basket hitch and corresponding leg angles.

2. Follow manufacturer's capacities, they vary from manufacturer to manufacturer.

3. Choker hitch values apply only to choke angles greater than 120 degrees.
Table 11-15. Load capacity of synthetic web slings in pounds. Design Factor + 5:1
(eye and eye, twisted eye, triangle fittings, choker fittings)

<table>
<thead>
<tr>
<th>Web width (in.)</th>
<th>Vertical</th>
<th>Choker</th>
<th>Basket or two legs</th>
<th>Web width (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nylon Single Ply Web Slings (6,000 lb/in. material)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1,600</td>
<td>1,280</td>
<td>3,200</td>
<td>2,270</td>
</tr>
<tr>
<td>2</td>
<td>3,200</td>
<td>2,560</td>
<td>6,400</td>
<td>5,540</td>
</tr>
<tr>
<td>3</td>
<td>4,800</td>
<td>3,840</td>
<td>9,600</td>
<td>8,320</td>
</tr>
<tr>
<td>4</td>
<td>6,400</td>
<td>5,120</td>
<td>12,800</td>
<td>11,090</td>
</tr>
<tr>
<td>5</td>
<td>8,000</td>
<td>6,400</td>
<td>16,000</td>
<td>13,860</td>
</tr>
<tr>
<td>6</td>
<td>9,600</td>
<td>7,680</td>
<td>19,200</td>
<td>16,640</td>
</tr>
<tr>
<td>Nylon Double Ply Web slings (6,000 lb/in. material)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3,200</td>
<td>2,560</td>
<td>6,400</td>
<td>5,540</td>
</tr>
<tr>
<td>2</td>
<td>6,400</td>
<td>5,120</td>
<td>12,800</td>
<td>11,090</td>
</tr>
<tr>
<td>3</td>
<td>8,800</td>
<td>7,100</td>
<td>17,760</td>
<td>15,390</td>
</tr>
<tr>
<td>4</td>
<td>11,520</td>
<td>9,210</td>
<td>23,040</td>
<td>19,660</td>
</tr>
<tr>
<td>5</td>
<td>14,000</td>
<td>11,200</td>
<td>28,000</td>
<td>24,260</td>
</tr>
<tr>
<td>6</td>
<td>16,320</td>
<td>13,050</td>
<td>32,640</td>
<td>28,260</td>
</tr>
</tbody>
</table>

(CFR 1910.194/ANSI/ASME B30.9)

(1) For an endless sling with vertical hitch carrying a load of such size as to throw the legs more than 5 degrees off vertical use rated load data for eye and eye sling, basket hitch and corresponding leg angles.

(2) Follow manufacturer’s capacities, they vary from manufacturer to manufacturer.

(3) Choker hitch values apply only to choke angles greater than 120 degrees.
11.3.5.3 Operation
The following shall apply to all personnel who use synthetic-web slings:

a. Determine the weight of the load.
b. Select a sling having suitable characteristics for the type of load, hitch, and environment.
c. Ensure that slings with end fittings that are used in a choker hitch have sufficient length to that the choking action is on the body of the sling.
d. In slings used in a basket hitch, balance the load to prevent slippage.
e. Do not drag slings across the floor or over any abrasive surface.
f. Do not twist or tie slings into knots.
g. Protect slings from being cut by sharp corners, sharp edges, and highly abrasive surfaces.
h. Do not pull slings from under loads when a load is resting on a sling.
i. Do not use synthetic-web slings to lift loads in excess of the rated capacity, properly derated for other than straight-pull configuration.
j. Store synthetic-web slings to prevent mechanical or chemical damage.
k. Do not use nylon slings where acid conditions exist.
l. Do not use polyester and polypropylene slings where caustic conditions exist.
m. Nylon and polyester slings shall not be used on contact with objects or at temperatures in excess of 194 degree F (90 degree C), or below -40 degree F (-40 degree C).

Polypropylene slings shall not be used in contact with objects or at temperatures in excess of 150 degree F (66 degree C), or below -40 degree F (-40 degree C). The sling manufacturer should be consulted for the temperature range of slings made from other synthetic yarns.
n. Do not use aluminum fittings where acid or caustic fumes, vapors, sprays, mists or liquids are present.
o. Ensure that each sling is permanently marked to show:
   1. Name or trademark of manufacturer.
   2. Manufacturer’s code or stock number.
   3. Rated capacity for types of hitches used.
   4. Type of synthetic-web material.

NOTE: Slings may be marked with serial number or other identifying number that can be used to determine capacity in situations where it becomes impossible to mark the sling as described above due to security classification of the loads to be lifted or for other valid reasons approved by the responsible manager.
p. Ensure that synthetic-web slings are marked with the inspection due date. This information may be stenciled or stamped on a metal tag affixed to the sling.
q. Synthetic slings (e.g., Kevlar, K-Spec, nylon, polyester) may be used in radiation areas only when a qualified person ensures that the absorbed dose does not exceed 100,000 rad during the life of the sling.

11.3.5.4 Critical Lifts
a. Synthetic-web slings used for critical-lift service shall have an initial proof load test of 200 percent of the vertical rated capacity. If proof testing cannot be verified, the sling(s) shall be proof tested before being used to make a critical lift.

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Wire Rope and Slings
b. The proof load for multiple-leg bridles slings shall be applied to the individual legs and
shall be 200 percent of the vertical rated capacity of a single-leg sling.
c. master links to which multiple-leg slings are connected shall be proof-loaded to 200 percent
multiplied by the force applied by the combined legs.

**11.3.6 SYNTHETIC ROUNDSLINGS**

a. Synthetic round-slings shall possess the following qualities:
   1. Core yarn shall be of a synthetic fiber wound together on a plurality of turns for even
distribution f the load.
   2. In chemically active environments the cover shall be the same type yarn as the load-bearing
core.
   3. The thread used in the manufacture of a synthetic round-sling shall be of the same type of
material as the core.
   4. Finishes and coatings shall be compatible with material of the core, cover, and thread and not
impair the performance of the round-sling.

b. Fittings shall be:
   1. Of sufficient strength to sustain twice the rated capacity without permanent-deformation.
   2. Of a minimum breaking strength equal to that f the round-sling.
   3. Free of all sharp edges that would in any way damage the round-sling.
   4. Compatible with the mechanical and environmental requirements imposed on the round-sling.
c. The round-sling manufacturer should be consulted before round-slings are used in chemically
active environments.

d. Nylon and polyester slings shall not be used on contact with objects or at temperatures in
excess of 194 degree F (90 degree C), or below -40 degree F (-40 degree C). Polypropylene
slings shall not be used in contact with objects or at temperatures in
excess of 150 degree F (66 degree C), or below -40 degree F (-40 degree C). The sling
manufacturer should be consulted for the temperature range of slings made from other
synthetic yarns.

e. The design factor for synthetic round-slings shall be a minimum of 5:1 based on breaking
strength.

f. Rated capacities are affected by the type of hitch used and by the angle from the vertical when
used as multi-legged slings or in basket hitches. The sling manufacturer shall supply data on
these effects.

g. Despite their inherent toughness, synthetic round-slings can be cut by repeated use around
sharp-cornered objects. They eventually show sings of abrasion when they are repeatedly used to
hoist rough-surfaced products. There are, however, protective devices offered by most sling
manufacturers that minimize these effects.

h. Synthetic round-slings are available in a number of configurations (see Figure 11-21).
i. The round-lsing capacities listed in Table 11-16 are approximate only. The capacities are also
based on a 5:1 design factor, and assume that the end fittings are of adequate strength.

**11.3.6.1 Inspections**

a. Users of synthetic round-slings shall visually inspect all slings before each use.
b. Annual inspection shall be made by a qualified inspector, and inspection records shall be kept
on file and readily available.
c. When it is necessary to use a polyester or nylon round-sling in a radiation area, the
responsible manager shall ensure that radiation exposure does not exceed 100,000
rad during the life of the sling.
d. Slings shall be removed from service if any of the following defects are visible:
1. Acid or caustic burns.
2. Melting or charring of any part of the surface.
3. Snags, punctures, tears, cuts, or abrasive wear that expose the core yarns.
4. Broken or worn stitches in the cover which exposes the core yarns.
5. Wear or elongation exceeding the amount recommended by the manufacturer.
6. Stretched, cracked, worn, pitted or distortion of fittings.
8. Missing or illegible sling identification. A sample periodic inspection form is included as Exhibit III at the end of this section. This form is intended to be a sample only, and is not intended to be mandatory.

**11.3.6.2 Proof-Testing**

a. When specified by the purchaser synthetic round slings of all types shall be certified as having been proof-tested prior to initial use.
   1. The proof load for round slings shall be 200 percent of the vertical rated capacity.
   2. The proof load for multiple-leg round slings shall be applied to the individual legs and shall be 200 percent of the vertical rated capacity of the round slings. Master links to which multiple-leg round slings are connected shall be proof-loaded to 200 percent times the force applied by the combined legs.

b. Test loads shall be accurate to within –5 percent, +0 percent of stipulated values. Either certification by the manufacturer or a pull test certified by a qualified person is acceptable.

**11.3.6.3 Operation**
The following shall apply to all personnel who use round slings:

a. Determine the weight of the load.

b. Select a sling having suitable characteristics for the type of lad, hitch, and environment.

c. Ensure that slings with end fittings that are used in a choker hitch have sufficient length so that the choking action is on the body of the sling.

d. In slings used in a basket hitch, balance the load to prevent slippage.

e. Do not drag slings across the floor or over any abrasive surface.

f. Do not twist or tie slings into knots.

g. Protect slings from being cut by sharp corners, sharp edges, and highly abrasive surfaces.

h. Do not pull slings from under loads when a load is resting on a sling.

i. Do not use round slings to lift loads in excess of the rated capacity, properly de-rated for other than straight-pull configuration.

j. Store round slings to prevent mechanical or chemical damage.

k. Personnel should never stand in line with or next to a round sling that is under tension.

l. If extreme temperatures are involved, ensure the guidance in 11.3.6.d is followed.

m. Do not allow the load, hook, or any fitting to constrict, bunch, or pinch round slings.

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**11-43 Chapter 11**

*Wire Rope and Slings*

n. Ensure that round slings are not used as bridles on suspended personnel platforms.

o. For multiple leg round slings used with nonsymmetrical loads, an analysis should be performed by a qualified person to prevent overloading of any leg.

p. Ensure that each sling is permanently marked to show:

1. Name or trademark of manufacturer.
2. Manufacturer’s code or stock number.
3. Rated capacity for types of hitches used.
4. Type of core material and cover material if different from core material.

NOTE: Slings may be marked with a serial number or other identifying number that can be used to determine capacity in situations where it becomes impossible to mark the sling as described above due to security classification of the loads to be lifted or for other valid reasons approved by the responsible manager.

q. Ensure that round-slings are marked with the inspection due date. This information may be stenciled or stamped on a metal tag affixed to the sling.

11.3.6.4 Critical Lifts

a. Synthetic round-slings used for critical-lift service shall have an initial proof load test of 200 percent of the vertical rated capacity. If proof testing cannot be verified, the sling(s) shall be proof tested before being used to make a critical lift.

b. The proof load for multiple-leg Synthetic round-slings shall be applied to the individual legs and shall be 200 percent of the vertical rated capacity of a single-leg sling.

c. Master links to which multiple-leg slings are connected shall be proof-loaded to 200 percent multiplied by the force applied by the combined legs.
### Table 11-9. Load capacity of wire-rope slings.
Strand laid grommet-hand tacked in pounds  Design Factor = 5:1

<table>
<thead>
<tr>
<th>Size (Note 1)</th>
<th>Vertical</th>
<th>Choker</th>
<th>Basket or two leg</th>
<th>60 degrees</th>
<th>45 degrees</th>
<th>30 degrees</th>
<th>Size (Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2,600</td>
<td>2,100</td>
<td>5,200</td>
<td>4,500</td>
<td>3,700</td>
<td>2,600</td>
<td>1</td>
</tr>
<tr>
<td>3/16</td>
<td>6,300</td>
<td>4,200</td>
<td>10,600</td>
<td>9,300</td>
<td>7,500</td>
<td>5,300</td>
<td>2</td>
</tr>
<tr>
<td>3/8</td>
<td>6,400</td>
<td>6,700</td>
<td>16,800</td>
<td>14,500</td>
<td>11,900</td>
<td>6,400</td>
<td>3</td>
</tr>
<tr>
<td>5/32</td>
<td>10,600</td>
<td>8,500</td>
<td>21,200</td>
<td>18,400</td>
<td>15,000</td>
<td>10,600</td>
<td>4</td>
</tr>
<tr>
<td>3/16</td>
<td>13,200</td>
<td>10,600</td>
<td>26,400</td>
<td>22,900</td>
<td>18,700</td>
<td>13,200</td>
<td>5</td>
</tr>
<tr>
<td>7/64</td>
<td>16,800</td>
<td>13,400</td>
<td>33,600</td>
<td>29,100</td>
<td>23,800</td>
<td>16,800</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>21,200</td>
<td>17,000</td>
<td>42,400</td>
<td>36,700</td>
<td>30,000</td>
<td>21,200</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>25,000</td>
<td>20,000</td>
<td>50,000</td>
<td>43,300</td>
<td>35,400</td>
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<td>8</td>
</tr>
<tr>
<td>9</td>
<td>31,000</td>
<td>24,800</td>
<td>62,000</td>
<td>53,700</td>
<td>43,800</td>
<td>31,000</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>40,000</td>
<td>32,000</td>
<td>80,000</td>
<td>69,300</td>
<td>56,600</td>
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<td>42,400</td>
<td>106,000</td>
<td>91,800</td>
<td>74,900</td>
<td>53,000</td>
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</tr>
<tr>
<td>12</td>
<td>66,000</td>
<td>52,800</td>
<td>132,000</td>
<td>114,300</td>
<td>93,300</td>
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<td>13</td>
<td>90,000</td>
<td>72,000</td>
<td>180,000</td>
<td>156,900</td>
<td>127,300</td>
<td>90,000</td>
<td>13</td>
</tr>
</tbody>
</table>

(CFR 1910.184/ANSI/ASME B30.9)

**NOTES:**

1. Roundslings are identified by the vertical rated load shown on the tag. The Size Number in this column have been adopted by the Web Sling and Tiedown Association to describe certain polyester roundslings. They are included for reference only. Other polyester roundslings may have different vertical rated loads.

2. Color guidelines for polyester roundsling covers are widely used to indicate the vertical rated load of roundslings; however, this is not followed by some manufacturers. Always select and use roundslings by the rated load as shown on the tag, never by color.
sample form only – to be used to define the general inspection requirements to remove rigging from service – contact EH&S for specific legal requirements.

WIRE-ROPE PERIODIC INSPECTION
(WIRE-ROPE SLINGS)

INSPECTOR ___________________________________ INSPECTION DATE _________________________

Notes: 1. Qualified inspector shall witness and verify all steps below.
2. When required, proof-test to 200% for mechanical-splice and endless slings and 125% for hand tucked slings of rated capacity to certify new equipment procured without manufacturer’s certification. Test loads shall be accurate to within −5%, +0% of the stipulated values.

Wire rope shall be immediately removed from service if any of the following conditions are present:

INSPECTION

_______ 1. Ten randomly distributed broken wires in one rope lay or five broken wires in one strand in one rope lay.

_______ 2. Wear or scraping of 1/3 the original diameter of the outside individual wire.

_______ 3. Kinking, crushing, bird-caging, or any other damage resulting in distortion of the wire-rope structure.

_______ 4. Heat damage.

_______ 5. Cracked, deformed, or worn end attachments.

_______ 6. Hooks that are cracked or opened more than 15% of normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plan of the unbent hook.

_______ 7. Corrosion of the rope or end attachments.

Size: (Length, Diameter, Etc.) ______________________________ Capacity (SWL) ______________________________

Actual Load Test _______________ lb

REMARKS ______________________________________________________________________________________

A qualified inspector shall inspect hook by visual examination, liquid penetrant examination or magnetic particle examination.

Acceptance: No cracks, linear indications, laps, or seams.

NDT INSPECTION OF HOOKS/RINGS, ETC. ______________________________

QUALIFIED INSPECTOR __________________________ DATE _________________________
EXHIBIT III
(SAMPLE FORM)

WIRE-ROPE PERIODIC INSPECTION REPORT
(HISTORICAL RECORD)

<table>
<thead>
<tr>
<th>Crane/Sling</th>
<th>Location</th>
<th>Rope Description</th>
<th>Breaking Strength</th>
<th>Application</th>
</tr>
</thead>
</table>

![Diagram of wire rope]

<table>
<thead>
<tr>
<th>DATE</th>
<th>Lay Length</th>
<th>Measured Diameter</th>
<th>Rope Damage</th>
<th>Broken Wires in 1 Strand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Broken Wires in 1 Lay</th>
<th>Excess Wear</th>
<th>Corrosion</th>
<th>End Attachments</th>
<th>Broken Wires</th>
<th>End Attachments</th>
<th>Fitting Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lubrication</th>
<th>Pass/Fail</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PEER and nees@berkeley labs. Revision 7.0.1: 06/06/2012
sample form only – to be used to define the general inspection requirements to remove rigging from service – contact EH&S for specific legal requirements.

RIGGING TACKLE PERIODIC INSPECTION
(CHAIN)

INSPECTOR______________________________________ INSPECTION
DATE________________________

Notes: 1. Qualified inspector shall witness and verify all steps below.
2. Proof-test to 200% of rated capacity to certify new equipment procured without manufacturer’s certification. Test loads shall be accurate to within –5%, +0% of the stipulated values.

INSPECTION
_______ 1. Hang chain in a vertical position, if practical, for preliminary inspection. Chain should hang reasonable straight if links are not distorted.
_______ 2. Accurately measure the reach (inside of crane ring to inside of hook) under no load when new and at each inspection, and keep a record of increase in length.
_______ 3. Check for localized stretch and wear. Lift each link from its seat and visually inspect for grooving. If grooving is noticed, verify stock diameter of links to be within the minimum safe dimension in the table below.
_______ 4. Sharp transverse nicks should be rounded out by grinding.
_______ 5. Check for evidence of heat damage. Chain slings shall be immediately removed from service if any of the following conditions are present:
a. Cracked or deformed master links, coupling links, etc.
b. Hooks that are cracked or opened more than 15% of normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.
c. Wear at any point of any chain link exceeding that shown in the table below.

Table 11-11. Maximum allowable wear at any point of link

<table>
<thead>
<tr>
<th>Chain size</th>
<th>Maximum (in.)</th>
<th>Allowable wear (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>3/64</td>
<td>3/64</td>
</tr>
<tr>
<td>3/8</td>
<td>5/64</td>
<td>5/64</td>
</tr>
<tr>
<td>½</td>
<td>7/64</td>
<td>7/64</td>
</tr>
<tr>
<td>5/8</td>
<td>9/64</td>
<td>9/64</td>
</tr>
<tr>
<td>¾</td>
<td>10/64</td>
<td>10/64</td>
</tr>
<tr>
<td>7/8</td>
<td>11/64</td>
<td>11/64</td>
</tr>
<tr>
<td>1</td>
<td>12/64</td>
<td>12/64</td>
</tr>
<tr>
<td>1-1/4</td>
<td>16/64</td>
<td>16/64</td>
</tr>
</tbody>
</table>

NOTE: For other sizes, consult chain or sling manufacturer.
Ten Rules of Layout and Design
(from MEASURING, MARKING AND LAYOUT /Carroll1998)

1). SEE IT BEFORE YOU BUILD IT: This means you must have a set of plans that facilitate your visualization of the project. Things have been built that would not fit through the door. The greater the magnitude of the project; the greater the need for a FLOW CHART to allow you to visualize the process and not lose track of the endless details.

2). WORK FROM CRITICAL TO NONCRITICAL DIMENSIONS: Generally there is only one dimension (or group) in the same straight line that can be controlled within fixed tolerances. Therefore it is incorrect to locate any point or surface with tolerances form more than one point in the same straight line. Dimensions should be given between those points that are essential to hold in a specific relation to each other. It is good practice to establish common location points in each plane and to give (as far as possible) all dimensions from these points.

3). AVOID CUMULATIVE ERROR: Try to use a single reference line or point (on each plane or a common edge of two) during layout. Working from point to point inevitability results in cumulative errors.

4). WORK WITHIN PRACTICAL TOLERANCES: Create as much clearance as possible and still remain within design tolerances. When tolerances are unnecessarily tight, nothing ends up fitting together and assembly becomes impossible. Reworking the parts and pieces becomes expensive, laborious and time consuming.

5). REASSIGN AND STRAIGHTEN OUT PERIODICALLY: Regularly check dimensions, check for plumb, level, square etc. Clear all debris. Put away tools. Organize the work site and remaining tools and materials.

6). THINK MODULARLY: Sectional assembly speeds things up. As far as possible, dimensions on comparison parts should be given from the same relative locations (this is how you can detect interference and other improper conditions).

7). LOOK FOR SIMPLE SOLUTIONS: Simplicity is the quintessence of elegance and the holy grail of good design.

8). WORK IN A LOGICAL SEQUENCE: Refer to your flow chart and determine what the logical sequence is. Establish a pattern for repetitive tasks.

9). BE CONSISTANT: Try to standardize your methods to conform to existing practices or to form a compromise between existing methods and your unique needs.

10). LEARN FROM YOUR MISTAKES: In attempting to work in accordance with general laws or principals, be aware that special requirements need special consideration.
UNIVERSITY OF CALIFORNIA, BERKELEY PACIFIC EARTHQUAKE ENGINEERING RESEARCH CENTER

Structural Lab and Earthquake Simulator Lab
Student Employee Agreement Form

This agreement outlines the general requirements for work performed by student employees at PEER Labs.

Work will be performed under the overall supervision of Wesley Neighbour but may be under the direct supervision of other members of the PEER organization or designated.

The general requirements are:

1. Provide your semester class and work schedule, attached to a copy of this agreement. If you will not be on time, leave a phone message with David (510-665-3639) or Wes (510-665-3409) the day before. Work hours are flexible, you can submit a new work schedule at any time to David MacLam (davidmaclam@berkeley.edu) or Wes Neighbor (wdn@berkeley.edu).

2. Keep a current Bay Area phone number and e-mail address on file with Veronica Rodriguez (510-665-3594, vrodriguez@berkeley.edu)

3. Regarding preservation of your research work:
   A. Record all data & calculations in a manner deemed appropriate by the Lab Staff, P.I. or Lead Researchers.
   B. Determine how you are to transmit data when appropriate.
   C. You are responsible for maintaining an electronic back-up of any electronic files you create.
   D. All written work and electronic files should be stored in a predetermined appropriate manner.

Agreed to by:
Name:___________________________________________Date____________________

Term:
Fall   Spring   Summer   Year:_______________________

Signature:_________________________________________________________________
DAILY CLEANUP CHECKLIST:

Name: __________________________________________________________

Date: ____________________

Supervisor: _____________________________________________________

Location: inside, outside, 420, 484, 421, Rooms ___________________________

<> All tools put away
<> Equipment: (crane off, fork truck gas off, test equipment valves off, air hoses wrapped up and hung
<> Extension cords wrapped up and put away
<> Walkways clear and swept clean
<> Safety areas clear (i.e. 5’ around breaker boxes, fire extinguishers, exits, etc)
<> Counters and tables cleaned and clear (well organized)
<> Lights off
<> Fans off
<> All rags picked up
<> All cribbing, lumber and blocking neatly stacked and out of pathways
<> Any extra nuts, bolts, fasteners, hardware, instrumentation restocked
<> Clean up any excess clutter
<> Lock doors and windows

NOTES____________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
________
JOBSITE PROJECT MANAGEMENT

Name ____________________________
Date ____________________________
Time ____________________________

Project ____________________________________________________________________________
__________________________________________________________________________________

Tool Checklist
__________________________________________________________________________________
__________________________________________________________________________________

Jobsite Assessment __________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

Site Conditions ______________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

History ____________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

Proposed Changes (actual & optimal) __________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

__________________________________________________________________________________
ARE YOU FULLY ENGAGED?
(from “The Power Of Full Engagement” Loehr/Schwarts)

Certainly it is the human/machine interface that is the driving force behind this work as well as the unanswered questions regarding how to project the performance of both human and machine. Here is yet another proposition obtained by induction from observed phenomena and raises questions pertinent to our self-imposed limitations.

Issues of social dysfunction are becoming increasingly addressed in the work place. For example, seldom (if ever) are the psychosocial aspects of the work place mentioned in safety manuals of any size or kind.

Yet, our physical and emotional states are fundamentally critical to safety (let-alone optimal functioning in the work place).

It may be impossible to ever develop any kind of simple formulas and methods to maximize work engagement for the benefit of all.

However, formulating a series of questions that you ask yourself on a regular basis, will facilitate the beginning stages of self examination that will ultimately (if pursued) guide the individual to (at least) enhanced engagement and improved health.

The ultimate goal is to increase growth and performance while simultaneously fostering personal renewal through the examination of the psychosocial dimension of the self and the application of performance psychology.

`Establishing a starting point:

If anyone ever reads this and if there is any interest in achieving dynamic personal growth, the first step is to adopt, modify and/or create a systemized approach to comprehensive self examination.

In writing, (for yourself) describe yourself in detail:

How do you define and support your physical health?
How do you interact with others?
How do you define your emotional self?

Gather information from other sources (coworkers, friends, family).
Identify and list common performance barriers and determine what your barriers are.

To substantially increase performance (long term) it is essential to regard all elements of the self as integrated and interrelated. Therefore, diet, nutrition, and physical fitness are as important for the general work force as for the professional athlete.

After the information gathering and analysis establish your own ritualized, behavior modification techniques. The changes you wish to make will eventually become as automatic as any of the things you do every day without much (if any) conscious thought.

It is important to realize that what we view as the truth is only the lens through which we view the world.
Acknowledgements and Sources

Many thanks to all my friends at PRC who provided the template and made this effort possible esp. Hector Matha and Irwin Guada, Also, Jack & Jerry at Woodworker Academy who provided extensive safety training. A big thank you to Valentine Corporation & Robert Valentine who has set-the-bar-high and Jim Coltharp who was always available for support and encouragement. Thank you to Chuck James for assistance with copying and binding. Gary Baine @ UC Berkeley’s EH&S, NIOSHweb page and OSHA.gov. as well as parts of the GSK Safety manual and The U.S. Department Of Energy ASME/ANSI B30.2, "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist)."

Books, publications & periodicals:
[Hand Book Of Rigging (Rossnagel) 1950]
[The Journal Light Construction]
[Steel Square Pocket Book (Stoddard) 1904]
[Rock Climbing (Mellor) 1997]
[Basic Construction Techniques (U.S. Navy) 1970]
[Tips & Techniques for Builders (Taunton Press)1995]
[The Very Efficient Carpenter (Haun) 1992]
[The Lead Carpenter Handbook (Faller) 2001]
[The Power Of Full Engagement (Loehr/Schwarts) 2003]
[Measuring, Marking & Layout (Carroll) 1998]
[The Brick Worker’s Bible (Self) 1980]
[Workshop Methods Of Work (Richey) 2000]
[Tricks Of The Trades (Fine Homebuilding) 1994]
[Universal Principals Of Design (Lidwell/Holden/Butler) 2003]
[Woodworker’s Essential (Horner) 2003]
[Welding Skills (Giachino/Weeks) 1985]

This document is a partially rewritten compilation with some original work.
American Institute of Steel Construction
AJSC Specifications for the design, fabrication, and erection of structural steel for buildings.

American Iron and Steel Institute
AISI Standards for Type-302 or Type-304 stainless steel.

American National Standards Institute and American Society of Mechanical Engineers
ANSI A10.28, Work Platforms Suspended From Cranes or Derricks.
ANSI A10.18, Floor and Wall Openings, Railings and Toe Boards.
ASME B30.2, Overhead and Gantry Cranes (Top-Running Bridge, Single or Multiple Girder, Top-Running Trolley Hoist).
ASME B30.5, Mobile and Locomotive Cranes.
ASME B30.6, Derricks.
ASME B30.7, Base-Mounted Drum Hoists.
ASME B30.9, Slings.
ASME B30.10, Hooks.
ASME B30.11, Monorail Systems and Underhung Cranes.
ASME B30.12, Handling Loads Suspended from Rotorcraft.
ASME B30.14, Side Boom Tractors.
ASME B30.16, Overhead Hoists (Underhung).
ASME B30.17, Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist).

ASME B30.20, Below-The-Hook Lifting Devices.
ASME B30.21, Manually Lever Operated Hoists.
ASME B30.22, Articulating Boom Cranes.
ASME B56.1, Safety Standard for Powered Industrial Trucks — Low Lift and High Lift Trucks.
ASME B56.5, Guided Industrial Vehicles.
ASME B56.6, Rough Terrain Fork Lift Trucks.
ASME B56.7, Industrial Crane Trucks.
ASME B56.11.4, Forks and Fork Carriers for Powered Industrial Fork Lift Trucks, Hook Type.
ASME PALD, Portable Automotive Lifting Devices.
DOE-STD-1090-2004


ANSI MH 27.1, Specifications for Underhung Cranes and Monorail Systems.

ANSI N14.6, Standard for Special Lifting Devices for shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials.

ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities.

ASME Cranes for Nuclear Facilities:

- ASME NUM-1, Rules for Construction of Cranes, Monorails, and Hoists (With Bridge or Trolley or Hoist of the Underhung Type).
- ASME NOG-1, Rule for Construction of Overhead and Gantry Cranes (Toprunning Bridge, Multiple Girder).

American Society for Nondestructive Testing

Recommended Practice No. ASNT-TC-1A.

American Welding Society

ANSI/AWS D1.1 Structural Welding Code Steel.

Crane Manufacturers' Association of America

CMAA No. 70, Specification for Electric Overhead Traveling Cranes.


Department of Energy

DOE 440.1A, Worker Protection Management for Federal and Contractor Employees.

DOE 440.1-6, Suspect Counterfeit Items Guide.

Department of Labor


29 CFR 1926, Occupational Safety and Health Regulations for Construction.

Department of Transportation

49 CFR 391.41, physical Qualification for Drivers.

National Fire Protection Association

ANSI/NFPA 505, Powered Industrial Trucks, Type Designation and Areas of Use.

NFPA 70, National Electrical Code.

Power Crane and Shovel Association

PCSA-4, Mobile Power Crane and Excavator Standards and Hydraulic Crane Standards.

Society of Automotive Engineers

SAE J376-85, Load-Indicating Devices in Lifting Crane Service.

Code SAE J765, Crane Load Stability Test

SAE J874, Center of Gravity Test Code.

SAE J987, Crane Structure, Method of test.

Underwriters' Laboratories

UL 558, Internal-Combustion-Engine-Powered Industrial Trucks.

UL 583, Electric-Battery-Powered Industrial Trucks.
“SAFETY IS, AS SAFETY DOES AND IF DONE CORRECTLY NO GETS HURT. The truth can be quite inconvenient, but if the narrative story is properly transmitted we all learn and everyone wins”

David A. MacLam