Yaskawa
Crane & Hoist
Safety Pocket Guide

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This guide is provided as a training aid and may not reflect current laws, regulations, and Yaskawa policies. Refer to the Yaksawa Crane and Hoist Safety Policy for the most current requirements.

www.YaskawaSafety.com

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Contents

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Definitions

ABRASION: Surface wear.

ATTACHMENT: A device other than conventional forks or load backrest extension, mounted permanently or removable on the elevating mechanism of a truck for handling the load. Popular types are fork extension clamps, rotating devices, side shifters, load stabalizers, and booms.

BIRDCAGING: The twisting of fiber or wire rope in an isolated area in the opposite direction of the rope lay, causing it to take on the appearance of a birdcage.

BRIDGE: The part of a crane, consisting of girders, railings, trucks, and drive mechanisms, that carries the trolley or trolleys.

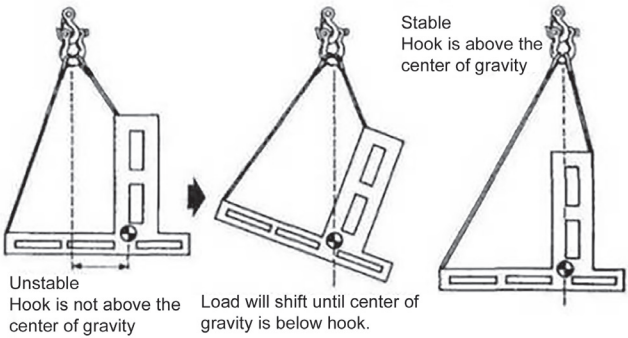
BRIDGE TRAVEL: Horizontal travel of the crane parallel with runway rails.

BRIDLE SLING: A sling composed of multiple legs (branches), the top ends of which terminate in a fitting that latches onto the lifting hook.

CHOKER ROPE: A short wire-rope sling used to form a slip noose around the object to be moved or lifted.

CRANE: A machine used for lifting and lowering a load vertically and moving it horizontally and that has an integrated hoisting mechanism.

CG: Center of Gravity



Effect of Center of Gravity during Lift

CRITICAL LIFT: A lift for which the application of requirements applicable to ordinary lifts would not adequately eliminate or control the likelihood or severity of:

- injury,
- undetectable damage,
- damage that would result in delay to schedule,
- any lift that involves the following:
  - 2 crane lift,
  - loads exceeding 80% of the cranes capacity,
  - loads exceeding 80% of the rigging capacity.

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HOIST: A device that applies a force for lifting or lowering.

HOOK LOAD: The total live weight supported by the hook of a crane including: the load, slings, spreader bars, and other rigging not part of the load but supported by the hook and required for the handling of the load.

KINK: Permanent distortion of wires and strands resulting from sharp bends.

LIFT, ORDINARY or PRE-ENGINEERED PRODUCTION: Repetitive, production-type lifting operation, independent of the nature of the load to be lifted, in which the probability of dropping, upset, or collision is reduced to a level acceptable to the responsible manager by preliminary engineering evaluation, detailed procedures, operation-specific training, and review of the process.

PEENING: Permanent distortion of outside wire in a rope caused by pounding.

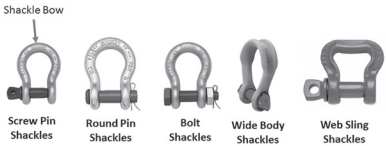
RATED CAPACITY: The maximum load that a piece of hoisting equipment is designed to carry.

REEVING: A system in which a rope travels around drums and sheaves.

RIGGING: The hardware or equipment used to safely attach a load to a lifting device.

RUNWAY: Assembly of rails, girders, brackets, and framework on which a crane operates.

SHACKLE: A type of clevis normally used for lifting.



SPAN: The horizontal, center-to-center distance of runway rails.

TAG LINE: A rope used to prevent rotation of the load.

WORKING LOAD LIMIT (WLL): The maximum weight the rigging can lift. NOTE: De-rating is sometimes necessary, which reduces the WLL.

WORK ZONES:

Fall Zone: Area that a load could fall. As a general rule, the fall zone is a ***minimum*** of two times the hook height.

Restricted Zone: Area that is blocked off for a lift. Only team members part of the lift should be in this area.

Landing Zone: Location that the load will be placed on or in. Should be clean and prepped before starting the lift.

Path: The way that the load will take from its starting point to the landing zone. Path must be clean and planned before the lift.

Work Zone: The path, Landing Zone, and Assembly Area.

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Qualifications

Operator-In-Training

May perform a lift using a crane under the supervision of a qualified trainer.

Operator/Rigger

Must successfully complete Crane education and training and demonstrate competence. Crane and hoist operators shall be requalified through a performance review recorded at least every three years.

Crane Trainer

Must successfully complete Crane and Hoist Train-The-Trainer course, demonstrate the proper use of a crane, and successfully train a crane operation course under the supervision of a Crane Train-The-Trainer instructor.

Lift Supervisor

Lift supervisors are required for non-standard lifts. Lift supervisors must be a qualified crane operator, completed an engineering crane class, and have EHS department approval.

Tag Line Operator

Must complete electronic crane and hoist safety program.

Personal Protective Equipment

Hard Hat

A Class 1 Hard Hat that meets ANSI Z89.1 standards is required whenever performing a lift where the load is chest high or higher.

Eye Protection

Eye protection that meets ANSI Z87.1 is required that satisfies the requirements of Yaskawa's PPE Policy.

Foot and Toe Protection

Foot and Toe protection that meets ASTM F2413 is required that satisfies the requirements of Yaskawa's PPE policy.

Safety Vests

Safety vests are required for critical lifts.

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Common Causes of Accidents

Cause	Prevention
Instability of Crane	• Annual inspections by certified 3rd party • Daily operator inspections of crane, hoist, and rigging • Verify load does not exceed load capacity of crane, hoist, and rigging • Proper use of outriggers (when applicable)
Instability of Load	• Inspect rigging before each lift • Ensure load is properly secured • CG is directly below hitching • Verify load does not exceed rating of rigging • Verify hoist hook is properly latched • Control the speed of the lift and all movements • Verify the entire travel of the load from lift point to place point is clear
Improper Operation	• Ensure competency of operators, riggers, and all people involved in the lift • Keep unqualified workers and bystanders outside of the restricted zone • Plan each lift • Use Critical Lift Plan and Lift Supervisor for critical lifts • Operate crane at proper speeds
Poor Communication	• Verify radios work prior to lift (if used) • Plan hand signals • Stop signal must be obeyed at all times.

Operator Responsibility

- Ensure you are qualified and competent to use lift equipment
- Utilize appropriate rigging gear within industry standards and manufacturer's recommendations
- Conduct regular inspection and maintenance of the rigging
- Plan the lift
- Consider what could go wrong, and have a plan if it does
- Ensure that there are no unqualified people within the restricted zone
- Tag out defective and suspect rigging/hoists and remove it from areas where it could be used
- Know how to disconnect power to the crane
- Notify your supervisor if you are impaired for any reason, including taking medication that can affect judgement, vision, or balance. Do not perform a lift or work in the restricted zone if impaired.
- Move slow when a load is on the line and avoid all quick changes in direction.

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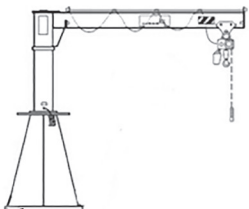
Common Crane Types in Yaskawa

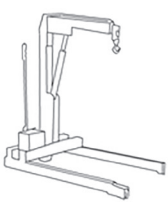
Bridge



Jib

A-Frame (a type of Gantry)

Fork Lift Attachment



Specialty

Basic Rigging Plan

Plan every lift and include the following questions:

- Who is responsible for the lift?
- Has communication been established?
- Is the rigging in acceptable condition?
- Does the rigging have proper identification?
- Does all gear have known working load limits?
- What is the weight of the load?
- Where is the load's center of gravity?
- What is the sling angle?
- Is the load less than 80% of the lowest capacity of the crane, hoist and any rigging, including any derating that may be required?
- Is a tag line required to control the load?
- Will personnel be clear of suspended loads?
- Will the load lift level and be stable?
- Are there any environmental concerns?
- What could go wrong and what will we do if it does go wrong?

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Inspections

Lift Site

NOTE: Yaskawa associates are not qualified to operate outdoor cranes, which have hazards not addressed in training.

- ☐ Clear path to eStop or disconnect
- ☐ No obstructions through lift zone
- ☐ No signs of leaks

Support Structure

- ☐ No abnormal signs of wear or distortion of the trolley
- ☐ Load Beam shows no signs of damage or stress
- ☐ End stops are functioning properly
- ☐ No signs of external damage
- ☐ Mounting hardware is secure
- ☐ Rating Label is legible

Hoist

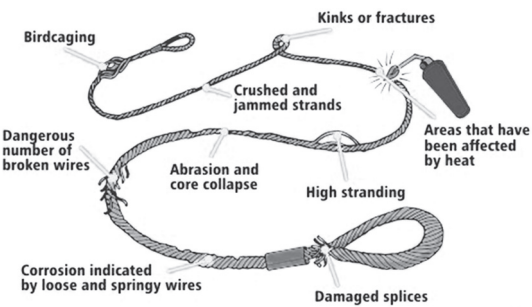
- ☐ Rating Label is legible
- ☐ eStops are functioning properly
- ☐ Operating mechanism is functioning properly
- ☐ Limit switches operating properly (if equipped)

Wire Ropes

- ☐ More then 10 Broken wires per Lay
- ☐ More then 5 Broken wires per Strand
- ☐ Look for Heat Damage, or Weld Splatter
- ☐ Look for Birdcaging, or High Stranding
- ☐ Look for Kinks or Knots
- ☐ Check for Reduction in Rope Diameter
- ☐ Any other Type of Damage
- ☐ Check for Damage wires near the End Fitting or Splices

Wire Slings and Bridles

- ☐ ≤ 15% wear on the ferrule
- ☐ Legible tag indicating size, length, and WLL



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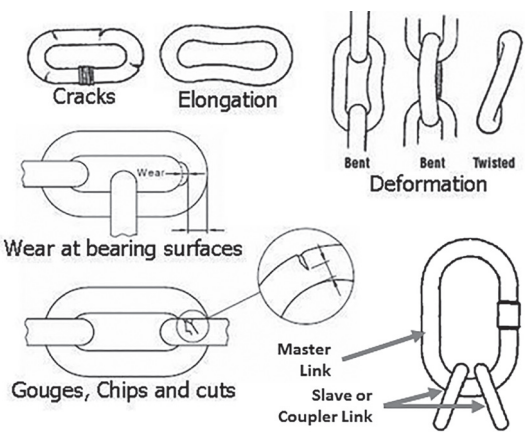
Chains

- ☐ Zero cracks, Gouges, or Nicks
- ☐ No Bends or Twisting
- ☐ No Heat Damage or Weld Splatter
- ☐ No more than 5% Stretch or Elongation
- ☐ Check for wear per manufacturer
- ☐ Check for any other signs of damage

Slings and Bridles

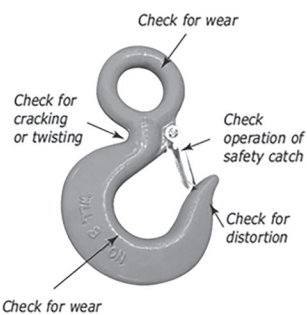
- ☐ Legible tag indicating size, length, and WLL



Hooks

If the hook has, or is designed to have, a latch:

- ☐ The latch is in place and functional
- ☐ No Cracks, Gouges, or Nicks
- ☐ No Heat Damage or Weld Splatter
- ☐ Manufacturer Mark or Name is present
- ☐ Tag out if any change in "A" dimension
- ☐ Tag out if visible signs of wear (beyond paint wear)
- ☐ Tag out if there is a twist in the hook.



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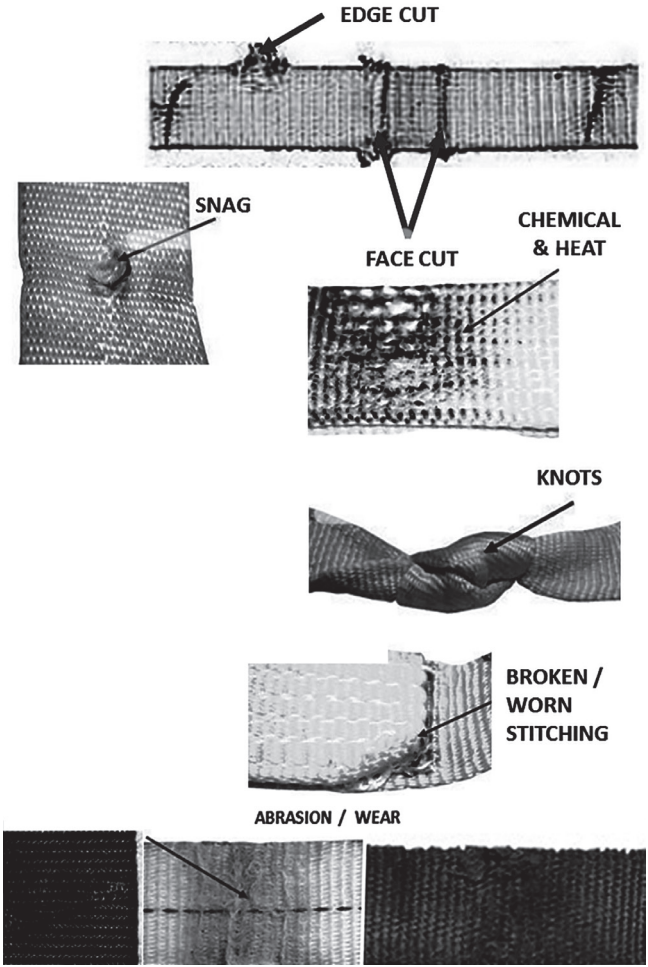
Nylon/Polyester Slings

- [ ] No signs of face cuts or edge cuts
- [ ] No snags
- [ ] No punctures
- [ ] No paint
- [ ] No chemical damage
- [ ] No heat damage
- [ ] No knots
- [ ] No broken or worn stitching
- [ ] No abrasion or wear
- [ ] Tag is legible and indicates size, length, and WLL


EDGE CUT
SNAG
FACE CUT
CHEMICAL
& HEAT
KNOTS
BROKEN /
WORN
STITCHING
ABRASION / WEAR

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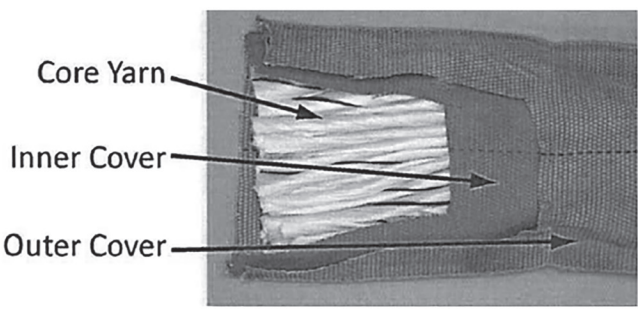
Synthetic/Poly Round Slings

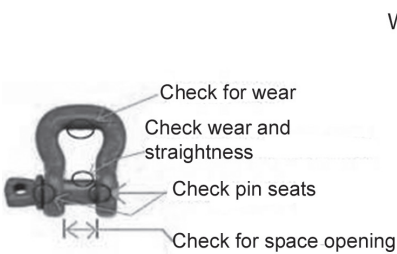
- ☐ Inner cover or core yarn is not visible
- ☐ No knots
- ☐ No broken/worn stitching
- ☐ No cuts in outer cover
- ☐ Tag is legible and includes size, length, and WLL

NOTE: Outer cover is only to protect the inner cover and yarn.



Shackles

- ☐ No signs of excess wear
- ☐ No cracks, gouges, or nicks
- ☐ Pin is straight
- ☐ Pin is fully seated / opening (± 1 thread)
- ☐ No signs of heat damage or weld splatter
- ☐ Pin matches shackle
- ☐ WLL is legible



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Eye Bolts & Swivels

All eye bolts and swivels

- [ ] No cracks, gouges, or nicks
- [ ] No bends or twisting
- [ ] No excess wear (≥ 15%)
- [ ] No heat damage or weld splatter
- [ ] No thread damage
- [ ] WLL is legible

Eye bolts only

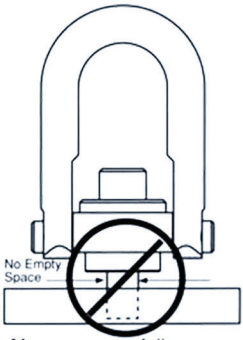
- [ ] Shoulder must be set flat on part

Swivels only

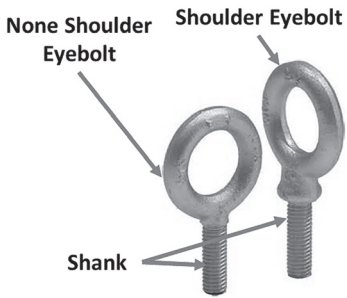
- [ ] Torque rating must be legible

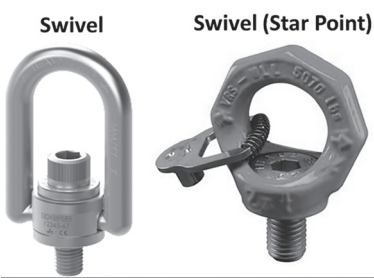
Star Point Swivels

- [ ] Does not need to be torqued
- [ ] Color will change from Pink if exposed to high temp



Always ensure full thread engagement when installing hoist rings!





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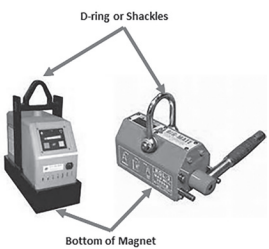
Magnets

All Magnets

- [ ] No wear on the D-ring or shackles
- [ ] No cracks, gouges, or nicks
- [ ] No heat damage or weld splatter
- [ ] All controls are functioning properly
- [ ] Bottom of magnet is clean
- [ ] Capacity table is legible

Power lift magnets

- [ ] Battery is charged
- [ ] Plugged in if requires powered



Powered Lift Magnets | Permanent Lift Magnets

Vacuum / Suction Lifter

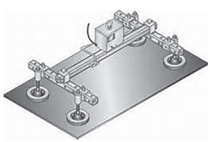
All Vacuum / Suction Lifters

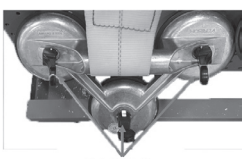
- ☐ No wear on the D-ring or shackles
- ☐ No cracks, gouges, or nicks
- ☐ No heat damage or weld splatter
- ☐ All controls are functioning properly
- ☐ Clean the suction
- ☐ WLL or Lift Table must be legible

Powered Vacuum / Suction Lifter

- ☐ Air supply is up and working

Suction Lifter





Control of Suction

Bottom of Suction Cup

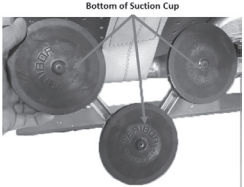


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Plate Clamps, Spreader Bars, & Edge Protectors

Plate Clamps

- [ ] No wear on the D-ring or shackles
- [ ] No cracks, gouges, or nicks
- [ ] No heat damage or weld splatter
- [ ] All controls are functioning properly
- [ ] The working face is clean & dry
- [ ] WLL of Lift Table must be legible

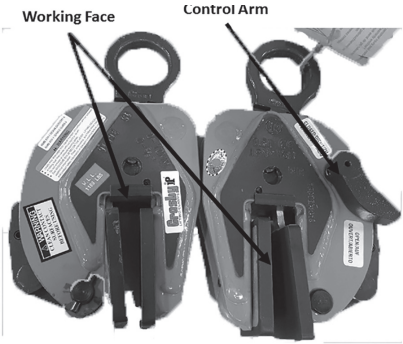
Spread Bars

- [ ] See Hook, Wire, & Chain Inspection
- [ ] No cracks, gouges, or nicks
- [ ] No heat damage or weld splatter
- [ ] All hardware is in place (Pins, Bolts, & Nuts)
- [ ] WLL is lebible

Edge Protector

- [ ] No holes
- [ ] No sharp edges that could damage part or rigging

Plate Clamps



Edge Protector

Spreader Bar

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Special Rigging & Bridles

Check for the following

- [ ] No cracks, gouges, or nicks
- [ ] No bends or twisting
- [ ] No heat damage or weld splatter
- [ ] No more than 5% stretch or elongation
- [ ] Check for wear per manufacturer recommendations
- [ ] Check for any other type of damage
- [ ] Check all controls
- [ ] WLL or capacity table must be legible

And refer to other related checklists


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DO NOT USE FAILED OR SUSPECT CRANES OR RIGGING.

DO NOT PUT FAILED OR SUSPECT RIGGING BACK IN THE STORAGE LOCATION.

Tagging out Equipment

Equipment that fails inspection must be removed from use until on of the following occurs:

1. The equipment is physically removed from Yaskawa facilities, or
2. The equipment has been repaired and inspected by competent authority, or
3. The equipment has been deemed acceptable by competent authority.

Cranes

1. Power source to hoist must be locked and tagged out
2. Place "Out of Service" or "Do Not Use" tag on hoist pendant or other operator control. Add a description of the suspected defect.
3. Notify supervisor.

Rigging

1. Place "Out of Service" or "Do Not Use" tag on the rigging. Add a description of the suspected defect.
2. Remove the rigging from all work areas where it could be unintentionally used.
3. Notify supervisor.

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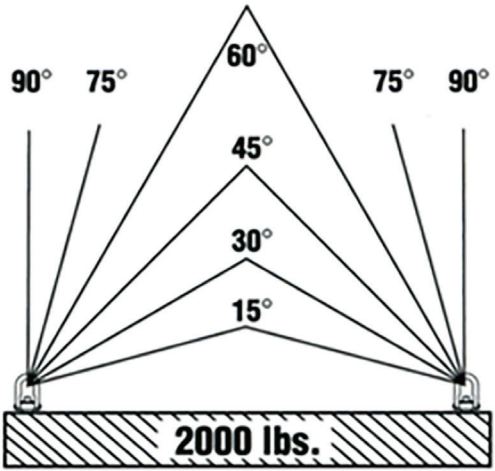

As the load raises, and moves farther out on the forks or boom, the truck CG moves. This de-rates the lifting capacity of the truck.

Rigging De-Rate

WLL: The working load limit (WLL) is the maximum allowed weight the rigging can lift.

De-Rating: The WLL is de-rated (the maximum allowed weight is reduced) based upon a number of factors, including:

- Sling Angle (or working angle)
- Orientation of material being lifted
- Material thickness
- Material surface condition
- Rigging hitch
- Center of gravity (CG) of load
- High or low temperatures
- Wind

Lift Truck De-Rating

When lifting a load suspended beneath the forks or boom of a powered industrial truck, the lifting capacity reduces as:

1. The truck mast raises, and
2. The load moves farther away from the truck's CG

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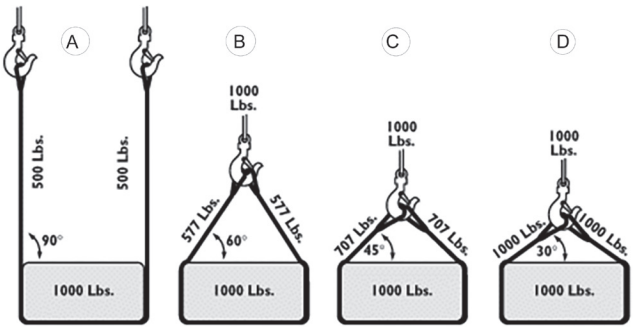
Why we de-rate slings based on angle

If you are working within the load ratings noted on the WLL tag, no further de-rate is required.



A 1,000 pound load is being lifted in each of the diagrams above. The load force on the sling changes based on the angle between the load and the hitch or hook.

A. The 1,000 pound load is equally distributed between the two slings. The load force on each sling is 500 lbs.
B. At a 60° angle, the load force on the sling increases. There is now 577 lbs of force on each sling even though the load only weighs 1,000 lbs.
C. At a 45° angle, the force on the sling increases to 707 lbs.
D. At a 30° angle, the load force on each sling increases to 1,000 lbs.

Since the angle of the sling affects the amount of weight it can actually support, we must de-rate the slings based on the sling angle.

The table below provides a de-rating factor based on the sling angle.

Sling Angle	Factor
30°	0.500
35°	0.574
40°	0.643
45°	0.707
50°	0.766
55°	0.819
60°	0.866
65°	0.906
70°	0.940
75°	0.966
80°	0.985
90°	1.00
Vertical(90°)	1.00
Choker	0.75
Basket	2.000

Sling Capacity =

(Sling WLL) * (Factor)

The load can be distributed between multiple slings. For instance, a 1,000 pound load can be lifted with two 500 lb slings if the sling angle is 90°.

HOWEVER, never count more than 3 slings. A 2,000 pound load cannot be lifted with four 500 lb slings because you only count three slings, or 1,500 lbs in this example.

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Sling Working Load Limit (WLL) Labels

If you are working within the load ratings noted on the WLL tag, no further de-rate is required.

EXAMPLE 1

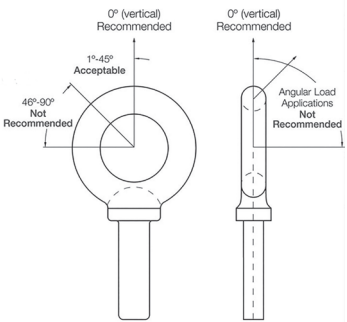
A load force of 1,700 lbs using the sling shown above is permitted. This sling is not permitted to be used at angles lower than 60°.

EXAMPLE 2

This sling does not include de-rating for angles. Use the chart on the back cover for the de-rating factor.

De-Rating Eye Bolts

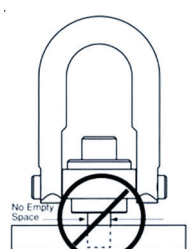
Eye bolts without a shoulder can only be used in a vertical lift.



Shouldered eye bolts are de-rated using the following table.

Sling Angle	Factor
0-5°	1.000
6-15°	0.550
16-90°	0.250

Eye Bolt Capacity = (Eye Bolt WLL) * (Factor)



Always ensure full thread engagement when installing hoist rings!

Swivel's do not need to be de-rated.

However, ensure the swivel is torqued, there are no visible threads, and the swivel is free to move.

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Critical Lifts

A critical lift is a lift that has additional risk to safety or production.

Examples:

- 2 or more cranes lifting on the load
- Lifting of personnel
- Any lift that exceeds 80% of crane capacity
- Any lift that exceeds 80% of rigging WLL
- Any lift deemed to be unique, difficult, results in restricted space, critical to production or scheduling
- As deemed by management

There are two types of critical lifts:

Standard Critical Lifts

- This is a critical lift that has been previously accomplished under the supervision of a lift supervisor, and
- Has been documented, and
- The documented, approved instructions are available at the time of the lift, and
- The documented, approved instructions are reviewed prior to the lift.

Non-Standard Critical Lifts

- This is a critical lift that has not been done before, or
- A critical lift that does not have documented instructions, or
- The instructions are not available for review.

Non-Standard Critical Lifts must be:

- Planned in advance,
- Reviewed with the entire lift team, and
- Completed under the supervision of a lift supervisor.

Contact EHS at 262-391-1697 for list of qualified lift supervisors.

CRITICAL LIFT PPE

- Standard work area PPE, plus
- Hard Hats
- Safety Glasses
- Safety Vests

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Crane Do's and Don'ts

DO NOT

- Operate any equipment for which you are not qualified
- Side load a crane
- Rigging a part with the crane hook
- Lift a load that exceeds 80% of the rated capacity
- Operate a crane while impaired
- Have any part of your body beneath the load
- Allow anyone else to have any part of their body beneath the load
- Perform fast or jerky movements of the load

DO

- Ensure the lift point is directly above the center of gravity
- Check the load & hitching with the load just off the ground
- Know how to disconnect the power to the crane
- Keep eye contact with the crane operator during the lift
- Follow the lift plan for all critical lifts
- Plan the exit path

Rigging Do's and Don'ts

DO NOT

- Overload the rigging
- Lift a load that exceeds 80% of the working load limit
- Use rigging that failed inspection
- Place defective or suspect rigging in the rigging storage location
- Ride on a load
- Leave a load suspended

DO

- Use the rigging in the orientation in which it was designed
- Use all rigging for what it was designed to do
- Keep loads as close to the ground as possible

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