



Rigger and Signal Person Training



Participant Guide

- Based on 29 CFR 1926 Subpart CC, supporting §1926.251, and applicable ASME B30 topics

Legal Disclaimer & Conditions of Use

This participant guide is an educational resource prepared for National Safety Services. It supports introductory construction rigger and signal-person instruction; it is not an engineered lift plan, a product manual, a legal opinion, or authorization to perform lifting work.

Participation, attendance, a completed worksheet, or receipt of this guide does not establish OSHA qualification, third-party certification, or employer authorization. Employers must determine task-specific rigger qualification. Signal persons must satisfy the applicable knowledge and practical-evaluation requirements before performing signaling duties.

This guide summarizes selected federal OSHA requirements and ASME subject areas. It does not reproduce or replace the complete standards. The employer must verify current federal and applicable state-plan requirements, project rules, adopted ASME editions, equipment manuals, and manufacturer inspection criteria. Do not assume that the latest ASME edition is automatically incorporated into an OSHA rule.

All numerical examples are idealized training cases. Actual lifting requires verified load weight and center of gravity, suitable lifting points, complete rigging analysis, crane capacity at the working configuration and radius, environmental controls, and qualified supervision as applicable.

Estimated material weights are not verified lifting weights.

Illustrations are conceptual and not fabrication drawings. Do not use them to build lifting devices, approve a sleeve or cradle, establish component capacity, or authorize repairs. Do not substitute generic inspection advice for the specific product removal criteria.

No representation of OSHA approval or ASME certification is made. No provision here reduces an employer's legal duties or an employee's applicable rights. Any additional contractual liability limitation should be reviewed by the organization's legal counsel.

Learning Objectives



- ▶ Explain the separate responsibilities of riggers and signal persons.
- ▶ Inspect and select slings, hooks, and hardware for assigned work.
- ▶ Determine load weight, balance, and basic sling-leg forces.
- ▶ Apply standard hand signals and structured voice communications.
- ▶ Control exposure to suspended loads and demonstrate safe work practices.

Regulatory and Standards Framework

REFERENCE	PRIMARY TRAINING APPLICATION
29 CFR 1926 Subpart CC	Crane operations, communications, qualification, and exposure controls
29 CFR 1926.251 (Subpart H)	Rigging identification, inspection, capacity, and safe use
ASME B30.9 / B30.26	Slings / detachable rigging hardware
ASME B30.10 / B30.20	Hooks / below-the-hook lifting devices
ASME B30.5	Mobile and locomotive crane operating context

- ▶ OSHA regulations are enforceable requirements; ASME volumes are consensus standards.
- ▶ ASME provisions may apply through incorporation, contracts, employer policy, or other governing requirements.
- ▶ Do not assume the newest ASME edition is automatically incorporated into OSHA.



Who Does What?

Role	Core responsibility
Employer	Assign qualified personnel; provide equipment, training, and controls
Qualified rigger	Select, inspect, attach, and control rigging for assigned tasks
Signal person	Communicate crane movements using qualified signaling methods
Crane operator	Operate within equipment limitations and respond to stop signals
Lift director / supervisor	Coordinate the lift, crew assignments, and site controls

Qualified Rigger: Task-Specific Ability

- ▶ A qualified rigger meets OSHA's criteria for a qualified person.
- ▶ Qualification may be based on recognized credentials or extensive knowledge, training, and experience, with demonstrated problem-solving ability.
- ▶ Qualification for simple loads does not automatically cover complex or unusual loads.
- ▶ Qualified riggers are required for rigging during crane assembly/disassembly.
- ▶ They are also required under §1926.1425(c) when specified load-handling work occurs within the fall zone.



Signal Person: Required Qualifications

- ▶ Know and understand the signaling methods used; know the Standard Method when using hand signals.
- ▶ Be competent in applying those signals.
- ▶ Understand equipment operation, limitations, load swing, stopping, and boom deflection.
- ▶ Know §§1926.1419–1422 and 1926.1428.
- ▶ Demonstrate knowledge through an oral or written test AND a practical test before giving signals.

Pre-Lift Planning and Briefing

- ▶ Confirm load weight, center of gravity, lifting points, and attachment condition.
- ▶ Select the crane configuration and rigging for the complete lift path.
- ▶ Identify the operator, rigger, signal person, and receiving crew.
- ▶ Review landing area, exclusion zones, power lines, weather, and escape routes.
- ▶ Agree on signals, radio checks, stop-work triggers, and emergency response.



Know When to Stop



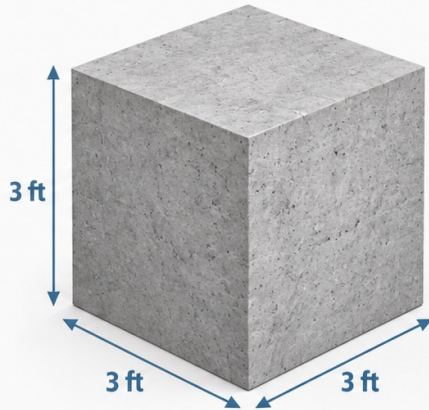
- ▶ Stop for unclear signals, communication loss, or unexpected load movement.
- ▶ Stop for damaged rigging, missing identification, or uncertain load weight.
- ▶ Stop if people enter a prohibited area or clearance cannot be maintained.
- ▶ Anyone aware of a safety problem must give a stop or emergency-stop signal.
- ▶ Resolve the hazard and reestablish clear communication before resuming.

Establish the Load Weight

- ▶ Use manufacturer data, shipping documents, verified drawings, or another reliable source.
- ▶ Recognized calculations may use measured dimensions and verified unit weights.
- ▶ Include contents, attachments, trapped liquids, and items shipped inside the load.
- ▶ Give the weight information to the operator when requested before the lift.
- ▶ Never guess a weight because the crane or sling appears large enough.

ESTIMATING CONCRETE LOAD WEIGHT

Solid concrete cube: 3 ft × 3 ft × 3 ft



SOLID CUBE — NO VOIDS

1 CALCULATE VOLUME

Length × Width × Height

$$3 \text{ ft} \times 3 \text{ ft} \times 3 \text{ ft} = 27 \text{ ft}^3$$

2 LOOK UP UNIT WEIGHT

Assumed normal-weight concrete:

150 lb/ft³

$$27 \text{ ft}^3 = 1 \text{ yd}^3$$

At 150 lb/ft³:

$$1 \text{ yd}^3 = 4,050 \text{ lb}$$

3 MULTIPLY TO FIND WEIGHT

$$27 \text{ ft}^3 \times 150 \text{ lb/ft}^3 = 4,050 \text{ lb}$$



ESTIMATED BLOCK WEIGHT:

4,050 lb

2.025 US short tons



TRAINING ESTIMATE ONLY: Verify actual concrete unit weight and load details before lifting. Account for rigging and lifting-device weight separately.

Unit-weight reference: FHWA Field Materials Manual — approximately 150 lb/ft³ for normal concrete.

COMMON CONSTRUCTION MATERIAL WEIGHTS

Approximate unit weights • lb per cubic foot (lb/ft³)

CONCRETE & MASONRY

All weights are lb/ft³

Normal-weight concrete:	140–150
Structural lightweight concrete:	100–125
Solid clay brick:	100–120
Solid concrete brick:	120–140
Compacted asphalt:	140–160



METALS & STONE

All weights are lb/ft³

Solid structural steel:	490
Solid aluminum:	169
Solid granite:	169



WOOD — TYPICAL

All weights are lb/ft³

Pine:	31
Oak:	47

SAND & AGGREGATE — BULK

All weights are lb/ft³

Dry sand:	80–100
Loose sand, nominal:	90
Damp sand, nominal:	100
Dry sand & gravel mix:	108
Wet sand & gravel mix:	125
Dry gravel: approximately	87–106



$$\text{ESTIMATED WEIGHT (lb)} = \text{VOLUME (ft}^3\text{)} \times \text{UNIT WEIGHT (lb/ft}^3\text{)}$$

Rectangular solid volume = Length × Width × Height (all dimensions in feet)

$$1 \text{ yd}^3 = 27 \text{ ft}^3 \quad | \quad 1 \text{ US short ton} = 2,000 \text{ lb}$$

$$\text{Concrete example: } 3 \text{ ft} \times 3 \text{ ft} \times 3 \text{ ft} \times 150 \text{ lb/ft}^3 = 4,050 \text{ lb}$$



ESTIMATING REFERENCE ONLY — VERIFY ACTUAL LOAD WEIGHT BEFORE LIFTING

Moisture, mix, species and compaction affect weight. Use verified product weights for hollow items and assemblies. Account for rigging and lifting-device weight separately.

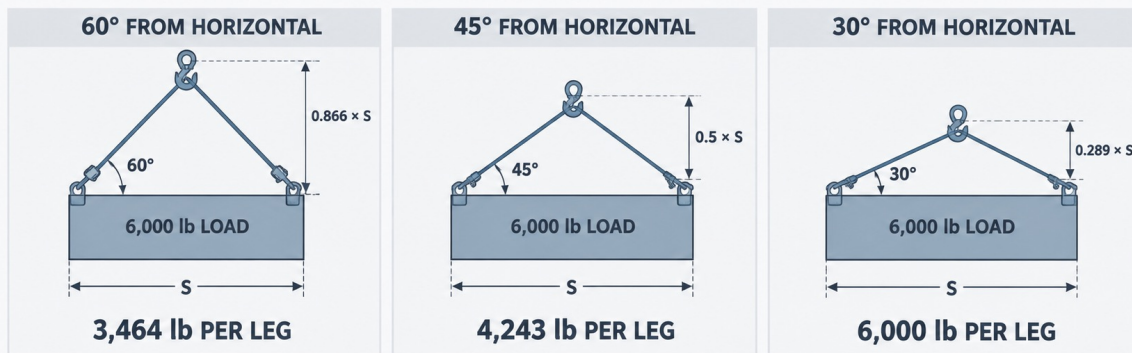
Compiled training estimates: Engineering ToolBox, construction-material density references, and FHWA concrete guidance.

Account for the Entire Suspended System

- ▶ The payload is not necessarily the complete load affecting crane capacity.
- ▶ Account for slings, shackles, lifting beams, hook blocks, and other suspended equipment as the crane load chart requires.
- ▶ Example: 4,050 lb payload + 950 lb rigging = 5,000 lb before other applicable deductions.
- ▶ The operator confirms required chart deductions and the worst radius/configuration.
- ▶ A strong sling cannot compensate for insufficient crane capacity.

SLING ANGLE AFFECTS LEG TENSION

Same load. Smaller horizontal angle. Greater tension.



$$\text{Tension per leg} = \text{Load weight} \div (2 \times \sin \theta)$$

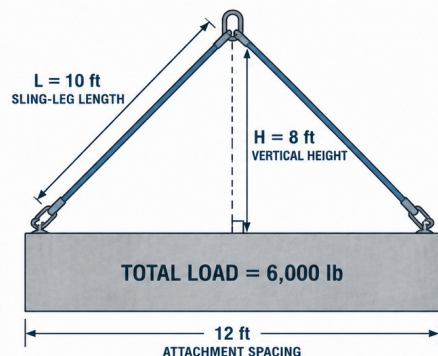
θ = sling angle measured from horizontal

Assumes two equal legs, a centered static load, and equal load sharing. Values rounded to nearest pound.

! Verify sling and hardware ratings for the actual hitch and angle. Do not use angles below 30° without manufacturer or qualified-person guidance.

References: OSHA Guidance on Safe Sling Use; ASSP sling-tension guidance.

SLING TENSION: THE L/H METHOD



1 FIND THE TENSION FACTOR

$$L \div H = 10 \div 8 = 1.25$$

2 FIND EACH LEG'S LOAD SHARE

$$6,000 \text{ lb} \div 2 = 3,000 \text{ lb}$$

3 CALCULATE LEG TENSION

$$1.25 \times 3,000 \text{ lb} = 3,750 \text{ lb}$$

TENSION IN EACH LEG:
3,750 lb

$$\text{Tension per leg} = (L \div H) \times (\text{Total load weight} \div 2)$$

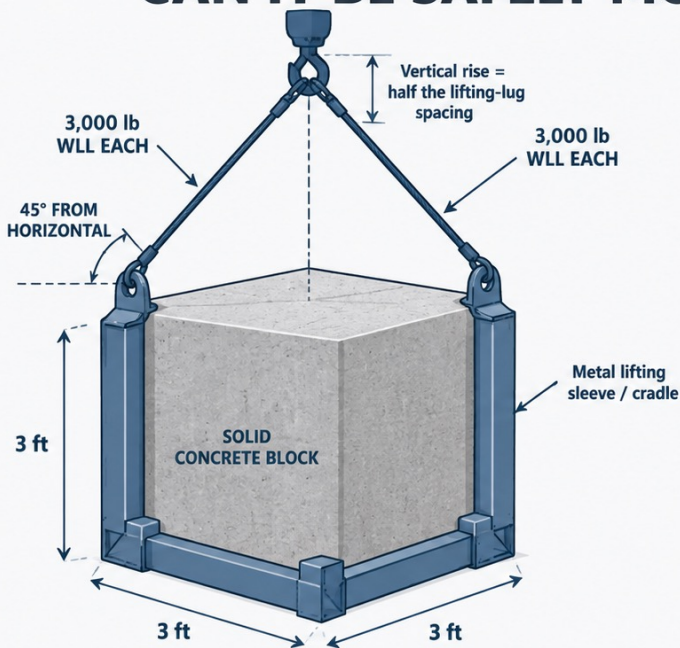
Use the same units for L and H. L/H is the angle factor, not a weight.

For two equal legs sharing a centered static load at equal attachment heights. Do not multiply L/H by the full load weight to calculate one leg's tension.

Verify actual sling, hardware, lifting-point, hitch and angle ratings. Unequal or dynamic loading requires further analysis.

Method references: Becht Engineering; Ashley Sling.

CAN IT BE SAFELY MOVED WITH A CRANE?



1 BLOCK WEIGHT

$$3 \text{ ft} \times 3 \text{ ft} \times 3 \text{ ft} = 27 \text{ ft}^3$$

$$27 \text{ ft}^3 \times 150 \text{ lb/ft}^3 = 4,050 \text{ lb}$$

2 TOTAL LOAD ALLOWANCE

Concrete block:	4,050 lb
Rigging, including metal sleeve:	950 lb
Total estimated suspended weight:	5,000 lb

3 TENSION IN EACH SLING LEG

$$T = W \div (2 \times \sin 45^\circ)$$

$$T = 5,000 \div 1.414 \approx 3,536 \text{ lb per leg}$$



NO — NOT WITH THIS RIGGING CONFIGURATION

3,536 lb calculated tension > 3,000 lb WLL per sling



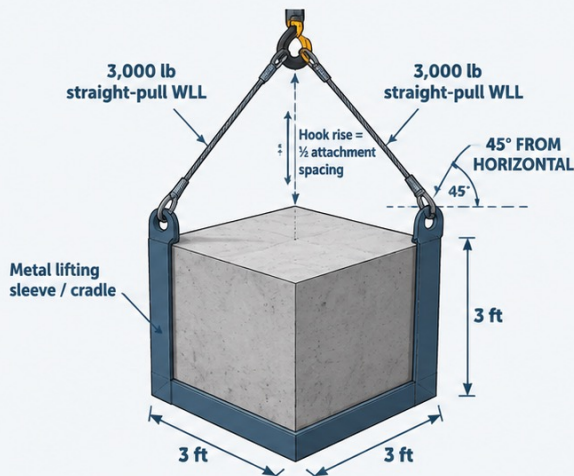
Two 3,000 lb slings do NOT provide 6,000 lb capacity at 45°.

Training estimate: centered static load, equal load sharing, 150 lb/ft³ concrete. Conservatively assigns the full 950 lb rigging allowance to the two-leg load calculation. Verify actual weight distribution, sleeve design and rating, all hardware, and crane capacity at the working radius before lifting.

Sling selection reference: OSHA Guidance on Safe Sling Use

CAN IT BE SAFELY MOVED WITH A CRANE?

SLING CAPACITY REDUCTION AT 45°



1

FIND THE REDUCTION FACTOR

$$RF = \sin 45^\circ = H \div L \approx 0.707$$

70.7% of vertical lifting capacity remains

29.3% capacity reduction

2

EACH LEG'S VERTICAL CONTRIBUTION

$$3,000 \text{ lb} \times 0.7071 \approx 2,121 \text{ lb}$$

Vertical load contribution — NOT a new axial WLL

3

COMBINED TWO-LEG CAPACITY

$$2 \times 3,000 \text{ lb} \times \sin 45^\circ \approx 4,243 \text{ lb}$$

5,000 lb LOAD > 4,243 lb CAPACITY

Concrete:	$3 \times 3 \times 3 \times 150 =$	4,050 lb
Rigging including sleeve:		950 lb
TOTAL ESTIMATED LOAD:		5,000 lb



NO — NOT WITH THIS RIGGING CONFIGURATION

Two 3,000 lb slings do NOT lift 6,000 lb at 45°.

Assumes centered static load, equal legs, equal load sharing, and 3,000 lb straight-pull rating per sling. Full 950 lb rigging allowance conservatively included.

Use manufacturer assembly ratings when provided; do not apply the angle reduction twice. Verify sleeve, hardware, actual load distribution and crane capacity separately.

Method: OSHA sling-use guidance; manufacturer angle-reduction guidance.

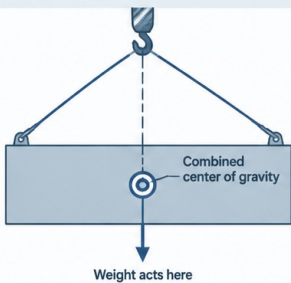
Center of Gravity and Load Balance

- ▶ The center of gravity is the point through which the load's weight acts.
- ▶ Position the hook above the combined center of gravity before taking the load.
- ▶ An offset center of gravity produces unequal support loads.
- ▶ Loose contents or moving components can shift balance during lifting.
- ▶ If the load tilts unexpectedly, stop, lower safely, and revise the rigging.

CENTER OF GRAVITY & LOAD BALANCE

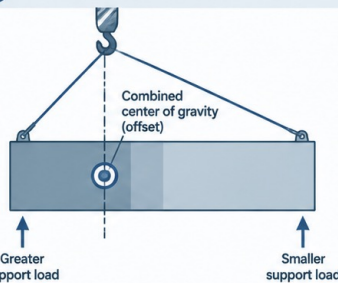
Align the hook. Understand the load. Control the lift.

1 ALIGN THE HOOK



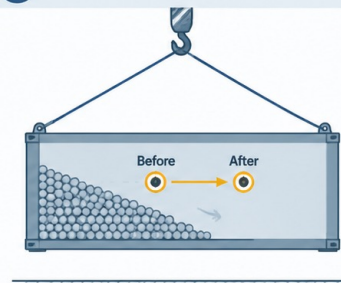
Position the hook above the combined center of gravity before taking the load.

2 RECOGNIZE UNEQUAL LOADING



An offset center of gravity produces unequal support loads.

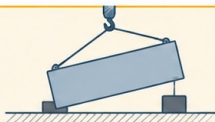
3 WATCH FOR SHIFTING CONTENTS



Loose contents or moving components can shift balance during lifting.



CENTER OF GRAVITY: The point through which the load's weight acts.



UNEXPECTED TILT?

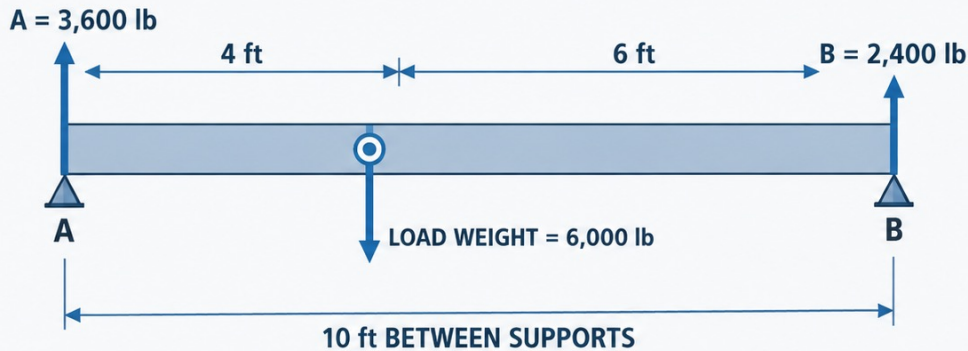
STOP → LOWER SAFELY → REVISE THE RIGGING

Do not continue the lift with an unbalanced or shifting load.

Unequal Loading: A Simple Example

- ▶ Training case: a rigid 6,000 lb load has two vertical support points 10 ft apart.
- ▶ The center of gravity is 4 ft from support A and 6 ft from support B.
- ▶ Vertical reaction at A = $6,000 \times 6 \div 10 = 3,600$ lb.
- ▶ Vertical reaction at B = $6,000 \times 4 \div 10 = 2,400$ lb.
- ▶ These are vertical reactions only; angled sling legs carry greater tension.

OFFSET CENTER OF GRAVITY: UNEQUAL SUPPORT LOADS



CLOSER SUPPORT CARRIES MORE

The center of gravity is closer to A, so A carries the larger vertical reaction.

LOAD SHARING CHECK

$$3,600 \text{ lb} + 2,400 \text{ lb} = 6,000 \text{ lb}$$

REACTION AT SUPPORT A

$$R_A = \text{Load} \times \text{distance from CG to B} \div \text{span}$$

$$6,000 \times 6 \div 10 = 3,600 \text{ lb}$$

REACTION AT SUPPORT B

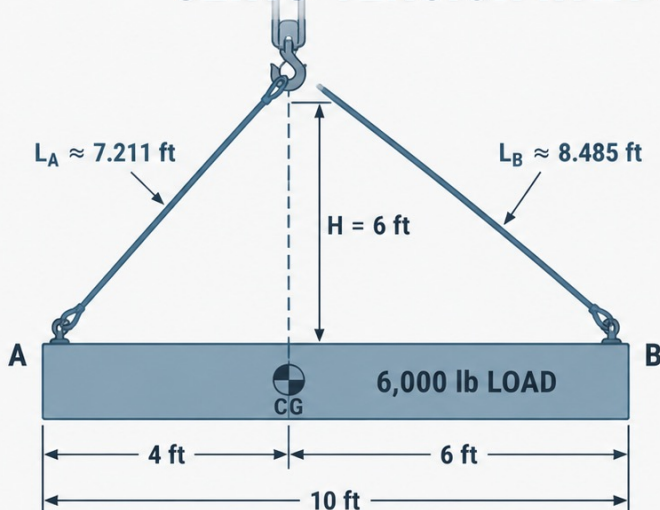
$$R_B = \text{Load} \times \text{distance from A to CG} \div \text{span}$$

$$6,000 \times 4 \div 10 = 2,400 \text{ lb}$$

VERTICAL REACTIONS ONLY — NOT ANGLED SLING TENSION

Angled sling legs carry greater tension than these vertical reactions. Assumes a rigid, static load with two vertical supports.

SLING TENSION WITH UNEQUAL SLING LENGTHS



1. CALCULATE VERTICAL LOAD SHARES

$$\text{A: } 6,000 \times 6 \div 10 = 3,600 \text{ lb}$$

$$\text{B: } 6,000 \times 4 \div 10 = 2,400 \text{ lb}$$

2. CALCULATE SLING LENGTHS

$$L_A = \sqrt{4^2 + 6^2} \approx 7.211 \text{ ft}$$

$$L_B = \sqrt{6^2 + 6^2} \approx 8.485 \text{ ft}$$

3. CALCULATE EACH LEG'S TENSION

$$\text{Tension} = \text{Vertical load share} \times (L \div H)$$

$$\text{A: } 3,600 \times (7.211 \div 6) \approx 4,327 \text{ lb}$$

$$\text{B: } 2,400 \times (8.485 \div 6) \approx 3,394 \text{ lb}$$

Results calculated using unrounded lengths.

LEG A: 4,327 lb TENSION

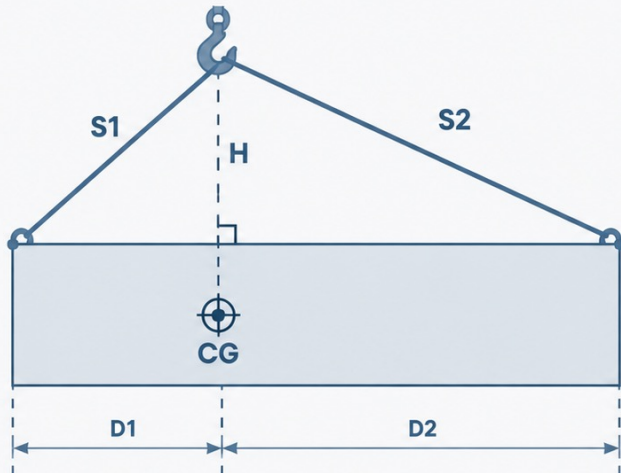
LEG B: 3,394 lb TENSION

The longer sling does not necessarily carry the greater tension.

! DO NOT ASSUME EACH LEG CARRIES HALF THE LOAD

Training example only: rigid static load, fixed CG, equal-height attachments, hook directly above CG. Sling and hardware self-weight omitted.
Verify actual equipment ratings and the complete lift plan.

CALCULATING TENSION IN UNEQUAL SLING LEGS



W = total load weight

SLING TENSION FORMULAS

$$T1 = (W \times D2 \times S1) \div [H \times (D1 + D2)]$$

$$T2 = (W \times D1 \times S2) \div [H \times (D1 + D2)]$$

SYMBOL KEY

- T1, T2** = tension in each sling leg
- S1, S2** = loaded sling-leg lengths
- H** = vertical rise to the upper connection
- D1** = horizontal distance from left attachment to CG
- D2** = horizontal distance from CG to right attachment
- W** = total load weight

Each leg's tension = its vertical load share × (sling length ÷ height)



USE CONSISTENT LENGTH UNITS. DO NOT ASSUME EQUAL LOAD SHARING.

Applies to a rigid static load, equal-height attachment points, and hook directly above CG. Idealized geometry neglects sling self-weight. Verify actual rigging ratings and the lift plan.

Load=1000, S1=5, S2=8, D1=3, D2=7, H=4

- ▶ S1 Tension = Load x D2 x S1 / (H(D1 + D2))
- ▶ Tension = 1,000 x 7 x 5 / (4(3+7))
- ▶ Tension = 1,000 x 7 x 5 / 40
- ▶ Tension = 1,000 x 7 x 0.125
- ▶ Tension = 875 Lbs

- ▶ S2 Tension = Load x D1 x S2 / (H(D1 + D2))
- ▶ Tension = 1,000 x 3 x 8 / (4(3+7))
- ▶ Tension = 1,000 x 3 x 8 / 40
- ▶ Tension = 1,000 x 3 x 0.2
- ▶ Tension = 600 Lbs

Working Load Limit and Design Factor

- ▶ Working load limit (WLL) is the rated maximum for specified conditions.
- ▶ The applicable hitch, angle, environment, and manufacturer restrictions affect usable capacity.
- ▶ Breaking strength is not the working load limit.
- ▶ The design factor is not extra capacity available to the crew.
- ▶ Every component must support its actual force; the limiting component controls the assembly.

Inspect the tag



Read the Identification Before Use

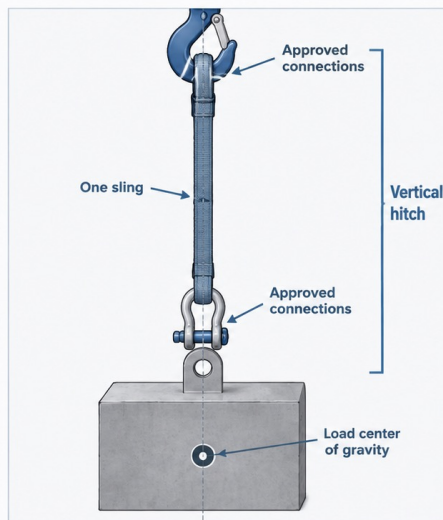
Component	Information to verify
Alloy chain sling	Size, grade, rated capacity, and sling manufacturer
Wire rope sling	Size, hitch ratings, rating angle, and number of legs if multiple
Synthetic web sling	Manufacturer, hitch capacities, and material
Shackle / other hardware	Required identification, rating, and manufacturer restrictions
Below-the-hook device	Rated load, identification, and operating instructions

Vertical Hitch



- ▶ One sling directly supports the load between approved connections.
- ▶ Use the sling's vertical rating only for the configuration covered by that rating.
- ▶ Confirm load stability; a single attachment may permit rotation or tipping.
- ▶ Seat the connection properly without side loading, pinching, or crowding.
- ▶ Protect the sling from sharp edges and unsuitable bearing surfaces.

VERTICAL HITCH: SINGLE-SLING SAFE USE



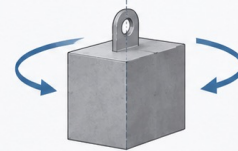
1 VERIFY THE VERTICAL RATING

Use the sling's vertical rating only for the configuration covered by that rating.



2 CONFIRM LOAD STABILITY

A single attachment may permit rotation or tipping.



3 SEAT CONNECTIONS CORRECTLY

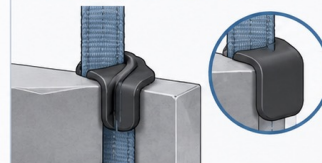
Avoid side loading, pinching and crowding.



✓ Properly seated in hook bowl with closed latch and axial alignment

4 PROTECT THE SLING

Protect against sharp edges and unsuitable bearing surfaces.



ONE SLING • APPROVED CONNECTIONS • CORRECT RATING • STABLE LOAD

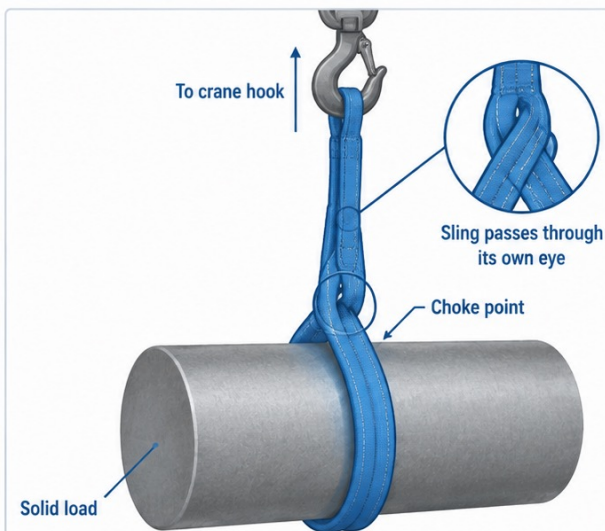
Check the actual sling identification and manufacturer instructions before use.

Choker Hitch



- ▶ The sling passes around the load and through its own eye or designated fitting.
- ▶ Use the manufacturer's choker rating; never assume full vertical capacity.
- ▶ Choke angle, load shape, and contact surfaces affect capacity and holding ability.
- ▶ Place the choke where it will not damage a splice, fitting, or sling body.
- ▶ A choker is not a guarantee against slipping or loss of loose material.

CHOKER HITCH: CORRECT SETUP & LIMITATIONS

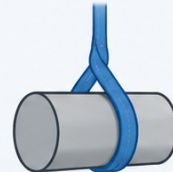


1 USE THE CHOKER RATING



Use the manufacturer's choker rating; never assume full vertical capacity.

2 CHECK GEOMETRY & CONTACT



Choke angle, load shape and contact surfaces affect capacity and holding ability.

3 POSITION THE CHOKE CAREFULLY



Place the choke where it will not damage a splice, fitting or sling body.

4 DO NOT RELY ON GRIP ALONE



A choker is not a guarantee against slipping or loss of loose material.

AROUND THE LOAD → THROUGH ITS EYE → VERIFY THE CHOKER RATING

A CHOKER HITCH DOES NOT GUARANTEE LOAD RETENTION

Follow the actual sling identification and manufacturer instructions for the load and configuration.

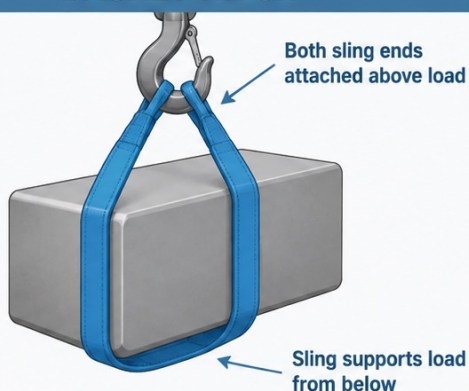
Basket Hitch and Multiple-Leg Assemblies

- ▶ A basket supports the load with both sling ends attached above it.
- ▶ Balance and contain the load to prevent slippage or rolling.
- ▶ Do not assume a basket always provides twice the vertical capacity.
- ▶ Do not calculate a three- or four-leg rating by simply multiplying one leg's WLL.
- ▶ Use the marked assembly rating and approved geometry; unequal leg loading may govern.



BASKET HITCHES & MULTIPLE-LEG ASSEMBLIES

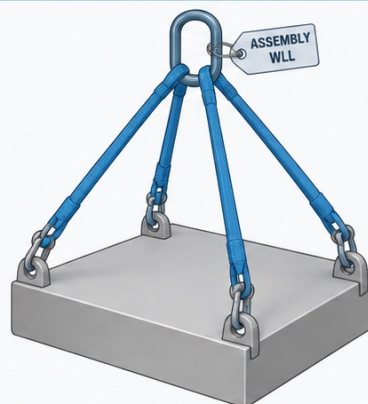
BASKET HITCH



Balance and contain the load to prevent slippage or rolling.

Do not assume a basket always provides twice the vertical capacity.

MULTIPLE-LEG ASSEMBLIES



Do not calculate a three- or four-leg rating by simply multiplying one leg's WLL.

Use the marked assembly rating and approved geometry; unequal leg loading may govern.

VERIFY THE RATING FOR THE ACTUAL HITCH, ANGLE & ASSEMBLY



DO NOT ASSUME EQUAL LOAD SHARING OR AUTOMATIC CAPACITY MULTIPLIERS

Follow the actual sling and assembly identification and manufacturer instructions.

Sling Angle: The Basic Relationship

- ▶ For this lesson, measure sling-leg angle from the horizontal load surface.
- ▶ As the angle decreases, tension in each leg increases.
- ▶ For two equal legs sharing a centered load: $T = W \div (2 \times \sin \theta)$.
- ▶ T is leg tension; W is total load carried by the two legs; θ is the horizontal angle.
- ▶ This simplified formula does not cover unequal loading, shock, or complex assemblies.

Angle Table: 10,000 lb Centered Load

Angle from horizontal	Leg factor: $1/\sin \theta$	Tension in EACH leg
90°	1.000	5,000 lb
60°	1.155	5,774 lb
45°	1.414	7,071 lb
30°	2.000	10,000 lb

Geometry, Bearing Diameter, and Edge Protection

- ▶ Tight bends can reduce sling capacity; use manufacturer bearing-diameter guidance.
- ▶ D/d expresses bearing diameter relative to rope diameter where applicable.
- ▶ Use edge protection appropriate for sling material, edge severity, and load pressure.
- ▶ A soft pad is not automatically adequate cut protection for a synthetic sling.
- ▶ Do not use wire-rope sling angles below 30° from horizontal except as recommended by the manufacturer or a qualified person.

Inspection: Before Use and During Service

- ▶ Inspect rigging before use on each shift and as necessary during use.
- ▶ Each day before use, a designated competent person must inspect slings and attachments.
- ▶ Check the entire sling length, eyes, splices, stitching, fittings, and identification.
- ▶ Remove damaged, defective, or improperly identified equipment from service.
- ▶ Follow applicable ASME and manufacturer periodic-inspection requirements; pre-use checks do not replace them.

Wire Rope Slings: Inspection and Use



- ▶ Look for broken wires, kinks, crushing, birdcaging, corrosion, and heat damage.
- ▶ Inspect eyes, sleeves, sockets, and fittings for damage or displacement.
- ▶ Apply the applicable construction-specific removal criteria; do not use a single broken-wire rule for every rope.
- ▶ Do not form wire-rope sling eyes with clips or knots; do not shorten slings with makeshift devices.
- ▶ Protect exposed wire ends and handle carefully to prevent puncture injuries.

Wire Rope Sling Damage Types – Remove From Service

KINKING



Reduces strength by 50% or more



BIRDCAGING



Caused by sudden release of tension



SEVERE CORROSION



Weakens internal wires unpredictably



BROKEN WIRES



ASME limit: 6 broken wires per lay



CRUSHING / FLATTENING



Changes cross-section, weakens rope



When in doubt, remove from service.

Alloy Steel Chain Slings

- ▶ Use identified alloy lifting chain with compatible rated attachments.
- ▶ Inspect links for cracks, deformation, stretch, nicks, gouges, and excessive wear.
- ▶ Inspect couplers, master links, shortening devices, and hooks.
- ▶ Never substitute bolts, rods, shop-made hooks, or makeshift links.
- ▶ OSHA periodic thorough inspection intervals must not exceed 12 months; retain the most recent inspection month.

ALLOY STEEL CHAIN SLING INSPECTION

Inspect the entire assembly — link by link, before use.



IDENTIFICATION

Tag present and readable: size, grade, rated capacity and sling manufacturer.



CRACKS, NICKS & GOUGES

Check link crowns, weld areas and fittings.



WEAR & CORROSION

Look for thinning, pitting and damaged contact areas. Measure against manufacturer limits.



STRETCH & DISTORTION

Look for elongated, bent or twisted links and binding between links.



HEAT & EXPOSURE

Look for heat discoloration, weld spatter and chemical damage. Review exposure history.



HOOKS & ATTACHMENTS

Check for cracks, deformation, wear, loose connections and latch malfunction.



DAMAGE OR DOUBT? STOP — TAG OUT — ISOLATE — REPORT

Do not make unauthorized repairs. Use applicable removal criteria and manufacturer limits; a visual check does not replace required periodic inspection.

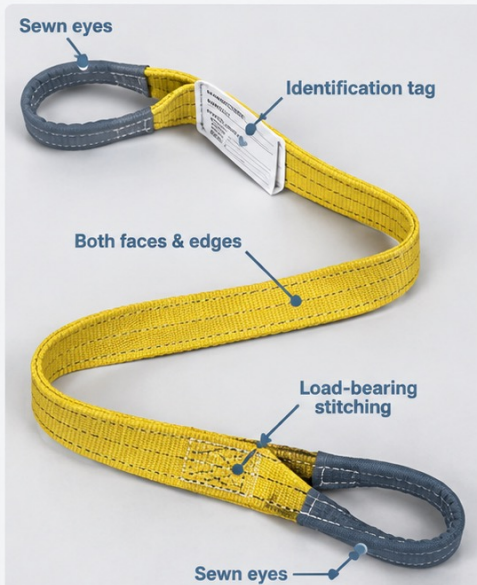
References: OSHA 29 CFR 1926.251; ASME B30.9; manufacturer inspection instructions.

Synthetic Web Slings

- ▶ Verify manufacturer identification, material, and rated capacities for the hitch.
- ▶ Remove for cuts, tears, snags, punctures, broken or worn stitching, burns, melting, or distorted fittings.
- ▶ Protect against cutting and abrasion at edges and bearing surfaces.
- ▶ Confirm chemical compatibility; nylon, polyester, and polypropylene have different limitations.
- ▶ OSHA maximum use temperatures: nylon/polyester 180°F; polypropylene 200°F.

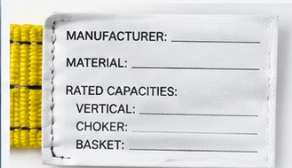
SYNTHETIC WEB SLING INSPECTION

Inspect both sides, edges, eyes and stitching before use.



IDENTIFICATION

Tag present and readable: manufacturer, material and rated capacities for the hitch.



CUTS, TEARS & SNAGS

Look for holes, punctures, cut edges and damaged fibers.



ABRASION & STITCHING

Check excessive wear and broken or worn load-bearing stitching, especially at eyes and splices.



HEAT & CHEMICAL DAMAGE

Look for melting, charring, burns and chemical attack.



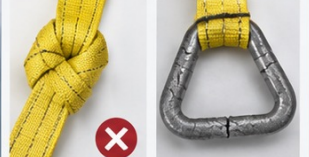
SUN & WEATHER EXPOSURE

Check for discoloration with brittle or stiff areas. Review UV, moisture and storage history.



KNOTS & FITTINGS

No knots. Check attached fittings for cracks, distortion and wear.



DAMAGE OR DOUBT? STOP — TAG OUT — ISOLATE — REPORT

Do not tie, sew or patch a damaged sling. Follow manufacturer removal criteria and protect serviceable slings from harmful exposure.

References: OSHA 29 CFR 1926.251; ASME B30.9; manufacturer inspection instructions.

Synthetic Round slings

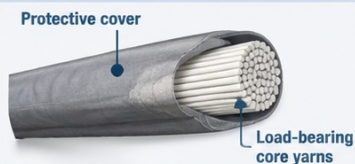
- ▶ Round slings contain load-bearing fibers inside a protective cover; they are not flat web slings.
- ▶ Check identification and inspect the cover, core exposure, lumps, heat damage, and chemical damage.
- ▶ Do not infer capacity from cover color alone or copy web-sling criteria without checking applicability.
- ▶ Use the applicable ASME B30.9 chapter and manufacturer criteria for the exact sling construction.

SYNTHETIC ROUNDSLING INSPECTION

Examine the entire cover and contact areas before use.



Construction illustration — do not cut open for inspection



IDENTIFICATION

Tag attached and readable. Verify manufacturer and rated capacity for the intended hitch.



⚠ Do not rely on cover color.

COVER DAMAGE & CORE EXPOSURE

Look for cuts, tears, holes, snags or abrasion exposing core yarns.



⊘ REMOVE FROM SERVICE

CORE CONDITION

Look and gently feel for unexplained lumps, bunching or irregularities. Isolate for review.



HEAT & WELD SPATTER

Look for melting, charring, fused fibers and spatter damage exposing the core.



⊘ REMOVE FROM SERVICE

CHEMICALS & WEATHER

Check for discoloration with brittle or stiff areas. Review chemical, UV and storage exposure.



⚠ Appearance alone does not prove remaining strength.

KNOTS & FITTINGS

No knots. Inspect any attached fittings for cracks, distortion, wear and corrosion.



⊘ REMOVE FROM SERVICE

⊘ REMOVE FROM SERVICE (if fitted)



DAMAGE OR DOUBT? STOP — TAG OUT — ISOLATE — REPORT

Do not cut open the cover, patch it or attempt field repairs. Follow manufacturer inspection and removal criteria.

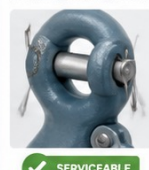
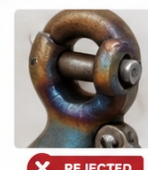
References: OSHA Guidance on Safe Sling Use — Synthetic Round Slings;
ASME B30.9; manufacturer instructions.

Hooks: Selection, Seating, and Inspection

- ▶ Use a hook with the proper rating and geometry for its intended loading.
- ▶ Seat the load in the bowl; do not tip-load or side-load unless specifically designed for it.
- ▶ Inspect for cracks, deformation, wear, damage, and latch malfunction.
- ▶ A latch retains slack rigging; it is not a load-bearing component.
- ▶ Apply manufacturer/B30.10 removal criteria; never straighten, weld, or repair a hook without authorization.

RIGGING HOOK INSPECTION

Check identification, body condition, opening, latch and attachment.

	IDENTIFICATION	CRACKS, NICKS & GOUGES	WEAR & CORROSION
	Verify required manufacturer and rated-load identification is present and readable.  ✓ SERVICEABLE	Examine the entire hook, especially the saddle, neck and attachment areas.  ✗ REJECTED Crack  ✗ REJECTED Gouge	Check thinning, pitting and worn contact surfaces. Compare measurements with original dimensions and manufacturer limits.  ✗ REJECTED  ✗ REJECTED
	Check increased throat opening and any visible bend or twist. Compare with the hook's original dimensions.  ✓ SERVICEABLE Normal profile  ✗ REJECTED Bent / twisted profile	Latch must operate and close correctly. Self-locking hooks must lock properly.  A latch is not a load-bearing part.	Check pins, retainers and connections. Look for heat damage, chemical attack or unauthorized alterations.  ✓ SERVICEABLE  ✗ REJECTED Heat damage



DAMAGE OR DOUBT? STOP — TAG OUT — ISOLATE — REPORT

⚠ Do not weld, heat, bend or grind a hook as an unauthorized field repair. Use the manufacturer's limits and applicable ASME B30.10 criteria.

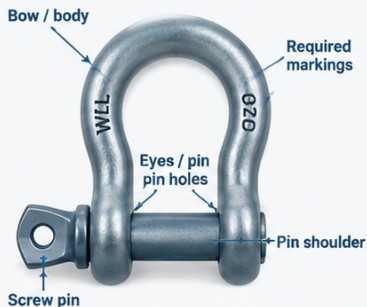
References: ASME B30.10; manufacturer hook inspection instructions.

Shackles: Correct Selection and Loading

- ▶ Verify rating, identification, pin fit, body condition, and intended loading direction.
- ▶ Use the correct manufacturer-specified pin; never replace it with a bolt or improvised part.
- ▶ Seat connections to avoid point loading, crowding, and unintended side load.
- ▶ If side loading is permitted, apply the specific manufacturer's reduction factors.
- ▶ Use suitable pin retention; prevent moving rigging from rotating a screw pin lose.

SHACKLE INSPECTION

Inspect the body, pin, markings and retention system before use.

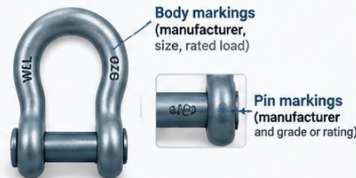


Bolt-type: nut & cotter pin



IDENTIFICATION

Body: manufacturer, size and rated load.
Pin: required manufacturer and grade or rating markings.



CRACKS & SURFACE DAMAGE

Look for cracks, deep nicks, gouges, pitting and excessive corrosion.



WEAR & DIMENSIONS

Check bow and pin contact areas. Compare with original or catalog dimensions and applicable removal limits.



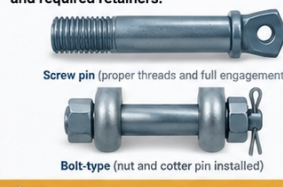
BENDING & ELONGATION

Look for bent pins, twisted bodies, spread eyes or elongated pin holes.



PIN FIT & RETENTION

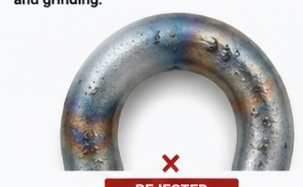
Correct matching pin; full engagement. Check damaged threads, shoulder seating and required retainers.



⚠ Never substitute a bolt or unidentified pin.

HEAT & ALTERATIONS

Look for heat discoloration, weld spatter, arc strikes or unauthorized welding and grinding.



DAMAGE OR DOUBT? STOP — TAG OUT — ISOLATE — REPORT

Do not straighten bent parts or make unauthorized repairs. Follow applicable ASME B30.26 and manufacturer removal criteria.

References: ASME B30.26; manufacturer shackle inspection instructions.

Eyebolts, Hoist Rings, Links, and Swivels

- ▶ Confirm the attachment point and supporting structure can resist the actual forces.
- ▶ Eyebolts and swivel hoist rings are not interchangeable.
- ▶ Use approved orientation, thread engagement, seating, torque, and angular loading limits.
- ▶ Check master links for fit in the hook without crowding or bending.
- ▶ Use a swivel under load only if its manufacturer permits that function.

EYEBOLTS, HOIST RINGS, LINKS & SWIVELS Inspection checks before use

EYEBOLTS



- ✓ Check eye, shoulder and shank for cracks, wear or bending.
- ✓ Inspect threads and the receiving hole for damage.
- ✓ Verify shoulder seating, thread engagement and permitted load direction.

⚠ Eyebolts are not swivel hoist rings.

HOIST RINGS



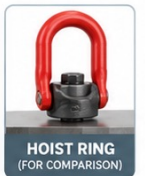
- ✓ Check bail, bolt, body and retaining components.
- ✓ Verify mounting surface, thread engagement and specified bolt torque.
- ✓ Check free pivot and swivel without binding or interference.

LINKS



- ✓ Check for cracks, wear, stretching, bending and twist.
- ✓ Inspect coupling pins, retainers and contact areas.
- ✓ Verify fit without crowding, binding or unintended bending.

SWIVELS



- ✓ Check eyes, body, pins and retainers.
- ✓ Check wear, cracks, corrosion and abnormal looseness.
- ✓ Check permitted rotation and freedom from binding.

⚠ Rotate under load **ONLY** if manufacturer permits.

✓ | **ALL HARDWARE: VERIFY REQUIRED IDENTIFICATION, RATING & MANUFACTURER LIMITS**

⚠ Look for heat damage, deep nicks, gouges, excessive pitting and unauthorized alterations.



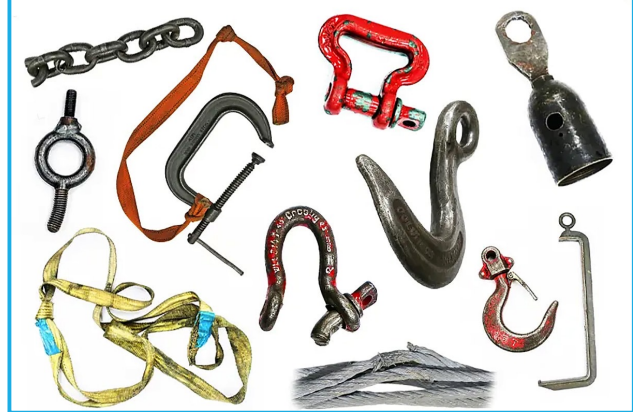
DAMAGE OR DOUBT? STOP — TAG OUT — ISOLATE — REPORT

Do not straighten, weld or modify hardware as an unauthorized repair. Apply ASME B30.26 and the exact product's inspection and installation instructions.

References: ASME B30.26, manufacturer lifting-point and hardware instructions.

Remove, Isolate, Report, and Store

- ▶ Stop using questionable equipment; do not leave it available for the next crew.
- ▶ Identify and isolate rejected equipment using the employer's procedure.
- ▶ Report the condition and arrange qualified review or authorized disposal.
- ▶ Do not make field repairs, welds, heat treatments, or tag substitutions without authorization.



Attach the Load Without Creating New Hazards



- ▶ Use verified lifting points and prevent components or loose material from falling.
- ▶ Keep the hook over the load to avoid side pull and unexpected movement.
- ▶ Do not kink, knot, or twist sling legs; seat fittings before tensioning.
- ▶ Keep hands and fingers out from between the sling and load as tension increases.
- ▶ Remove slack slowly; avoid shock loading and do not pull trapped slings from beneath loads.

Trial Lift and Initial Load Control



- ▶ As a planned safe practice, raise the load only enough to verify balance and secure attachment.
- ▶ Keep personnel clear; inspect from a safe position without reaching under the load.
- ▶ Check for sling movement, tilt, binding, unexpected resistance, and loose items.
- ▶ If any problem appears, stop and lower safely before making adjustments.
- ▶ A trial lift does not replace weight verification, rated-capacity checks, or inspection.

Suspended Loads, Fall Zones, and Landing

- ▶ Use available routes that minimize exposure to hoisted loads, consistent with public safety.
- ▶ A stationary suspended load still creates a fall-zone hazard.
- ▶ Only the exceptions in §1926.1425 permit employees within that zone.
- ▶ When landing, only employees needed to receive the load may be in the fall zone.

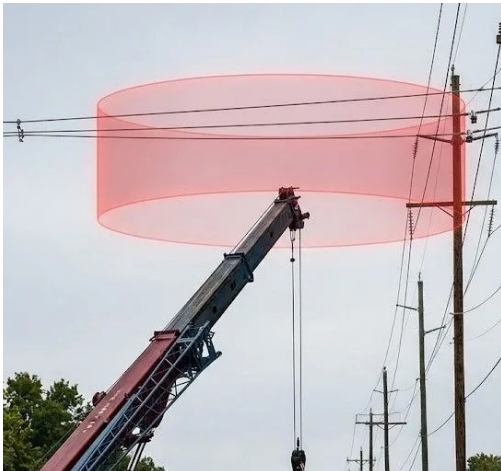


Tag Lines and Safe Landing

- ▶ Use a tag or restraint line if needed to prevent hazardous load rotation.
- ▶ Plan line position to avoid entanglement, snags, crush points, and pull-in hazards.
- ▶ Never wrap a tag line around the body; maintain an escape route.
- ▶ For encroachment precautions under §1926.1408(b), tag lines must be nonconductive.
- ▶ Land on stable supports; verify the load is secure before releasing tension and removing rigging.



Power Lines: Plan Before Operating



- ▶ Treat power lines as energized unless the utility confirms de energization and visible grounding at the site.
- ▶ For operations under §1926.1408, assess whether any equipment, load line, load, or rigging could approach within 20 ft.
- ▶ If so, implement an authorized option: deenergize/ground, maintain 20 ft with required controls, or use Table A with required controls.
- ▶ Higher-voltage lines, closer-than-Table-A work, and unloaded travel have additional rules.

Power-Line Table A: Minimum Clearances

Nominal AC voltage	Minimum clearance
Up to 50 kV	10 ft
Over 50 to 200 kV	15 ft
Over 200 to 350 kV	20 ft
Over 350 to 500 kV	25 ft
Over 500 to 750 kV	35 ft
Over 750 to 1,000 kV	45 ft
Over 1,000 kV	Utility owner/operator or qualified registered professional engineer establishes

Electrical Contact: Crew Response

- ▶ Alert the operator and keep everyone away from the crane, load, rigging, and tag lines.
- ▶ Do not approach or touch potentially energized equipment or attempt a contact rescue.
- ▶ Call emergency services and the utility; follow the site emergency plan.
- ▶ Operators generally remain in the cab unless an imminent emergency requires evacuation.
- ▶ Train the crew on step potential and the safest emergency evacuation method before work begins.

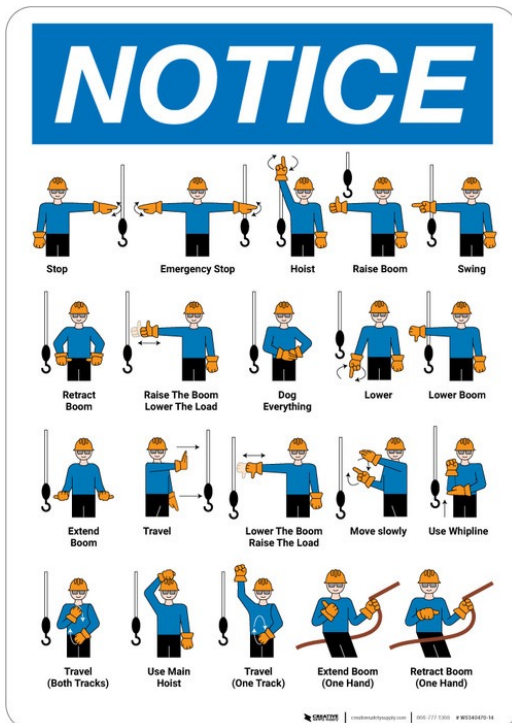


When Is a Signal Person Required?



- ▶ The load travel or placement area is not in full view of the operator.
- ▶ The view in the direction of equipment travel is obstructed.
- ▶ The operator or person handling the load identifies a site-specific safety need.
- ▶ Choose a signaling method suitable for the site and equipment.
- ▶ Establish a safe signal-person position and a clear, reliable communication path.

Signal Discipline and Posting Requirements



- ▶ Use Standard Method hand signals unless a permitted exception applies.
- ▶ Only one person signals a crane at a time, except anyone may give a safety stop.
- ▶ Directions must be from the operator's perspective.
- ▶ Post hand-signal charts on equipment or conspicuously near hoisting operations.

Mobile Crane Hand Signals



Hoist



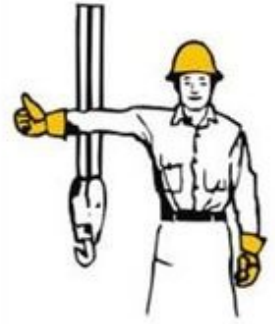
Lower



Use Main Hoist



Use Whipline



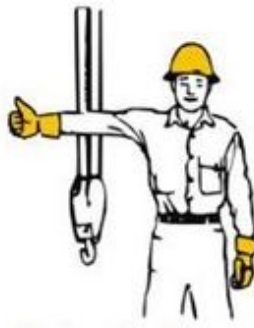
Raise Boom



Lower Boom



Move Slowly



**Raise the Boom
Lower the Load**



**Lower the Boom
Raise the Load**



Swing



Stop



Emergency Stop



Travel



Dog Everything



**Travel
(Both Tracks)**



**Travel
(One Track)**



Extend Boom



Retract Boom

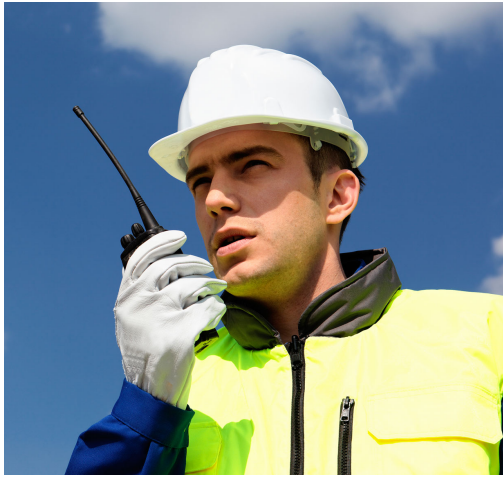


**Extend Boom
(One Hand)**



**Retract Boom
(One Hand)**

Radio and Electronic Signal Systems



- ▶ • Test devices on site before operations for clear, effective, reliable transmission.
- ▶ • Use a dedicated channel except for the specific exceptions in §1926.1420.
- ▶ • The operator must receive signals hands-free.
- ▶ • Check batteries, range, interference, dead zones, and backup arrangements.
- ▶ • If several cranes share communications, identify the intended crane before function/direction or use an equally effective system.

Voice Signals: Required Order



- ▶ Before operations, the operator, signal person, and lift director, if any, agree on the voice signals.
- ▶ First: identify the function and direction, such as “Hoist up.”
- ▶ Second: state distance and/or speed, such as “Two feet, slowly.”
- ▶ Third: give the function and stop command, such as “Hoist stop.”
- ▶ Everyone involved must communicate effectively in the language used.

COMMON LIFT OR ENGINEERED LIFT?

A screening path — apply the employer / client lift-classification procedure first.

BEFORE CLASSIFYING: Are weight, center of gravity, lifting points, crane capacity and site conditions verified?

If NO or UNKNOWN: STOP. Obtain the missing information and resolve hazards. Unknowns are not permission to lift.

1 Does a governing rule or project policy trigger special planning?

Examples: multiple cranes supporting one load; personnel lifting; a specified utilization threshold; an employer-designated critical lift.

NO

2 Is there an unusual load, load path, rigging or site condition?

Examples: shifting CG, complex load sharing, custom lifting device, unverified support capacity, submerged/stuck load or difficult clearance.

NO

3 Is the lift fully within an established routine procedure?

Known stable load; approved standard rigging; verified ratings and ground support; controlled route; assigned qualified personnel.

YES

COMMON / ROUTINE LIFT CANDIDATE

Use the employer-approved routine lift process, pre-lift briefing, inspections and site controls. Classification still requires employer / lift-supervision acceptance.

QUALIFIED-PERSON / LIFT-SUPERVISION REVIEW

Any YES to Questions 1-2, or NO / UNCERTAIN to Question 3, goes here.

Prepare the required special or critical lift plan.

Does a governing requirement or the qualified review require engineering analysis?

YES

ENGINEERED LIFT

Obtain the required engineering analysis / design and documented plan. Secure required review and approvals before execution.

NO

SPECIAL / CRITICAL PLAN — NOT AUTOMATICALLY ENGINEERED

Use qualified-person planning and the applicable approvals. Add engineering whenever the governing requirement or qualified reviewer calls for it.

CLASSIFICATION IS NOT AUTHORIZATION TO LIFT

Proceed only after the plan, equipment, personnel, controls and required approvals are in place. Reassess when conditions change.

IMPORTANT DISTINCTIONS

“Common,” “critical” and “engineered” are not one universal OSHA classification system. Do not treat 75% utilization as a universal OSHA trigger. Use the applicable project threshold. A blind lift requires appropriate signaling; it is not automatically an engineered lift.

OSHA §1926.1432: multi-crane plan by a qualified person; engineering expertise when that person determines it is needed. Personnel lifting has separate requirements (§1926.1431).

NATIONAL SAFETY SERVICES | Training screening aid — not a lift plan | Source: OSHA 29 CFR 1926.1432

THANK YOU!

**For your participation and
commitment to working safely.**

Rigger & Signal Person Training

Plan the lift. Check the rigging. Communicate clearly.

