

OVERHEAD CRANE REGULATIONS

- [29 CFR 1910.179](#) Overhead cranes and gantries
- [29 CFR 1926.554](#) Overhead hoists
- [ASME B30.2](#) Overhead and gantry cranes (Top running bridge, single or multiple girder, top running trolley hoist)
- [ASME B30.11](#) Monorails and underhung cranes
- [ASME B30.16](#) Overhead hoists (underhung)
- [ASME B30.17](#) Overhead and gantry cranes (Top running bridge, single girder)

SAMPLE

These regulations apply to most general purpose overhead cranes but certainly not all of them. Many manufacturers have their own standards as do some industries such as Agriculture, Mining, Offshore oil platforms, etc.

We have included only the two OSHA standards and the B30.16. This is because they are almost identical when it comes to operation and inspections.

DEFINITIONS OF SERVICE

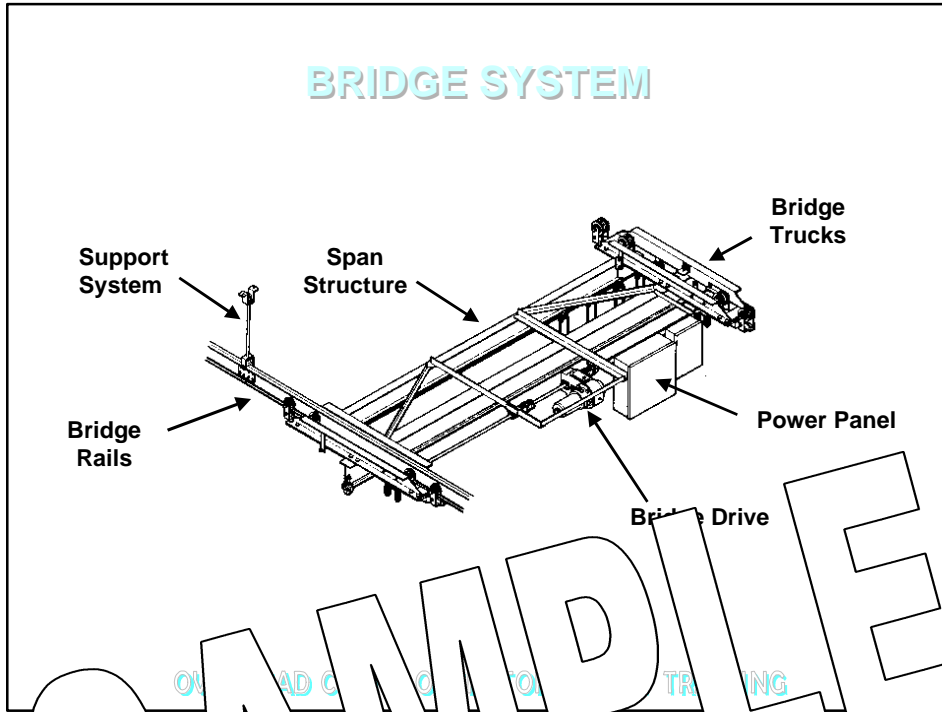
Normal Service: Involves operations of the crane with randomly distributed load within the rated load limit or uniform loads of less than 65% of rated load limit for no more than 25% of the time for a normal work shift.

Heavy Service: Involves operation of the crane within the rated load limit that exceeds normal service.

Severe Service: Involves operation of the crane in normal of service with abnormal operating conditions.

SAMPLE

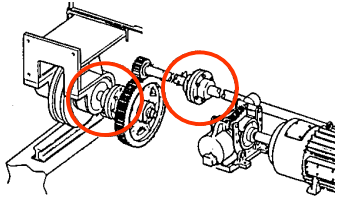
Some cranes are used more heavily than others. The frequency of use should be determined in determining how often the crane should be inspected and maintained. Even cranes that are not used need to be inspected, lubricated and maintained. Especially cranes that are out in the weather all year or in corrosive environments.



SAMPLE

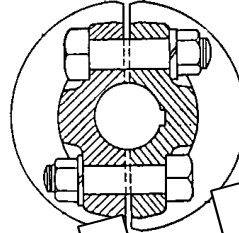
Climbing and working the bridge system is normally not part of the daily inspection. Use these facts to familiarize the student with the components of the bridge crane and how they work together to make a successful lift. Many of the components can be inspected from the ground as the crane is being operated. If something seems wrong, then a closer look would be warranted.

DRIVE COUPLINGS



Check Couplings for:

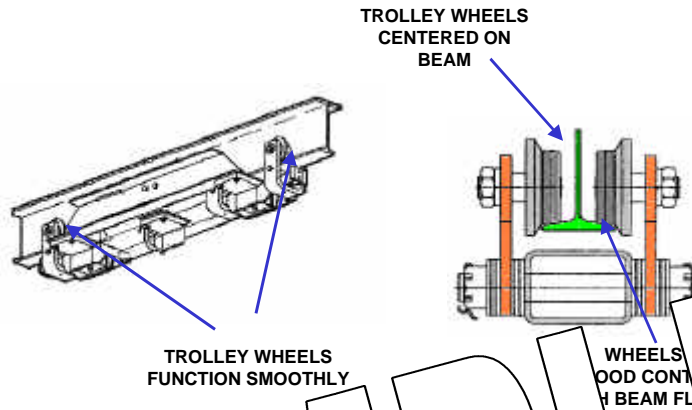
- Loose bolts
- Loose or missing keys
- Cracks



SAMPLE

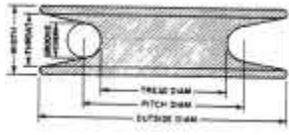
1. Coupling and drive shaft inspection is normally not part of the daily maintenance schedule. To familiarize the student with the components of a crane and how they work together to make a successful lift.
2. Many of these components can be inspected from the ground as the crane is being operated. If something seems wrong, then a closer look would be warranted.

MONORAIL CRANE TROLLEY

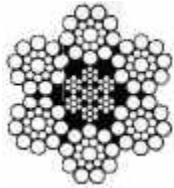


1. Check on a daily basis the trolley system is normally not part of the daily maintenance. This is to familiarize the student with the components of the trolley and how they work together to make a successful lift.
2. Many of these components can be inspected from the ground as the crane is being operated. If something seems wrong, then a closer look would be warranted.

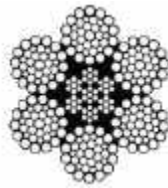
WIRE ROPE



STANDARDS FOR SHEAVE & DRUM RATIOS		
D = Diameter of drum or sheave		
d = Diameter of wire rope		
Ratio = D / d		
ASNE/B30.5 "MOBILE CRANES"		
Minimum Ratios		
	<i>Drum</i>	<i>Sheave</i>
Load Hoist	18	18
Boom Hoist	15	15
Load Block		16



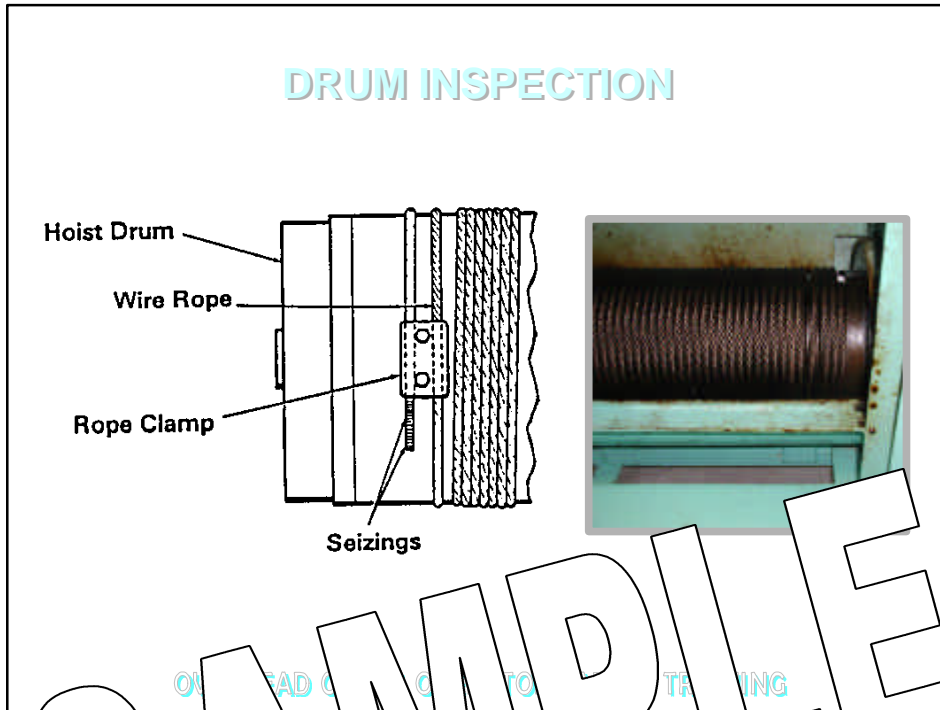
ABRASION RESISTANCE
 Increases with larger wires
 Decreases with smaller wires



FATIGUE RESISTANCE
 Decreases with few wires
 Increases with more wires

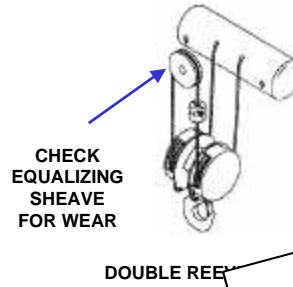
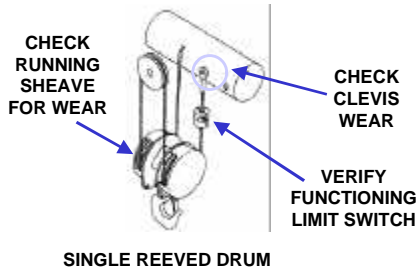
SAMPLE

1. Plot the trade-off between abrasion and fatigue resistance.
2. Show how sheave and drum diameter relate to each other and the effects of rope life.
3. Review sheaves are dimensioned.



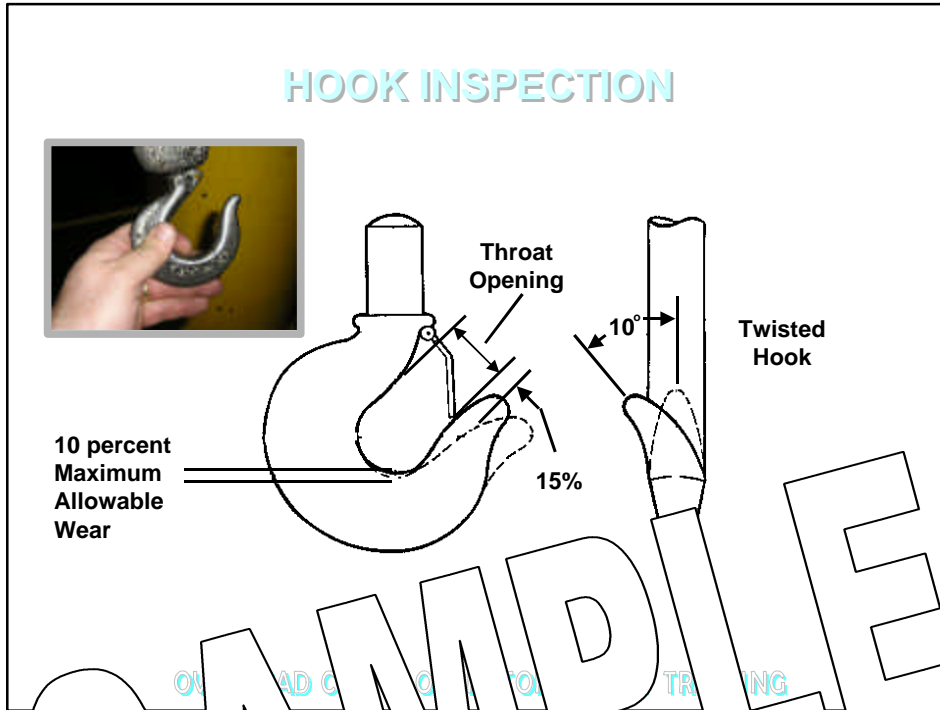
1. Check to make sure the wire rope is seated properly on the drum.
2. On new drums, make sure the drum hasn't stamped a groove which could damage the rope.
3. Check to see if the dead end is secured properly.
4. Never lower down to the point that there would be less than 2 wraps left on the drum.
5. Check oil often.

HOIST MACHINERY



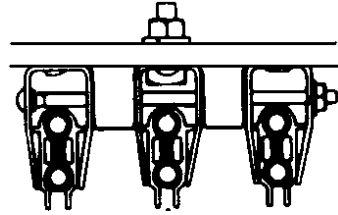
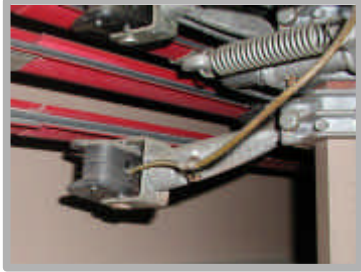
SAMPLE

1. Check running sheave, equalizing sheave for wear and free movement.
2. Check limit switch mechanism, stop hook or load if two-blocked.
3. Check oil level, especially if you detect any leakage.



1. Hooks shall be inspected periodically.
2. Hooks shall be inspected per manufacturer's procedures.
3. Wear exceeding 15% in the neck of the hook and 10% in other areas including the body of the hook is cause for removal.
4. An increase in the hook throat opening of more than 15% is cause for removal.
5. Any twist in the hook of more than 10% is cause for removal.
6. The hook safety latch should be present and function properly.

ELECTRICAL CONDUCTORS



Check Conductors for:

- Loose fasteners
- Burned surfaces
- Dirt and corrosion
- Electrical connections

Current Coil
on this
face

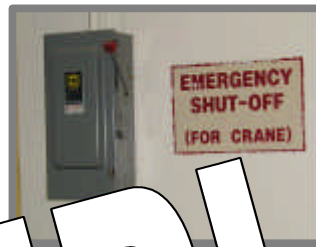
SAMPLE

Always shut the train before working in or on the electrical conductors.

LOCK-OUT TAG-OUT



ALWAYS DE-ENERGIZE ELECTRICAL SYSTEMS BEFORE INSPECTING AND WORKING ON THEM.



SAMPLE

Before adjustments and repairs are made on a crane the following precautions

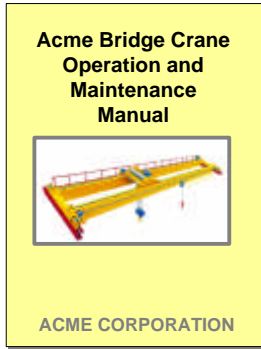
29 CFR - 1910.179 (2)(i) The crane to be repaired shall be run to a position where it will cause the least interference with other cranes and operations in the area.

- (b) All controllers shall be at the off position.
- (c) The main or emergency switch shall be open and **locked** in the open position.
- (d) Warning or "out of order" signs shall be placed on the crane, also on the floor beneath or on the hook where visible from the floor.
- (e) Where other cranes are in operation on the same runway, rail stops or other suitable means shall be provided to prevent interference with the idle crane.

1910.179(I)(2)(ii) After adjustments and repairs have been made the crane shall not be operated until all guards have been reinstalled, safety devices reactivated and maintenance equipment removed.

1. The emergency shut off must be visible and accessible.

SAFE CRANE OPERATIONS



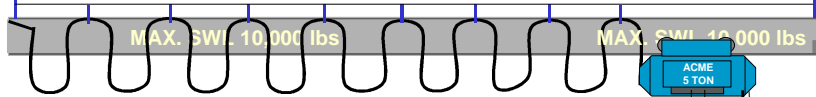
**Read and understand
the operators manual**



SAMPLE

The Operation and Maintenance Manual should be available to every person
who is responsible for the safe operation of the crane.

SAFE CRANE OPERATIONS



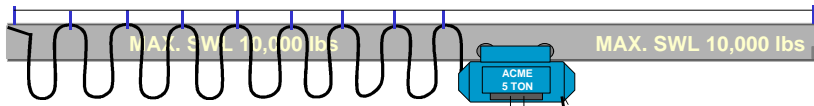
The employer shall insure that the operator does not leave his position at the controls while the load is suspended.



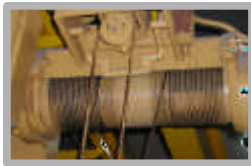
SAMPLE

- 2
 - The operator shall insure that the operator does not leave his position at the controls while the load is suspended.
1. Always lower the load down and secure it before leaving the area.

SAFE CRANE OPERATIONS



The load shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.



SAMPLE

29 CFR 1910.179(b)(1) The load shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.

1. You must not run out of hoist line. Many cranes have automatic stops that can be set so this will not happen. Still it is good practice to check your line when lowering loads down close to the limit of your line.

SAFE CRANE OPERATIONS

- Read and understand the operators manual
- Follow all placards, warning labels and signs on machine
- Know the SWL of the crane and never exceed it
- Determine the weight of the load from accurate sources
- If an estimate of the load is near the max. capacity of the crane, then use a dynamometer to measure the exact weight
- Use a loud signal, such as a whistle, horn or bell or verbal warning to alert employees of crane movement
- Never hoist a load over the heads of employees
- Never use limit switches or end stops as operating controls
- Begin each shift by testing the upper limit switches
- Avoid running the crane into the end stops or limit switches
- Never walk backward when guiding a load

SAMPLE

Summary of safe crane operations

SAFE CRANE OPERATIONS

Cab-operated overhead cranes:

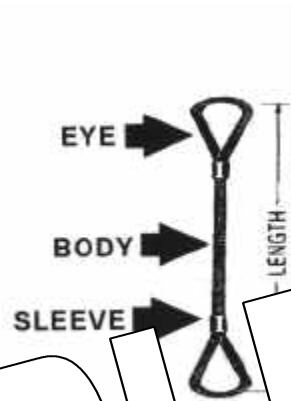
- Enter and exit cab only through approved access ways
- Never walk along runway tracks
- Never climb or jump from one crane to another
- Use both hands to climb access ladder
- Keep unnecessary items out of the cab
- Complete the pre-shift inspection checklist before operation
- Know the location of emergency shutoff switches
- Know emergency evacuation routes
- Place all controls in the OFF position before turning the main switch ON
- Maintain a portable fire extinguisher in the cab
- Never move the cab without a signal from the designated signal person
- Avoid bumping crane and carriage stop blocks
- If a power failure occurs, place all controls in the OFF position
- Park the cab in an approved, designated position

Summary of safe crane operations

SAMPLE

WIRE ROPE SLING INSPECTION

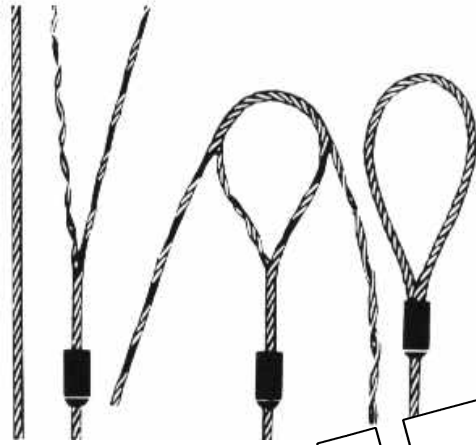
KINKING
CRUSHING
UNSTRANDING
BIRDCAGING
STRAND DISPLACEMENT
CORE PROTRUSION
CORROSION
BROKEN OR CUT STRANDS
BROKEN WIRES



SAMPLE

1. Wire rope slings shall be inspected on a regular basis and a record kept of the inspection for reference and for inspection criteria.
2. As of July, 2000, all wire rope slings shall have a tag which indicates the lifting capacity for vertical, choker, and basket hitches.

FLEMISH EYE

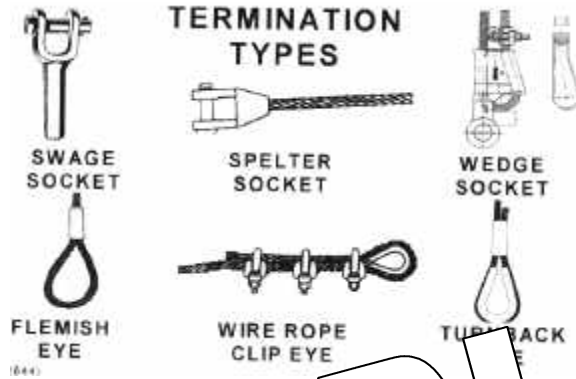


Separate rope into 2 part,
3 adjacent strands and 3
adjacent strands and core.
These 2 parts are re-laid
back in opposite directions
to form an eye and the ends
are secured with a pressed
steel sleeve.

The Flemish eye is a low angle eye for a "Flemish" eye.
The strength of the eye is the same as the strength of the steel sleeve.
They may be used with a thin wire so.

SAMPLE

TYPES OF TERMINATIONS

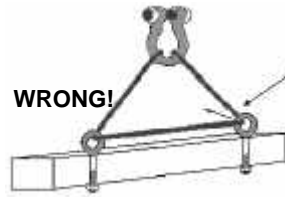
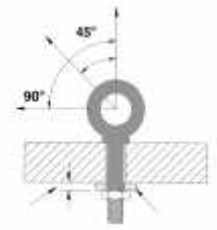


1. Wire sockets are used when attaching lifting blocks or hooks often.
2. Slings are often attached to a wire rope eye made with wire rope clips.
3. Eyes made with wire rope clips may be used to terminate the dead end of the hoist.



1. Shackles must be painted and the weight written on them along with the manufacturer's name and the date they were made.
 2. Only shackles of the screw pin or bolt type may be used for lifting.
 3. If a shackle is used as a permanent part of the hoist line, then it must be moused closed or use the bolt type with a cotter pin.
 4. Shackle that only use a cotter pin to keep the pin in are not legal for lifting.
- When inspecting them, look for:
 - Wear
 - Deformation
 - Pin or bolt substitution
 - Non-rated shackles
 - Worn threads on the pin

EYE BOLTS



DO NOT REEVE SLINGS ONE EYE BOLT TO ANOTHER. LOAD ON BOLT IS ALTERED.

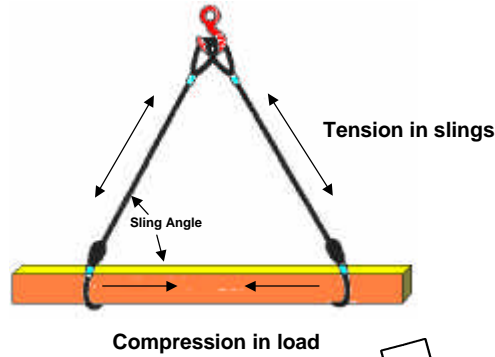


DIRECTION OF PULL	ADJUSTED WORKING LOAD
In-Line	Full Rated Working Load
45 Degrees	30% of Rated Working Load
60 Degrees	60% of Rated Working Load

SAMPLE

1. The capacity of eye bolts is significantly reduced when pulled other than vertically.
2. Emphasize this to the students.
3. Threading a rod through the eye bolts increases the stress on the eye bolts by two and should never be done.

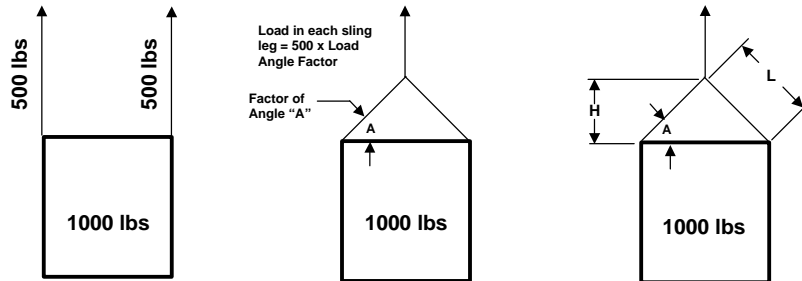
SLING ANGLES



Stresses in the sling increase as the sling angle decreases.

1. When slings are used together in a two-sling arrangement as shown above the stresses on the slings are reduced and the compression force on the load is created.
2. As the sling angle decreases the stresses in the sling and on the load increase.

SLING ANGLES



Sling Angle Degree (A)	Load Angle Factor = L/H
90	1.000
60	1.155
50	1.305
45	1.414
30	2.000

SAMPLE

1. Always need to calculate the stress on the sling based on the height of the object and a measurement of the sling length.
2. As shown in the diagram, the length of the sling is divided by the height of the object from the top of the load.
3. The answer is then multiplied by the portion of the load it is to support and this will be the stress in the sling.

Example: If my sling was 8 feet long and the height 'H' was 4 feet, 8 divided by 4 equals 2. The portion of the weight the sling is to support is half of 1000 lbs or 500 lbs. 2 X 500 = 1000 lbs which is the stress in the sling.

ESTIMATING WEIGHTS

Calculating the weight

To find the weight of any item you need to know its volume and unit weight.

- Volume x Unit weight = Load weight
- Unit weight is the density of the material
- Unit weight is normally measured by pounds per cubic foot.

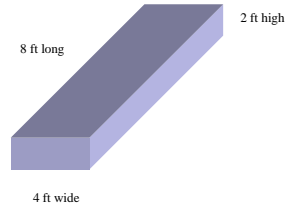
1. Always remember that the weight is only an estimation. But it will get you close.
2. Always err on the safe side of your calculations.

CALCULATING VOLUME

Volume of a cube

$$\text{Length} \times \text{Width} \times \text{Height} = \text{Volume}$$

$$8 \text{ ft} \times 4 \text{ ft} \times 2 \text{ ft} = 64 \text{ cubic feet}$$



If the material was **cedar**, then all we would have to do to determine its weight would be to multiply the unit weight of cedar x 64.

$$\text{Unit weight} \times \text{Volume} = \text{Weight}$$

$$34 \text{ lbs.} \times 64 \text{ cubic ft.} = 2,176 \text{ lbs.}$$

SAMPLE

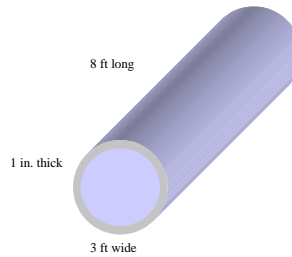
1. Calculating the volume of a cube is easy to calculate.
2. Finding the weight of a cube is done by multiplying the volume of the cube by the unit weight of the material it is made of.

CALCULATING VOLUME

Volume of pipe

Calculating the volume of pipe is a bit trickier but it is just simply subtracting the volume of the hole from the volume of the pipe.

If the pipe were one inch thick, three feet wide and 8 feet long, then we would figure the volume of the entire pipe and subtract the volume of the hole to get the volume of the material.



$$3.14 \times (1 \frac{1}{2} \text{ ft.})^2 \times 8 \text{ feet} = \text{total volume of pipe (56.52 ft}^3\text{)}$$

$$3.14 \times (1 \text{ ft } 5 \text{ in.})^2 \times 8 \text{ feet} = \text{volume of hole (50.41 ft}^3\text{)}$$

$$56.52 \text{ ft}^3 - 50.41 \text{ ft}^3 = 6.11 \text{ ft}^3$$

Volume of material x unit weight = total weight

If this pipe were steel, it would be 490 lbs.

SAMPLE

1. Finding the volume of a pipe is a bit different than finding the volume of a cylinder. You have to do it twice and then subtract the volume of the hole from the total volume of the pipe.
2. It is important to know how to change fractions into decimals. Calculators are a must for this. To change 1 foot 5 inches (or 17/12ths) into a decimal, simply divide 12 into 17 which would be 1.4266.