

E. Material Handling

The following are general safety rules and requirements regarding material handling and material handling equipment regularly used on campus.

1. Lifting by Hand

Lifting and carrying can be done without injury by using the following criteria:

a. Personal Protection

- i. Hand protection shall be used when lifting; however, gloves or loose clothing shall not be worn around rotating and reciprocating equipment
 1. Leather gloves and aprons shall be worn when handling rough or sharp objects.
 2. Chemical gloves, splash suits, and eye protection shall be worn when handling chemicals of any nature (corrosives, flammables, etc.).
- ii. Eye protection are recommended to be worn at all times.
- iii. Steel-toed shoes and/or shin guards are recommended to be worn at all times.

b. Body Condition

How much should you lift? Lifting capacity depends on body condition; that is, flexibility and strength, and physical make-up. To help your condition, build up your strength by a regular exercise program and stretch your body before doing any lifting.

c. Sizing up the Load

Questions to ask:

- i. Is it too big for you to handle?
- ii. What about the shape? Is it irregular, square, rectangular, etc.?
- iii. Can you get a firm, comfortable grip?
- iv. How many loads are there and where are they going?

d. Lifting It Right

- i. There are six steps to proper lifting:
 1. Keep feet parted—one alongside the object and one behind the object. Comfortably spread feet give greater stability; the rear foot is in position for the upward thrust of the lift.
 2. Keep back straight, nearly vertical. Use the sit-down position to do so, but remember that “straight” does not mean absolutely “vertical”. A straight back keeps the spine, back muscles, and organs of the body in correct alignment. It minimizes the compression of the guts that can cause hernia.
 3. Tuck in chin so the neck and head continue the straight back line and keep spine straight and firm.
 4. Grasp the object with the whole hand. The palm grip is one of the most important elements of correct lifting. The fingers and hand are extended around the object to be lifted. Use the full palm;

fingers alone have very little power. Wearing gloves is recommended.

5. Tuck elbows and arms in and hold load close to body. When the arms are held away from the body, they lose much of their strength and power. Keeping the arms tucked in also helps keep body weight centered.
 6. Keep body weight directly over feet. This provides a more powerful line of thrust and ensures better balance. Start the lift with a thrust of the rear foot.
- ii. When setting the load down, the same six proper lifting steps shall be used in reverse.
 - iii. To change direction, the worker shall lift the object to the carrying position and turn the entire body including the feet. He/she shall avoid twisting the body. In repetitive work, the person and the material both shall be positioned to prevent twisting of the body when moving the material.
- e. Team Lifting
- i. When two or more people carry one object, they shall adjust the load so that it rides level.
 - ii. When long sections of material (pipe, lumber) are carried, the load shall be carried on the same shoulder and both persons shall walk in step.
 - iii. When team lifting, one person shall be designated to give the signal when to lift.
- f. Handling of Specific Shapes
- i. Barrels and drums
 1. It is recommended that a hand truck or other type of material handling equipment be used for lifting and transporting barrels and/or drums.
 2. If it is necessary to roll a barrel or drum, the worker shall push against the sides with both hands. To change directions, the drum or barrel shall be stopped, the direction changed by grabbing the upper and lower rim seams, and movement started.
 3. When uprighting a full drum, the six steps to safe lifting shall be adhered to.
 - ii. Long Objects (Pipe, Lumber, Barsteel, etc.)

There are two schools of thought on this. The method chosen shall be determined by the obstructions to be encountered.

 1. The item shall be carried on the shoulders with the front end held as high as possible to avoid striking other employees—especially when going around corners.
 2. The item shall be carried on the shoulders with the front end low so it does not catch overhead objects.
 - iii. Compressed gas cylinders
 1. Compressed gas cylinders may be rolled on the bottom edge for short distances. They shall never be dragged.

2. Because of their shape, smooth surface, and weight, cylinders are difficult to carry by hand. Cylinders weighing more than 40 pounds total should be transported on a hand or motorized truck, suitably secured to keep them from falling.
- g. Items to remember when lifting by hand:
 - i. Avoid twisting while turning with a load.
 - ii. Watch for narrow places when moving materials.
 - iii. Avoid high reaching and lifting. A suitable ladder or platform shall be used to get up to load.
 - iv. Do not jump with a load.
 - v. Do not catch or throw loads.
 - vi. Check the materials to be lifted for nails, splinters, rough strapping, or other things that might injure hands.
 - vii. Ascertain good visibility—especially on stairs.
2. Handtrucks
 - a. General
 - i. Keep truck under control at all times.
 - ii. Trucks shall be stored in designated areas—not in aisles.
 - iii. Housekeeping—all aisles and loading areas shall be kept clear.
 - iv. Always move the truck at a safe speed. Do not run.
 - v. Loads shall be packed securely; avoid overhanging.
 - vi. No riders or horseplay.
 - vii. Hands shall be kept inside to protect them in narrow areas if the truck does not have knuckle guards or handles.
 - b. One Axle Handtrucks
 - i. Keep the center of gravity of the load as low as possible. Place heavy objects below higher objects.
 - ii. Place the load so it is carried by the axle, not the handles.
 - iii. Load only to a height that will allow a clear view ahead.
 - iv. When lifting from a horizontal position, have a straight back and lift with the legs. The load shall be put down the same way.
 - v. Let the truck carry the load. The operator shall balance and push only.
 - vi. Never walk backwards with a handtruck.
 - vii. For extremely bulky or pressurized items, such as gas cylinders, strap or chain the item to the truck. Valve caps shall be on valves.
 - viii. Always move the truck at a safe speed. Do not run.
 - c. Two Axle Trucks
 - d. NOTE: Many one axle handtruck rules apply here also
 - i. Load evenly to prevent tipping.
 - ii. Push. Do not pull.
 - iii. The truck shall not be loaded so high that the operator cannot see where in the direction of travel. If the load is high, two persons are needed; one to push and one to guide.
 - iv. Truck contents shall be arranged so they will not fall if accidentally bumped.

- v. When entering elevators or tight areas, enter with the load forward. Make sure load is bound to truck.

3. Requirements for Heavy Construction Equipment

(Rollers, Compactors, Front-end Loaders, Bulldozers, Trucks, etc.)

- a. All vehicles of these types shall have a suitable horn available which is tested before the vehicle is used.
- b. Operators shall wear seat belts at all times when machinery is in operation.
- c. All controls (brakes, steering, etc.) shall be tested each shift before the vehicle is used.
- d. No riders shall be allowed on machines unless the machine is designed to carry riders.
- e. Blades, buckets, and shovels on earth-moving machines shall be lowered to the ground when the equipment is parked or unattended.
- f. All earth-moving equipment shall have a roll-over protection structure (ROPS) and seat belts.
- g. Trucks that are loaded by a crane, power shovel, loader, or similar equipment shall have a cab shield and/or canopy strong enough to protect the operator from shifting or falling materials. Operators shall be out of the vehicles while they are being loaded. Brakes shall be set.
- h. All trucks, excluding pickup trucks and earth-moving equipment, shall have an audible warning device that sounds automatically when they are backing up. The sound shall be able to be heard at least 200' away.
- i. Smoking during vehicle refueling is prohibited.
- j. All vehicles shall be operated in a safe manner. Earth-moving equipment shall not exceed 15 mph.
- k. All vehicles shall be inspected before each use and thoroughly on a regular basis.

4. Fork Trucks

Fork trucks are used to carry, push, pull, lift, stack, and tier materials.

- a. Only trained and authorized operators shall be permitted to operate a powered industrial truck. Training shall include:
 - i. Lecture
 - ii. Instructor led demonstration field activities
 - iii. Workplace evaluation
- b. Guarding
 - i. Hazardous moving parts such as chain and sprocket drives and exposed gears shall be guarded to protect the operator in his normal operating position.
 - ii. All fork trucks shall have an overhead guard in accordance with ANSI B 56.1.
 - iii. Exposed tires shall have guards that will stop particles from being thrown at the operator.
 - iv. Hydraulically-driven lifting systems shall have a relief valve installed and suitable stops shall be provided to prevent travel over of the carriage.

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- v. A load backrest extension shall always be used when the type of load presents a hazard to the operator. The top of a load shall not exceed the height of the backrest.
- c. Loading
 - i. If the material being handled is obstructing the view, the operator is required to travel backwards. The operator shall face the direction of travel at all times.
 - ii. Only loads within the rated capacity of the truck shall be handled. No counter weights shall be allowed. A nameplate showing the weight of the truck and its rated capacity shall be located in plain view on the truck.
 - iii. Backwards tilt shall be used to stabilize the load.
 - iv. Loads shall be checked for overloading and for loose material before making the lift.
 - v. Extreme care shall be taken when handling long items, i.e., bar stock and lumber.
 - vi. The load shall never be driven in an upward position, nor raised or lowered while moving.
 - vii. Forks shall be locked to the carriage, and the fork extension designed so as to prevent unintentional lifting of the toe or displacement of the fork extension.
 - viii. Bridge plates and dock boards shall be strong enough to support the intended load. They shall also have side boards, anti-slip surfaces, and be secured to the dock.
 - ix. Chocks shall be used on truck wheels when unloading. See attached diagram.
- d. Inspections

All fork trucks should be inspected before each use and formally on an annual basis.
- e. Miscellaneous
 - i. Powered industrial trucks shall be equipped with horns.
 - ii. Steering wheel knobs are prohibited.
 - iii. All trucks shall be equipped with an ABC fire extinguisher.
 - iv. Fork trucks shall not be used on upper level floors unless the floors are designed for that load capacity.
 - v. Diesel or gasoline fork trucks shall be used in adequately vented areas only.
 - vi. Never give rides on a fork truck unless the truck is designed for it.
- f. General Operating Requirements
 - i. No excessive speed or reckless driving.
 - ii. When the operator will be farther than 25' from the truck, the forks shall be down, motor cut off, and emergency brake applied
 - iii. No one shall be allowed to pass under the elevated portion of any truck—loaded or empty.
 - iv. The operator shall come to a stop at blind corners and before passing through doorways.

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- v. Extreme caution shall be taken when operating on turns, ramps, grades, or inclines.
- vi. Reverse control shall never be used for braking.
- vii. Always drive with the load pointing upgrade unless a bulky load permits poor visibility.
- viii. Trucks shall not be used for any purpose other than the one for which they were never designed, i.e., bumping skids, pushing piles of material out of the way, using forks as a hoist, etc.
- ix. Trucks shall ascend or descend grades slowly. When ascending or descending grades in excess of 10%, loaded trucks should be driven with the load upgrade. Unloaded trucks should be operated on all grades with the load-engaging means downgrade.
- x. When standard forks are used to pick up round objects such as rolls or drums, care shall be taken to see that the tips do not damage the load or push it against workers.
- xi. Operators of lift trucks shall not move improperly loaded skids or pallets, broken pallets, or loads too heavy for the truck.

NOTE: Using a lift truck as an elevator for employees shall only be done if the work platform is securely seated on the forks, fastened to the vertical face, and provided with handrails and toeboards. The truck shall also have an overhead guard for the operator's protection. The operator shall not leave the controls while the truck is being used as a man lift.

5. Hoists

- a. Hoists are used to raise, lower, and transport heavy loads for limited distances.
 - i. Hoists shall not be used to lift, support, or otherwise transport people unless designed for that purpose.
 - ii. The load capacity of each hoist shall be shown in conspicuous figures on the hoist body. Lifts shall not be made beyond the rated capacity of the hoist, slings, chains, ropes, straps, etc.
 - iii. All hoists shall have safe operating procedures affixed to them.
 - iv. Hoists operating on rails, tracks, or trolleys shall have positive stops or limiting devices on the equipment, rails, tracks, or trolleys to prevent overrunning of safe limits.
 - v. Pick up loads only when they are directly under the hoist.
 - vi. Unless they are grounded, rope-operated electric hoists shall have non-conducting control cords.
 - vii. Control cords shall be clearly marked "hoist" or "lower" or a similar combination.
 - viii. The block shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.
 - ix. When lifting and moving material, the area should be clear. No one shall be allowed to walk under the load.
 - x. No load shall be left suspended without an operator at the controls.
 - xi. When not in use, the hoist shall be lifted in the upward position.

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- b. Hoists shall be inspected before each use. Regularly scheduled detailed inspections shall pay special attention to load hooks, ropes, brakes, limit switches, wear damage, and railstops. During inspection and/or repair, the power shall be disconnected and potential energy sources depleted. A warning sign stating such shall be posted. See Lock out / Tag out Program.
6. Insulated Aerial Baskets
See Electrical Safety for additional guidance.
 - a. Aerial baskets shall be of the proper design and construction for the intended work.
 - b. The design limits of the equipment must be thoroughly understood and the baskets operated within the limits of their capabilities.
 - c. Daily inspections shall be performed by the operator to uncover defects before they become serious in nature. Annual comprehensive inspection and dielectric testing shall be performed on an annual basis.
 - d. All maintenance, both preventive and corrective, shall be performed by qualified personnel.
 - e. Operation of aerial baskets shall be trained on and familiar with the specific type of aerial basket being operated.
 - f. Adequate clearances shall be observed. The ability to judge distances is essential. Sufficient rubber protective equipment is as necessary in working from aerial baskets as in working from a pole.
 - g. Pre-job briefing (tail board conference) shall be conducted before jobs involving aerial baskets.
7. Hand Signals
Basic hand signals should be used by all operators and riggers of cranes, hoists, boom trucks, aerial baskets, etc., shall use.
NOTE: See Appendix for hand signals.
8. Slings
 - a. Materials Used
 - i. The type of sling to be used is determined by the load to be lifted.
 - ii. Fiber rope is particularly suitable for the handling of loads that may be damaged by contact with metal slings. Fiber rope is generally made from manila, sisal, benequen, nylon (2.5 x breaking strength & 4 x elasticity of manila), polyester, and polypropylene (special applications). Manila and nylon ropes give the best uniform strength and service.
 - iii. Wire rope is used widely instead of fiber rope because
 1. It has a greater strength and durability under severe working conditions.
 2. Its physical characteristics do not change when used in varying environments.
 3. It has controlled and predictable stretch characteristics
 4. Where mechanical type loop endings are employed or where swayed or pressed on terminations are used.
 - iv. Chain slings are used when a high resistance to abrasion and corrosive substances is needed. Chain slings are generally made from alloy steels such as stainless steel, monel metal, bronze, etc.

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- v. Web slings are used when lifting loads in need of surface protection; used on tubular, nonferrous, ceramic, painted, polished, highly machined, and other products with a fine or delicate surface.
- vi. Two types of web slings.
 - 1. synthetic web—nylon or polyester
 - 2. metal mesh web—alloy steel = sharp edges, concrete, high temperature
- b. Rated Capacity
 - i. As the sling is used, factors such as abrasion, nicking, distortion, corrosion, and other factors affect the load rating.
 - ii. Slings can be used at various angles, but stress increases rapidly with the angle of lift. All slings shall be ordered with this in mind
NOTE: Most slings have catalogs and rating tables for load rating worked out—consult them.
 - iii. Each sling shall bear a tag indicating its rated load capacity. Rated capacity is based on newly manufactured slings.
 - iv. Allowances shall be made when hitches are used.
 - v. If loads having sharp edges or corners are to be lifted, pads or saddles shall be used to protect the ropes and chains.
- c. Inspection
 - i. Slings shall be checked daily by trained employees.
 - ii. Any damaged or suspected damaged slings shall be removed immediately from service and made unusable.
 - iii. Fiber ropes shall be inspected every 30 days and more often if used in critical applications. Rope shall be examined over the length of the rope for wear, abrasions, powdered fibers between strands, variations in size or roundness of strands, dis-location, and rotting.
 - iv. Wire rope shall be inspected when installed, weekly during use, and regularly by a trained inspector. Wear of crown wires, broken wires, kinking, high strands, corrosion, loose wires, nicking, and lubrication shall be checked. Experience and judgement of all factors, combined with the length of time in service and the tonnage hoisted by the rope, determines when it should be discarded.
 - v. Chain slings shall be inspected daily by personnel using the chain and semi-annually or more often by persons qualified by experience or training. A link-by-link inspection link inspection shall be made to detect bent links, cracks in welded areas, transverse nicks and gouges, corrosion pits and elongation (stretching by overloading).
 - vi. Web slings shall be inspected by the user it each time they is used. Also, periodic inspections shall be made by a person experienced in the inspection of web slings. Web slings shall be checked for abrasive wear, cuts, tears, snags, punctures, etc.