Material Handling Equipment
Module 3

Rigging Equipment

OSHA 1910.184 Slings: governs slings made from alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope, and synthetic web.
Material Handling and Storage
Module 3

To safely use slings take the following precautions:

- A competent person should conduct inspections of slings before and during use
- Remove damaged or defective slings from service

Source 1910.84(d)
To safely use slings take the following precautions:

- “Do not kink sling legs
- Do not load slings beyond their rated capacity
- Keep suspended loads clear of all obstructions
- Remain clear of loads about to be lifted and suspended
- Do not engage in shock loading
- Avoid sudden crane acceleration and deceleration when moving suspended loads”
- Do not use knots or bolts or other makeshift devices to shorten slings
Overhead crane, chain, hook and hardware used to move beams during fabrication
Material Handling Equipment
Module 3

Chains
- Inspect prior to use – each shift and during use
- Discard defective equipment
- Do not over load rigging
- Specialized Hooks – clamps – should be proof tested

Do not use because of different Grade of material

https://www.osha.gov/dsg/guidance/slings/alloy.html
Material Handling Equipment
Module 3

- ID tag attached
- Listing -- size, grade, rated capacity & Mfg
- Hook – ring – load rating not less than chain’s rating
- No make shift equipment – hook, rods, bolts
- When to discard chain?
- Wear exceeds limits of 1910 Table N-184-1
- Inspections based on:
  - Frequency of use
  - At least yearly
  - Severity of service
  - Nature of lift
  - Use common sense
  - Document dates of inspection
Material Handling Equipment
Module 3

Chains

- Job or shop hooks and links or makeshift fasteners are not allowed
- Use the correct size pin for the job

Right  Wrong
Material Handling Equipment
Module 3

Chains

- AISC has a daily chain inspection form available at its website

http://www.aisc.org/content.aspx?id=31828
Material Handling Equipment

Module 3

Wire rope

- Cover/protect protruding ends of strands from splices
- Lubricate – protect wire rope
- Splice requirements
- Use wire rope ‘U-bolt’ clamp
- Check load capacity tables
- End attachments need to be proof tested
Material Handling Equipment

Module 3

Wire rope

- Do not pull sling from under loads
- Do not use if:
  - More than 10% of visible strands are broken
  - Signs of excess wear, corrosion, or defect
  - Protect slings from sharp edges
  - Sling – wires are kinked

Remove from service
Material Handling Equipment
Module 3

Wire rope

Bird Caging

Kinking

Crushing

If these happen, remove the wire rope sling from service
Material Handling Equipment

Module 3

Wire Ropes

- AISC has a wire rope inspection form posted at it’s website

![Wire Rope Sling Inspection Form](http://www.aisc.org/content.aspx?id=31828)
Material Handling Equipment
Module 3

Synthetic Web Slings
Remove from service if any of these are present:
- Acid or caustic burns
- Melting or charring of any part
- Snags, punctures, tears or cuts
- Broken or worn stitches
- Red core warning thread visible
- Distortion of fittings

Red core waning thread visible

Material Handling Equipment
Module 3

Synthetic web

- Mfg identification tag attached & legible
- Tag list rated capacity for type of hitch used
- Avoid sharp edges and high temperature with sling

Pending photo approval

Look for sling ID tag
Material Handling and Storage
Module 3

Synthetic Web Slings

Fittings must be:
- At least as strong as that of the sling
- Free of sharp edges that could damage the webbing

Material Handling and Storage
Module 3

Synthetic Web Sling Stitching

- Stitching is the only method allowed to attach end fittings to webbing, or to form eyes

Material Handling and Storage
Module 3

Eye Size
Eyes should fit freely on the hook. Snug fit greatly increase eye strain.

Choker Hitch
Tight chokes greatly increase sling stress. Full wrap before choke gives no-slip lifting.

Sling Load Chart
As the sling-to-load angle decreases, so does the rated capacity of a sling.

Use this chart for all type slings: rope, chain or synthetic web.

Sling-To-Load Angle is always the angle between the sling leg and the horizontal surface.
Material Handling and Storage
Module 3

Inspect slings:

- Each day before use
- Where service conditions warrant
- Remove them from service if damaged or defective or the red core warning thread is visible

AISC has a synthetic sling inspection form on its website

[Image of synthetic sling inspection form]

http://www.aisc.org/content.aspx?id=31828
Questions on slings and rigging?
Material Handling and Storage
Module 3

Movement at Ground or Floor Level

- Receiving materials
- Stored in Plant Yard
- Moved into Plant
- Additional Operations
- Moved at Work Station
- Moved to Work Station
- Stored
- Loaded for Shipping
- Shipped
Material Handling and Storage
Module 3

Movement at Floor or Ground Level-Key Topics

- Powered Industrial Trucks-(Forklifts)

Drawings from
https://www.osha.gov/SLTC/etools/pit/forklift/types/classes.html#class1
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts)

Hazard: “Approximately 100 employees are fatally injured and approximately 95,000 employees are injured every year while operating powered industrial trucks.”

“Forklift turnover accounts for a significant number of these fatalities.”

https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling and Storage
Module 3

Potential Hazards: Moving material within the shop-
Powered Industrial Trucks-(Forklifts)

☐ Tipping, struck by caught between, wrong equipment
  for hazard classification

Hazard Avoidance:

 ✓ Select proper equipment for application and hazard
 ✓ Only qualified operators should use equipment
 ✓ Check equipment before use
 ✓ Do not overload
 ✓ Center loads

https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling and Storage
Module 3

Potential Hazards: Moving material within the shop-
Powered Industrial Trucks-(Forklifts)

- Tipping, struck by caught between, wrong equipment
  for hazard classification

Hazard Avoidance:

- Drive safely
- No horseplay
- Watch for obstructions
- Do not leave unattended vehicles running
- Proper maintenance

https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts)-Equipment

- Powered industrial trucks (forklifts) must meet requirements of American National Standard for Powered Industrial Trucks, Part II ANSI B56.1-1969

- Do not modify or make attachments without written approval from the manufacturer

- Nameplates and markings must be in place and legible

- Forklifts that are used in hazardous locations are required to be appropriately marked/approved for such use

https://www.osha.gov/Publications/OSHA2236/osha2236.html
https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts)-Operator Qualifications

- Train and certify all operators to ensure safe operation
- Do not operate a forklift if under 18 years old
- Must be competent
- Trainees must be supervised by a competent person and not endanger others
- Refresher training
- Reevaluation every three years
- Training requirements defined in 1910.178

https://www.osha.gov/Publications/OSHA2236/osha2236.html
https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts) Operation – before you operate:

- Check that rollover protective structure is in place
- Check overhead guards are in place to protect from falling objects
- Reverse signal alarm should be operational
- Check defects before using
- Fill fuel tanks only when the engine is off

https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts) Operation-Loads

- Make sure loads are not heavier than the capacity of the industrial truck
- Loads should be stable and safely arranged and within the rated capacity of the truck
- Follow safe operating procedures for picking up, moving, putting down and stacking loads
- Center the load on the forks and as close to the mast as possible to minimize tipping or load falling
- Place the load at the lowest position for traveling
- Don’t place extra weight on the rear of a counterbalanced forklift to allow an overload
- Dock boards (bridge plates) are properly secured when loading or unloading from loading docks

https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts) Operation-driving and operating

- Drive safely-never over 5 mph- slow at congested areas
- Always wear seat belts
- Keep hands, arms legs and feet inside the truck
- No riders unless there is an approved seat
- Avoid traveling with elevated loads
- Observe all traffic regulations and plant speed limits
- Look in the direction of and keep a clear view of the path of travel
- Run trucks at a safe speed that permits safe stopping

https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts) Operation-Continued

- Stunt driving and horseplay are prohibited
- Check for headroom for the fork-lift under overhead installations, lights, pipes, etc
- Operators maintain a safe distance from the edge of ramps or platforms while using forklifts on any elevated dock, platform or freight car

https://www.osha.gov/Publications/OSHA2236/osha2236.html

https://www.osha.gov/Publications/warehousing.html


https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts) Source OSHA
Operation-Unattended vehicles

- “Load engaging means should be fully lowered, with controls neutralized, power shut off and brakes set when a forklift is left unattended”
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts)-Maintenance

- Properly maintain equipment, including tires and batteries
- Remove defective forklifts from service
- Handling batteries can be dangerous and requires special care and qualified personnel
- Charge batteries in designated areas

3220-10N 2004
https://www.osha.gov/Publications/OSHA3252/3252.html
Material Handling Equipment
Module 3

Powered Industrial Trucks (Forklifts)

- OSHA has a number of helpful materials available

https://www.osha.gov/SLTC/etools/pit/forklift/types/classes.html#class1
Material Handling Equipment
Module 3

Powered Industrial trucks (Forklifts)

Forklift Safety
Safety and Health Topics: Powered Industrial Trucks
OSHA website index links to specific requirements and other Federal agency requirements.

Sample Daily Checklists for Powered Industrial Trucks
Material Handling and Storage
Module 3

Movement at the Workstation-Key

- Receiving materials
- Stored in Plant Yard
- Moved into Plant

Additional Operations
- Moved at Work Station
- Moved to Work Station

Stored
Loaded for Shipping
Shipped
Material Handling and Storage
Module 3

Movement at the Workstation-Key Topics

- Jib Cranes
- Carts
- Hoist Balancers
- Tool balancers
Material Handling and Storage
Module 3

Moving material at the work station
- Steel may be moved at the work station or between work stations by:
  - Overhead cranes
  - Jib cranes
  - Rollers
  - Carts and dollies
  - Hoist balancers
  - Tool suspension devices
  - Workers or pairs of workers
  - Others in your shop?

Jib Crane

Roller system used to move material for fabrication
Material Handling Equipment
Module 3

Lighten the Load- Use Material Handling Equipment

Pallet Jack
Hand carts for moving small materials in the shop

Photos from OSHA 3341-03N 2008
Material Handling and Storage
Module 3

Potential Hazards: Moving material at the work station
- Injuries from dropped work, pinches, cuts, scrapes, burns from hot work, musculoskeletal injuries

Hazard Avoidance:
- Use proper PPE for the task
- Proper equipment use
- Being aware
- Being attentive of where your hands and feet are
- Don’t work fatigued
- Use proper lighting
- Properly maintained equipment
Material Handling Equipment
Module 3

Lighten the Load- Use Material Handling Equipment

- Carts designed to transport and carry materials can reduce lifting, pushing, and pulling forces
- Allow for heavy materials, tools, or equipment to be moved without carrying
- Save time
- Available in many shapes and sizes

Adapted from OSHA 3341-03N 2008
Material Handling Equipment
Module 3

Carts

Hand cart for small loads

Photo from CIANBRO

Drawing from: https://www.osha.gov/SLTC/etools/pit/forklift/types/classes.html#class1
Material Handling Equipment
Module 3

Lighten the Load- Use Material Handling Equipment

Points to Remember:

- Motorized pallet jacks, if available, can be used for frequent or distant movement of materials. Handles should be located at the rear of the cart and positioned at waist level
- Don’t obstruct view with the load
- Balance loads and keep load within manufacturer’s recommended weight limits
- Pushing is easier than pulling
- Use proper wheels

Adapted from OSHA 3341-03N 2008
Material Handling Equipment
Module 3

Jib Cranes

- “Wall, floor, or pillar mounted I-beam with a rolling trolley/hoist used to lift and position equipment and material”
- Jib cranes can be used near a work stations to help with tasks

Photo from OSHA 3341-03N 2008
Material Handling Equipment
Module 3

Jib Cranes

- AISC provides a useful pre-lift checklist. It is included in the training packet.

http://www.aisc.org/content.aspx?id=31828
Material Handling Equipment
Module 3

Jib Cranes

- AISC pre-lift checklist continued

http://www.aisc.org/content.aspx?id=31828
Material Handling Equipment
Module 3

Tool Balancers

- Tool balancers help support tools comfortably for operators
- Tools can be positioned over the work station
- Can be used with a variety of tools

Source CIANBRO
Material Handling and Storage
Module 3

Storage and stacking of material

- Receiving materials
  - Stored in Plant Yard
- Additional Operations
  - Moved at Work Station
- Stored
- Loaded for Shipping
- Shipped
- Moved into Plant
- Moved to Work Station
Material Handling and Storage
Module 3

Storing Materials-Key Topics

- Storing
- Stacking
- Housekeeping

Steel from the mill stored in the yard

Fabricated beams and spandrel frames ready to be shipped to a construction site
Material Handling and Storage
Module 3

Storing and stacking

Steel from the mill stored Inside shop

Fabricated beams ready to be shipped to construction site
Material Handling Equipment
Module 3

Storage and stacking

Heavy steel shapes from the mill

Heavy plate from the mill
Material Handling Equipment
Module 3

Hazard Potential: Stored materials
- Improperly stored materials may fall, and injure workers
- Improper manual lifting or carrying loads that are too large or heavy
- Being struck by materials or being caught in pinch points
- Incorrectly cutting ties or securing devices

Hazard Avoidance:
- “Stack loads evenly and straight
- Place heavier loads on lower or middle shelves and racks
- Remove one object at a time from shelves and racks
- Keep aisles and passageways clear and in good repair”
- Non-compatible materials should not be stored together

Adapted from Source OSHA 3220-10N 2004
Material Handling Equipment
Module 3

Materials Storage-Steel


- Included in ANSI Z229.1-1982 are practices for handling and storing steel material.

Steel shapes stacked and nested

Adapted from source: ANSI Z229.1-1982
Material Handling Equipment
Module 3

Store material in arrangements that allow for:

- Easy movement
- Easy access and movement
- Materials and stacks to be stable

Racks used for storing plate and bar stock

Adapted from source: ANSI Z29.1-1982
Material Handling Equipment
Module 3

Structural shapes received from the mill

- Can be nested or blocked
- Optimize pile height for space and stability
- ANSI Z229.1-1982 suggested maximum pile heights for wide flange shapes 6-8” deep should be limited to 6’-0” in height for shapes 10-16”, 11’-0” in height and for 18-36”, is 14 ‘-0” feet in height.
- Under general industry standards If workers must work on loads higher than 4 feet, fall protection is required

Nested wide flange shapes

Adapted from source: ANSI Z229.1-1982
Material Handling Equipment
Module 3

Materials Storage - storage yards and storage areas

- Store material on level surfaces free of trip hazards
- Maintain walkways
- Store on firm ground
- In periods of freezing and thaws inspect areas for stability
- Maintain approach aisles to piles
- Use sound timber blocking for storing steel shapes to maintain pile stability
- Do not extend blocking beyond piles interfering with walkways and adjacent lifts

Adapted from source: ANSI Z29.1-1982
The variety of raw and fabricated steel shapes at the shop require planning and care when stacking.
Material Handling Equipment
Module 3

Use of wood blocking between beam material

Wood blocking used between shapes
Material Handling Equipment
Module 3

Stacking Small steel items – angles
Material Handling Equipment
Module 3

Stacking Steel Pipe

Round HSS steel shapes should be blocked, placed in racks or cribbing or bundled and tied together.

Blocking

Round HSS shapes stored for fabrication—blocking is used to prevent shapes from rolling.
Material Handling Equipment
Module 3

String coils
- Steel coils should be blocked to prevent movement

Steel coils weighing 10 tons are blocked to prevent rolling
Material Handling Equipment
Module 3

Materials Storage

- Secure materials stored in tiers by stacking, racking, blocking, or interlocking to prevent them from falling
- Post safe load limits of floors and shelves.

Source OSHA 3220-10N 2004
Material Handling Equipment
Module 3

Materials Storage-Fuels

- Store fuel in portable containers
- Transportation of gasoline requires USDOT container
- Tank size – 8 gallon or less
- Approved OSHA can
- Approved USDOT – (stamp-imprint)
- Diesel fuel containers
- Tank size – 119 gallons or less
- Except from using specified container
Material Handling Equipment
Module 3

Q and A
Storing Materials
Material Handling Equipment
Module 3

Take a Stretch!