Basic Rigging
Module 00106-09
Upon completion of this module, you will be able to:
1. Identify and describe the use of slings and common rigging hardware.
2. Describe basic inspection techniques and rejection criteria used for slings and hardware.
3. Describe basic hitch configurations and their proper connections.
4. Describe basic load-handling safety practices.
1. Select and inspect appropriate slings for a lift.
2. Given various loads, determine the proper hitch to be used.
3. Select and inspect appropriate hardware and/or lifting equipment.
4. Demonstrate and/or simulate the proper techniques for connecting hitches.
5. Demonstrate the proper use of all hand signals according to ANSI B30.2 and B30.5.
6. Describe or demonstrate pre-lift safety checks.
7. Demonstrate and/or simulate how to lift the load level.
8. Describe and/or demonstrate safety precautions for attaching and disconnecting a load.
WHAT IS RIGGING?

Rigging is the planned movement of material and equipment from one location to another, using slings, hoists, or other types of equipment.
Figure 1 Overhead crane.
Figure 2 Mobile cranes.
Figure 3 Identification tag.
Figure 5 Synthetic web sling shaping.
Figure 6 Protective pads.
Figure 7 Synthetic web sling warning yarns.
Figure 8 Synthetic web slings.

- **Endless**
- **Regular Eye-and-Eye**
- **Round**
Figure 10 Synthetic web sling hardware end fittings.
Figure 12 Twin-Path® sling.
Figure 14 Tattle-tails.
I-P Figure 16 Sling damage rejection criteria. (2 of 2)

- **Figure 16 Sling damage rejection criteria.**

  - **(I)** Puncture
  - **(J)** Broken splice or stitching
  - **(K)** Snag showing red thread
  - **(L)** Tensile damage
  - **(M)** Tensile break
  - **(N)** Overload damage (tattle-tails pulled in)
  - **(O)** Friction burn from abrasion and heat damage
  - **(P)** Severe heat damage
Figure 17 Markings on alloy steel chain slings.
Figure 18 Chain slings.
Figure 19 Three-leg chain bridle.
Figure 20 Eye and sorting hooks.

EYE HOOK WITH GATE
106F20A.EPS

SORTING HOOK
106F20C.EPS

ROUND REVERSE EYE HOOK
106F20B.EPS
Figure 21 Damage to chains.

- **HEAT DAMAGE AND CRACK**
  - As the link stretches, the barrels will close up.

- **IMPACT DAMAGE**
  - Bent Links
  - Link barrel has bent from being wrapped around a load with sharp corners.
  - Link bent from impact.

- **OVERLOAD DAMAGE**

- **TWISTED LINKS**
  - Links twisted from knotting or placing a twist into the chain prior to load stress.

- **EXCESSIVE WEAR**
  - Links wear at the bearing surfaces.

- **CUTS, CHIPS, AND GOUGES**

- **RUST AND CORROSION**
Figure 22 Wire rope sling.
Figure 23 Wire rope components.
Figure 24 Wire rope supporting cores.

- Fiber Core
- Independent Wire
- Strand (Steel)
Figure 25 Common types of wire rope damage.

- **BROKEN WIRES**
- **KINKING**
- **BIRDCAGING**
- **CRUSHING**
- **CORROSION**
Figure 27 Single vertical hitch.

- SLING
- FREE ROTATION
- ATTACHMENT HARDWARE
- TAG LINE
- INTERFACE PANEL
- LOAD
Figure 28 Bridle hitch.
Figure 29 Multiple-leg bridle hitch.
Figure 30 Choker hitch.

- **NOT CORRECT**
- **CORRECT**

SHACKLES
Figure 32 Double choker hitch.
Figure 33 Double-wrap choker hitch and double-wrap choker hitch constriction.
Figure 34 Basket hitch.
Figure 36 Shackles.

- Screw Pin Anchor Shackle
- Screw Pin Chain Shackle
- Round Pin Anchor Shackle
- Round Pin Chain Shackle
- Safety Anchor Shackle
- Safety Chain Shackle
Figure 37 Wide-body shackle.
Figure 38 Synthetic web sling shackle.
Figure 41 Three basic designs for eyebolts.

- **UNSHOULDERED**
- **SHOULDERED**
- **SWIVEL**
Figure 41 Effects of angular pull on shouldered eyebolts.

NOTE: Some manufacturers recommend that no pulling take place beyond 45°.
Figure 42 Proper installation of shouldered eyebolts.
Figure 43 Effects of angular pull on swivel eyebolts.

<table>
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<tr>
<th>THREAD SIZE (inches)</th>
<th>SAMPLE RATED CAPACITY FROM 0°–180° (pounds)</th>
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<tr>
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<td>1½&quot;</td>
<td>24,000</td>
</tr>
<tr>
<td>2&quot;</td>
<td>30,000</td>
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BOLT SPECIFICATION IS GRADE 8 ALLOY SOCKET HEAD CAP SCREW TO ASTM A 574.
Figure 44 Rejection criteria on eyebolts.

- Scraping
- Bent Shank
- Stress Cracks
- Rust and Corrosion
- Elongation
- Damaged Threads
- Deformation
- Wear
Figure 45 Basic nonlocking clamp.
Figure 46 Nonstandard types of lifting clamps.
Figure 47 Rejection criteria for lifting clamps.

- Abrasion
- Change in shape
- Excessive rust or corrosion
- Missing or illegible capacity
- Cracks
- Loose or damaged rivets
- Changes in opening at the jaw plate
- Wear of cam teeth
Figure 48 Rigging hooks.
Figure 49 Rejection criteria for rigging hooks.

- Wear or scraping
- Cracks
- Cuts or gouges
- Excessive rust or corrosion
- Increase in throat opening
- Twist
- Elongation
Figure 50 Sling stress example 1.
Figure 51 Sling stress example 2.

1,000 LBS
1 155 LBS
1,155 LBS

1,000 LBS
1 155 LBS
1,155 LBS

1,155 POUNDS

60°

1,155 POUNDS

2,000 POUNDS

1,155 POUNDS OF STRESS ON EACH SLING

1,155 POUNDS OF STRESS ON EACH SLING
Figure 52 Sling stress example 3.

1,000 LBS
1,414 LBS
1,414 LBS

414 POUNDS
414 POUNDS

45°

1,414 POUNDS OF STRESS ON EACH SLING

2,000 POUNDS

1,414 POUNDS OF STRESS ON EACH SLING
Figure 53 Sling stress example 4.

1,000 LBS
11,000 LBS
2,000 LBS

1,000 LBS
11,000 LBS
2,000 LBS

1,000 POUNDS
1,000 POUNDS

30°

2,000 POUNDS OF STRESS ON EACH SLING
2,000 POUNDS OF STRESS ON EACH SLING
Figure 54 Block and tackle hoist system.
Figure 55 Types of chain hoists.

- **ELECTRIC**
  - Image: 106F55A.EPS

- **PNEUMATIC**
  - Image: 106F55B.EPS

- **MANUAL**
  - Image: 106F55C.EPS
Figure 59 Eyebolt orientation.
Figure 60 Point-loaded capacity reductions.
Figure 62 Mobile crane hand signals. (1 of 2)

- **Swing**: Extend arm with closed fist, extend index finger. Use appropriate arm for desired direction.
- **Raise Boom and Lower Load**: Extend arm, thumb up, open and close fingers.
- **Lower Boom and Raise Load**: Extend arm, thumb down, open and close fingers.
- **Travel**: Extend arm, palm raised, and motion arm in the direction desired.
- **Extend Boom**: Extend arms in front of body, palms up, fists closed, extend thumbs out to the sides.
- **Retract Boom**: Extend arms in front of body, palms down, fists closed, extend thumbs inward.
- **Travel Both Tracks**: With clenched fists, roll one fist over the other.
- **Travel One Track**: Raise arm, fist clenched, to indicate lock track; roll other fist to travel. Raised hand indicates track to travel.
- **Stop**: Extend arm, palm down, and hold. Move hand and forearm in a horizontal chopping motion.
Figure 62 Mobile crane hand signals. (2 of 2)

- Emergency Stop — Same position as for 'Stop; extend and retract arms rapidly.
- Dog Everything — Clasp hands, interlocking thumbs, in front of the body.
- Move Slowly — Placing the hand over any signal indicates a slow movement. “Hoist up” is used as an example.
- Raise Load or Hoist Up — Fist up with pointer finger pointing straight up. Move hand in small horizontal circles.
- Lower Load or Hoist Down — Fist down with pointer finger pointing straight down. Move hand in small horizontal circles.
- Use Main Hoist — Rap on hard hat with closed fist.
- Use Auxiliary Hoist — Strike open palm with elbow.
- Raise Boom — Extend arm with closed fist, thumb extended up.
- Lower Boom — Extend arm with closed fist, thumb extended down.
Figure 63 Overhead crane hand signals.

- **Raise Load or Hoist Up**: Fist up with pointer finger straight up. Move hand in small horizontal circles.
- **Lower Load or Hoist Down**: Fist down with pointer finger straight down. Move hand in small horizontal circles.
- **Travel Bridge**: Palm raised, move arm in desired direction.
- **Travel Trolley**: Palm-up fist, thumb extended, move hand in desired direction.
- **Stop**: Extend the arm, palm down, and hold. Move hand and forearm in a horizontal chopping motion.
- **Emergency Stop**: Extend and retract arm, palm down, in rapid motion. Can also be done using both arms.*
- **Hoist or Trolley Selection**: Raise hand, holding up appropriate number of fingers to designate desired hoist or trolley.
- **Move Slowly**: Placing the hand palm down over any signal indicates to move slowly. “Hoist up” is used as an example.
- **Magnet Disconnected**: Placing both arms straight out, palms down indicates that the operator has disconnected the magnet.

*NOTE: The Emergency Stop signal is the only signal that can be given by anyone other than the designated signal person.
Figure 64 Rear swing path.
STANDARD

TWISTED
VERTICAL PULL

PERPENDICULAR PULL
INCORRECT

CORRECT
DANGER: LOAD BUCKLE

106SA04.EPS
### Maximum Safe Working Loads - Pounds

(Safety Factor = 5) Does not apply to chain slings

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**Wire Rope Slings**

6 x 19 Classification Group, Improved Steel, Fibre Core

Rope diameters up to 3 3/4 inches are available.

- **Note:** Table values are for slings with eyes and thimbles in both ends. Flemish Spliced Eyes and mechanical sleeves.
- Eyes formed by cable clips - reduce loads by 20%

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**Chain Slings (Alloy Steels)**

Web Width (Inches)

- Web widths up to 1 3/4 inches are available.

- **Note:** The information below applies to the 2-Leg Bridle Hitch end of the Single Basket Hitch with legs inclined for the wire rope and chain slings.

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<th>Single Basket Hitch Lifting Values by 3/4</th>
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**Polypropylene Rope Slings**

Spliced eyes in both ends.

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<th>Single Basket Hitch Lifting Values by 3/4</th>
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<td>LOAD ANGLE FACTOR</td>
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<td>------------</td>
<td>-------------------</td>
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