

RIGGING SAFETY



**UNSAFE
RIGGING
COULD BECOME
THE WEAKEST
LINK!!
Section 15**



RIGGING SAFETY



RIGGING EQUIPMENT SHALL BE INSPECTED BY A COMPETENT PERSON BEFORE USE ON EACH SHIFT AND AS NECESSARY DURING ITS USE TO ENSURE THAT IT IS SAFE.

QUALIFIED RIGGING LIFT SUPERVISOR and QUALIFIED RIGGER

- 1) Be at least 18 years of age**
- 2) Be able to communicate with crane operator, lift supervisor, flagman and affected employees on site**
- 3) Have basic knowledge and understanding of equipment-operating characteristics, capabilities, and limitations**

QUALIFIED RIGGERS AND LIFT SUPERVISORS MUST DEMONSTRATE KNOWLEDGE AND PROFICIENCY TO APPROPRIATE MANAGEMENT PERSONNEL IN THE FOLLOWING;

- 1) Personnel roles and responsibilities**
- 2) Site preparation**
- 3) Rigging equipment and materials**
- 4) Safe Operating procedures**

RIGGING SAFETY cont.



QUALIFIED RIGGERS AND LIFT SUPERVISORS MUST DEMONSTRATE KNOWLEDGE AND PROFICIENCY TO APPROPRIATE MANAGEMENT PERSONNEL IN THE FOLLOWING;

- 5) Principles of safe rigging**
- 6) Environmental hazards (overhead interferences)**
- 7) Rigging the load, handling the load, common causes of crane-related accidents**

RIGGING SAFETY cont.



MULTIPLE LIFT RIGGING (MLR)

- 1) A multiple lift is considered a critical lift and requires a written critical lift plan per Section 16.H**
- 2) For the purpose of erecting/placing structural steel ONLY and must follow Section 15.C and 29 CFR 1926.753 Subpart R**
- 3) Must follow the following criteria**
 - a. MLR assembly used**
 - b. maximum of five members are hoisted per lift**
 - c. Only beams and similar structural members are lifted**
 - d. All employees engaged in MLR are trained**
 - e. All loads are rigged by a qualified rigger**
 - f. Manufacturer specifications allow MLR**
 - g. Components designed capacity with a 5:1 safety factor for all components**

MULTIPLE LIFT RIGGING (MLR) cont.

h. The total load doesn't exceed the rigging capacity

MULTIPLE LIFT RIGGING SHALL BE RIGGED WITH MEMBERS:

- 1) ATTACHED AT THEIR CENTER OF GRAVITY**
- 2) Rigged from the top down**
- 3) Rigged at least 7 feet apart**
- 4) Members shall be set from the bottom up**
- 5) Controlled load lowering shall be used whenever the load is over the connectors (people!!!)**

RIGGING SAFETY



RIGGING EQUIPMENT SHALL BE INSPECTED BY A COMPETENT PERSON BEFORE USE ON EACH SHIFT AND AS NECESSARY DURING ITS USE TO ENSURE THAT IT IS SAFE.

RIGGING EQUIPMENT, WHEN NOT IN USE, SHALL BE REMOVED FROM THE IMMEDIATE WORK AREA AND PROPERLY STORED AND MAINTAINED IN A SAFE CONDITION .

WHEN HOISTING LOADS, A POSITIVE LATCHING DEVICE SHALL BE USED TO SECURE THE LOAD AND RIGGING.

**FIBER ROPE, CHAIN, WIRE ROPE &
WIRE ROPE CLIPS**

**SLINGS: ROPE SLINGS, WEB SLINGS
WIRE ROPE SLINGS, BRAIDED SLINGS
& CHAIN SLINGS.**

**HOOKS, SHACKLES, RINGS/LINKS,
TURNBUCKLES, EYE-BOLTS**

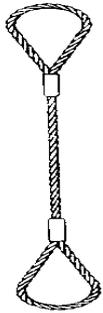
BELOW THE HOOK DEVICES

TABLE 16-2

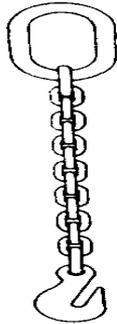
Wire Rope Removal and Replacement Criteria

<u>Standard</u>	<u>Equipment</u>		<u># OF BROKEN WIRES IN RUNNING ROPES</u>			<u># OF BROKEN WIRES IN STANDING ROPES</u>	
			<u>In one rope lay</u>	<u>In one strand</u>	<u>At end connection</u>	<u>In one rope lay</u>	<u>At end connection</u>
<u>ASME/B30.2</u>	<u>Overhead & gantry cranes</u>		<u>12**</u>	<u>4</u>	<u>N/S</u>	<u>Not Specified</u>	
<u>ASME/B30.4</u>	<u>Portal, tower, & pillar cranes</u>		<u>6**</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
<u>ASME/B30.5</u>	<u>Mobile & locomotive cranes</u>	<u>Running ropes</u>	<u>6**</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
		<u>Rotation-resistant ropes</u>	<u>2 randomly distributed broken wires in 6 rope dia. or 4 randomly distributed broken wires in 30 rope dia. ***</u>				
<u>ASME/B30.6</u>	<u>Derricks</u>		<u>6**</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
<u>ASME/B30.7</u>	<u>Base-mount derrick hoists</u>		<u>6**</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
<u>ASME/B30.8</u>	<u>Floating cranes and derricks</u>		<u>6**</u>	<u>4</u>	<u>4</u>	<u>4</u>	<u>4</u>
<u>ASME/B30.16</u>	<u>Overhead hoists</u>		<u>12**</u>	<u>4</u>	<u>N/S</u>	<u>Not Specified</u>	
<u>ANSIA10.4</u>	<u>Personnel hoists</u>		<u>6**</u>	<u>4</u>	<u>4</u>	<u>2**</u>	<u>2</u>
<u>ANSIA10.5</u>	<u>Material hoists</u>		<u>6**</u>	<u>Not Specified</u>		<u>Not Specified</u>	

RIGGING GEAR



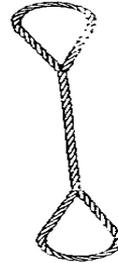
WIRE ROPE



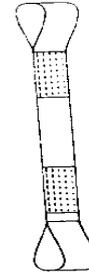
CHAIN



MESH



ROPE



WEB



ROUNDSLINGS

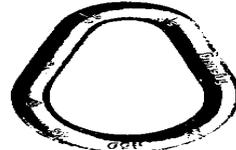
STEEL

SLINGS

SYNTHETIC



END LINK



SLING LINK



WELDLESS RING



SWIVEL HOIST

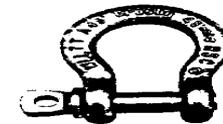
RINGS



EYE BOLT



TURNBUCKLE



SHACKLE

OTHER THINGS

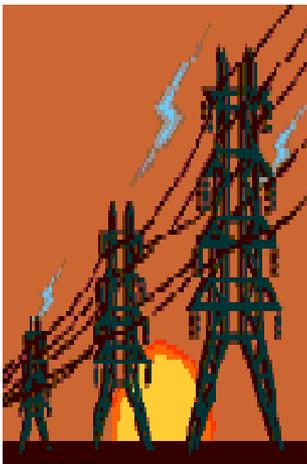
TAG LINES



Control loads be lifted by crane

Excessive length could cause
A safety problem

Max. Length about 10 Feet.



Work around power lines

Use non-conductive tag lines

See Pages 3-6

Can You Name this Violation?



LIFTING ANGLES



90° (STRAIGHT UP & DOWN) FROM THE LOAD...THE FULL CHAIN CAPACITY CAN BE LIFTED.

THE GREATER THE ANGLE FROM VERTICAL AWAY FROM THE CENTER OF THE LOAD...THE LESS THE LIFTING CAPACITY OF THE CHAIN (See Pg. #14)

NOTE: SLING ANGLE APPLIES TO ALL TYPE SLINGS!

Slings are not to be used an angles less than 30° from the horizontal!

WIRE ROPE



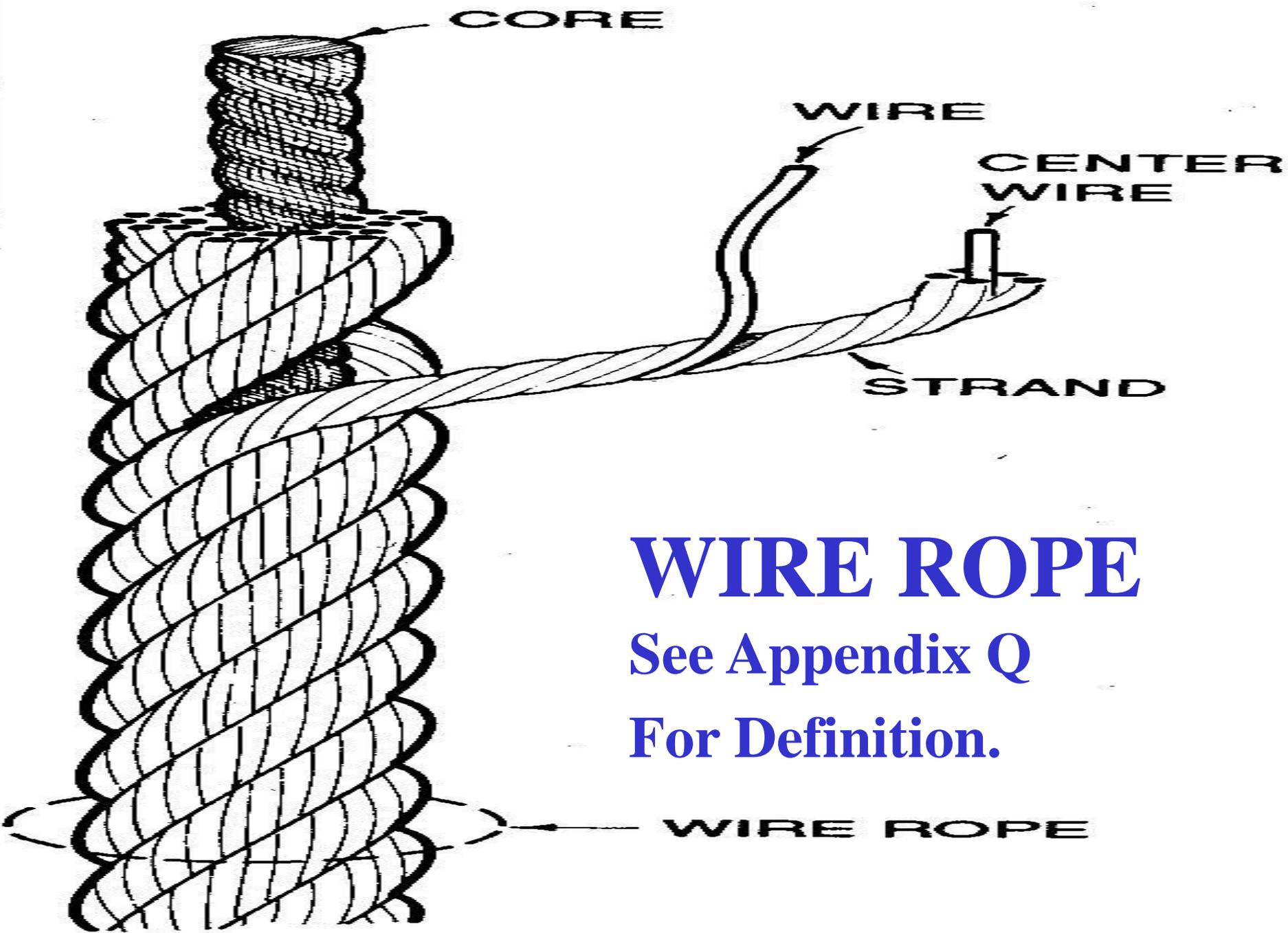
LIFTING SLINGS

STANDING LINES ON CRANES

RUNNING LINES ON CRANES

HORIZONTAL LIFE LINES

Pages 15-31



CORE

WIRE

CENTER
WIRE

STRAND

WIRE ROPE

See Appendix Q

For Definition.

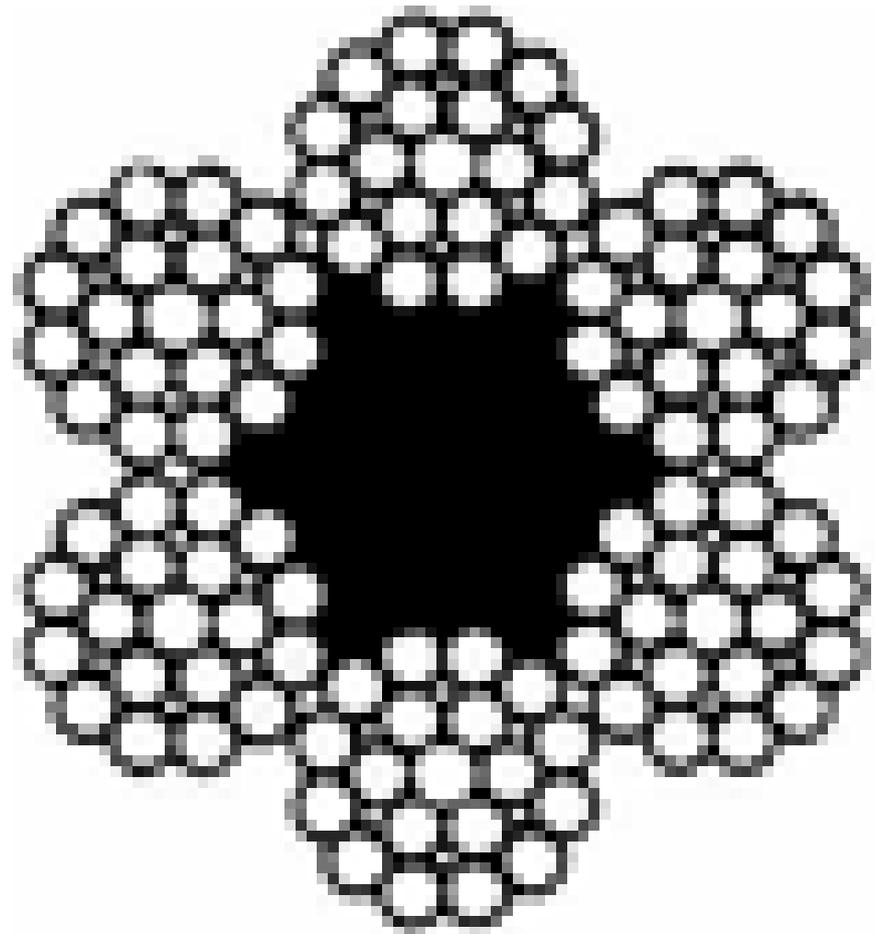
WIRE ROPE

WIRE ROPE

TYPICAL WIRE ROPE (6 X 19)

1st # is number of strands
2nd # is number of wires
per strand

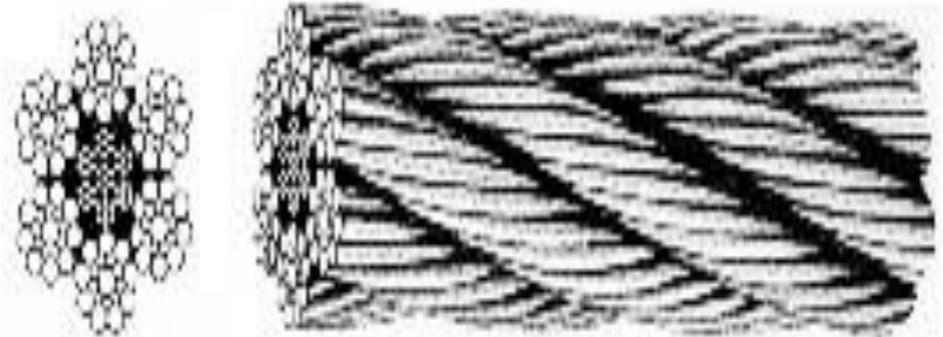
CENTER CORE
FIBER
OR
METAL



See Page #17 for classifications & types

WIRE ROPE TYPES

**MOST COMMON
RIGHT REGULAR
LAY...Wires wind
in one direction &
strands in the opposite
direction.**



6 x 19 Seale Right Regular Lay, IWRC

**Less likely to kink & untwist, easier to handle
And more resistant to crushing.**

WIRE ROPE TYPES



**WHY IT IS IMPORTANT TO UNDERSTAND ABOUT
TYPES OF WIRE ROPE?**

**CRANE MANUFACTURERS MANUAL
WILL STIPULATE THE SIZE & TYPE
OF WIRE ROPE TO USED FOR EACH
OF THE CRANE HOISTS.**



**WRONG TYPE OF WIRE ROPE
USED ON THIS CRANE HOIST**

INSPECTING WIRE ROPE



CRANES

RUNNING LINES

STANDING LINES

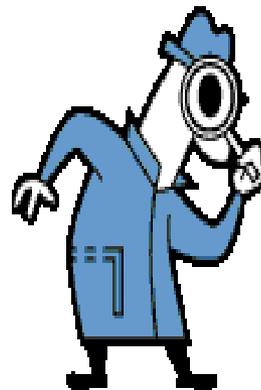
**6 Broken Wires
In one rope lay**

**3 Broken Wires
in one rope lay**

OR

**3 Broken Wires
In one strand**

**2 Broken Wires
at end connection**





**STANDING
WIRE ROPE
LINE**

**RUNNING
WIRE ROPE
LINE**



Link-Belt

WHAT IS ONE ROPE LAY?



**THE LENGTH OF WIRE
ROPE THAT ONE STRAND
TAKES TO MAKE ONE
COMPLETE REVOLUTION
AROUND THE CORE OF
THE WIRE ROPE (See Pg 18)**

WIRE ROPE INSPECTION ITEMS



Crushed Wires



Broken Wires



**DAMAGE FROM HEAT AND CORROSION
(Electrical contact with wire rope)**

(See page 26 & 27)

INSPECTING WIRE ROPE

Bird Cage



Kinked



WIRE ROPE SLINGS

- **WIRE ROPE SLINGS**



Look on
Page #25

FIVE BASIC TYPES

SOCKET (POURED) 100%

WEDGE SOCKET 75%-90%

MECHANICAL (above) 90%-95%

HAND TUCKED 80%-90%

WIRE ROPE CLIPS 80%

LIFTING CAPACITY OF SLINGS

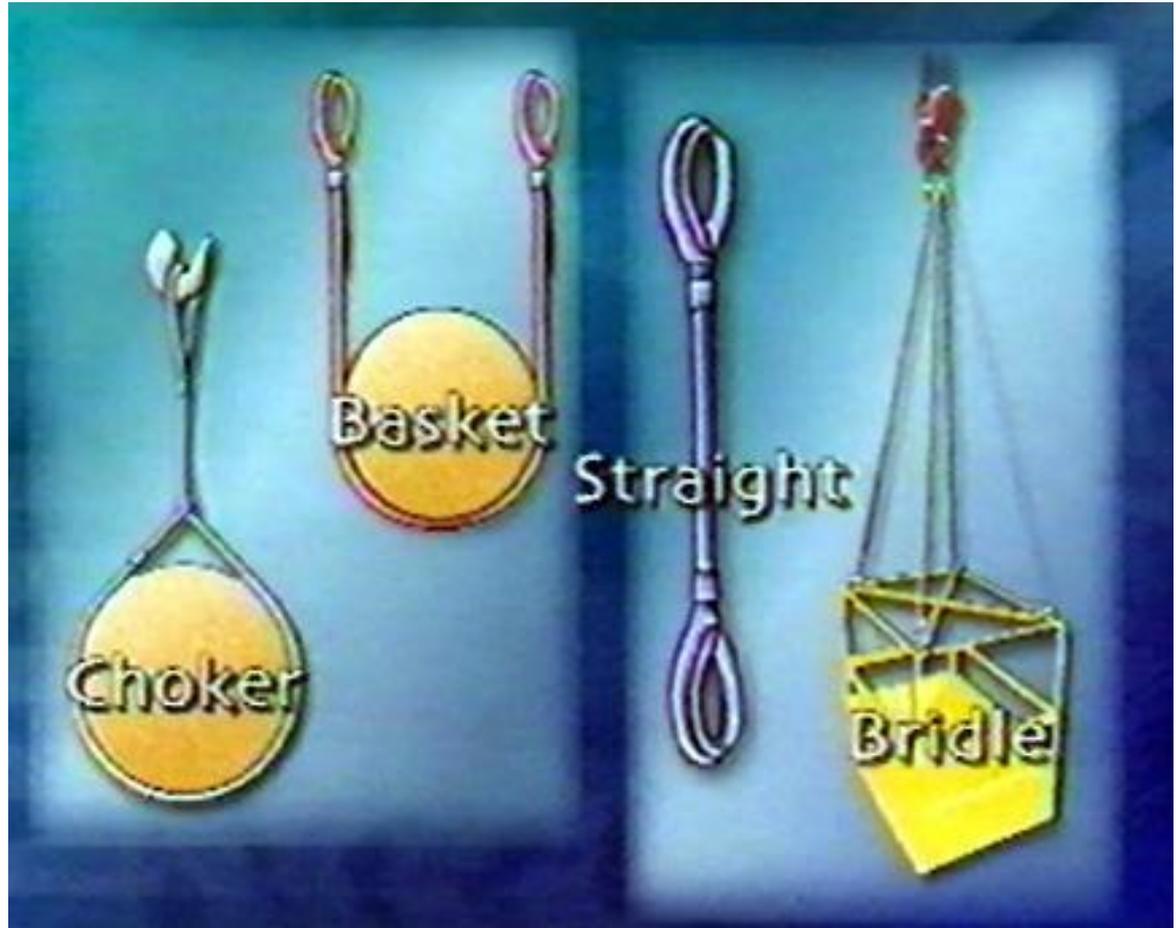


385-1-1
15.G.06

COE says “Wire rope slings shall have affixed a durable permanent ID tag with the diameter, rated load, & lifting capacity in the vertical, chocker, and basket configuration. Also the date the sling was placed in service.

TYPES OF SLING HITCHES

Choker
Basket
Straight
Bridle



TYPES OF HITCHES



VERTICAL HITCH: Full rated lifting capacity of the sling may be used. (Watch Rotation!)

CHOKER HITCH: Reduced lifting capacity of single sling is 75% of full rating of sling, dual slings capacity rating based on lifting angle of the slings (See page # 30)

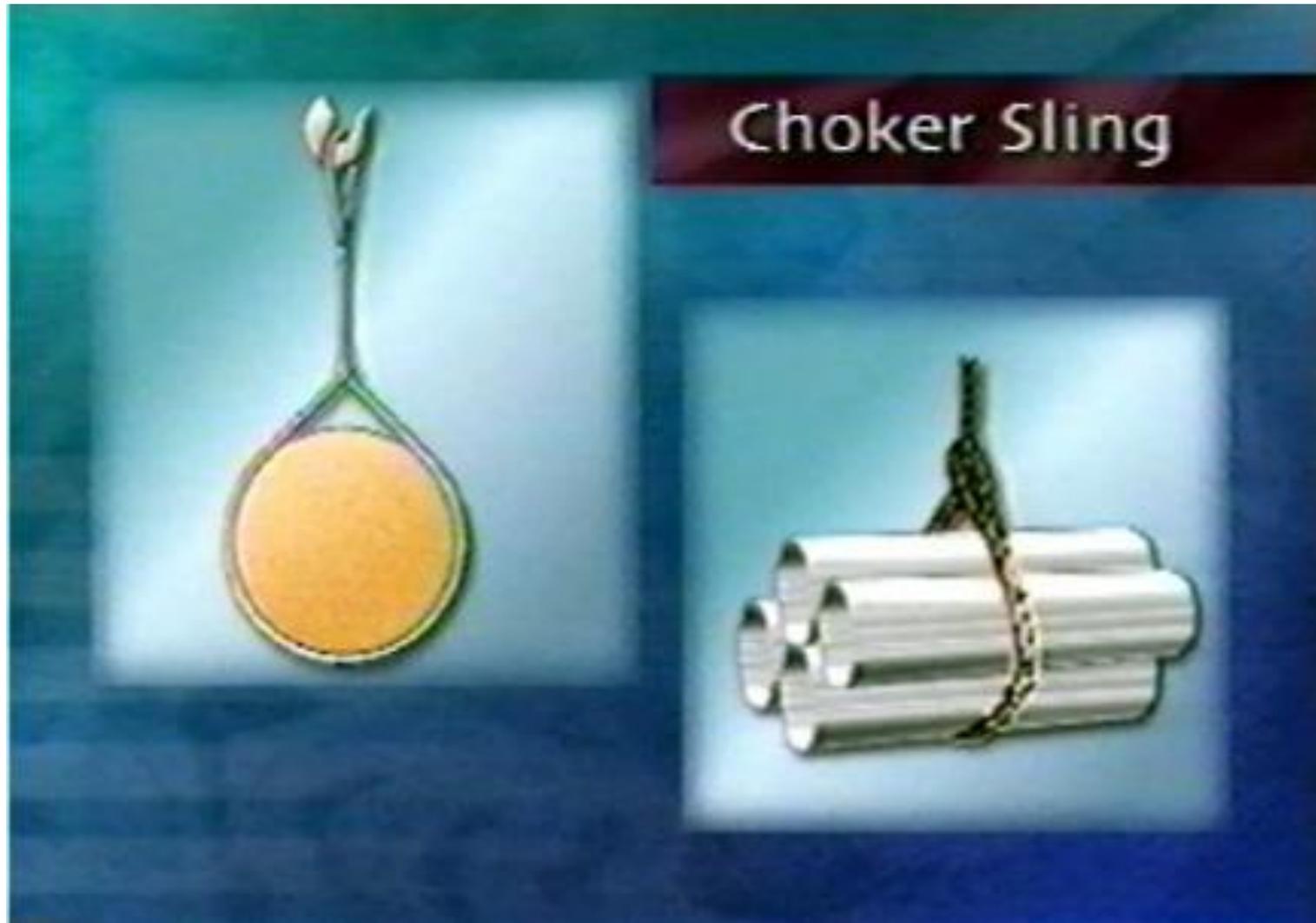
BASKET HITCH: Distributes the weight of the Load evenly between two slings. Both eyes of Each sling are placed on lifting hook, load in “in the cradle”. (See Page # 31)

Straight Sling



The total weight of the load is supported by a single leg
The working load limit of the sling must exceed the load

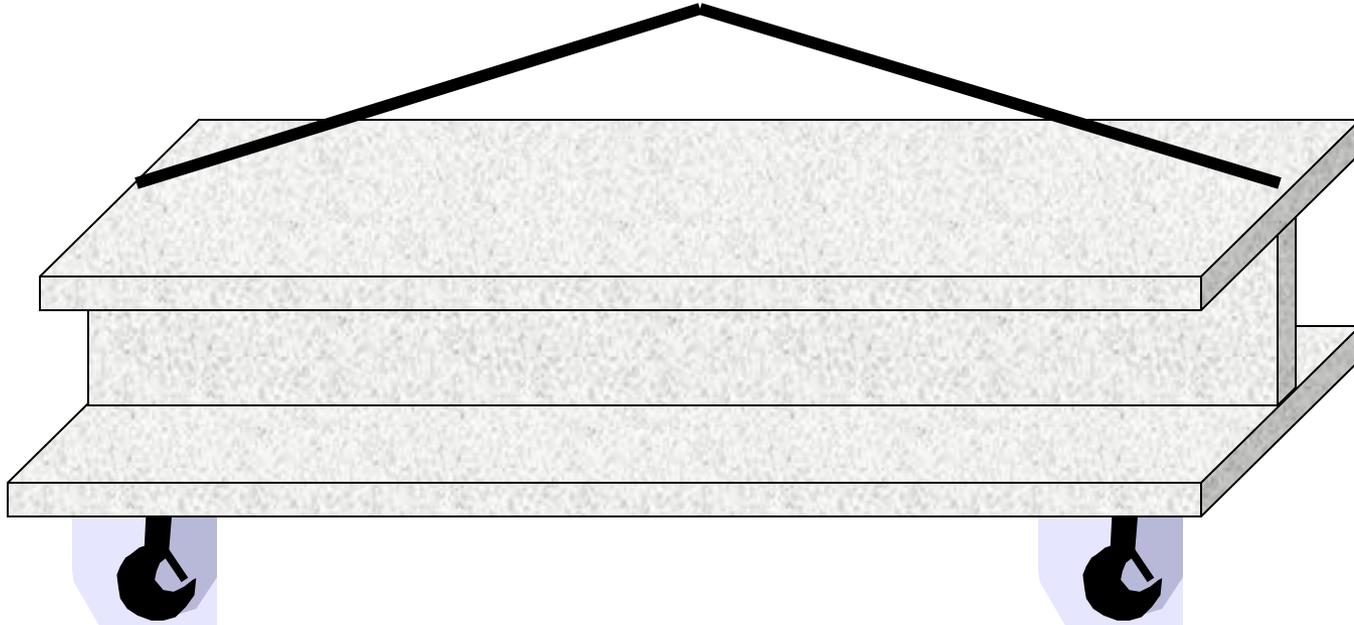
Choker Sling



Basket Sling



Spreader Beams



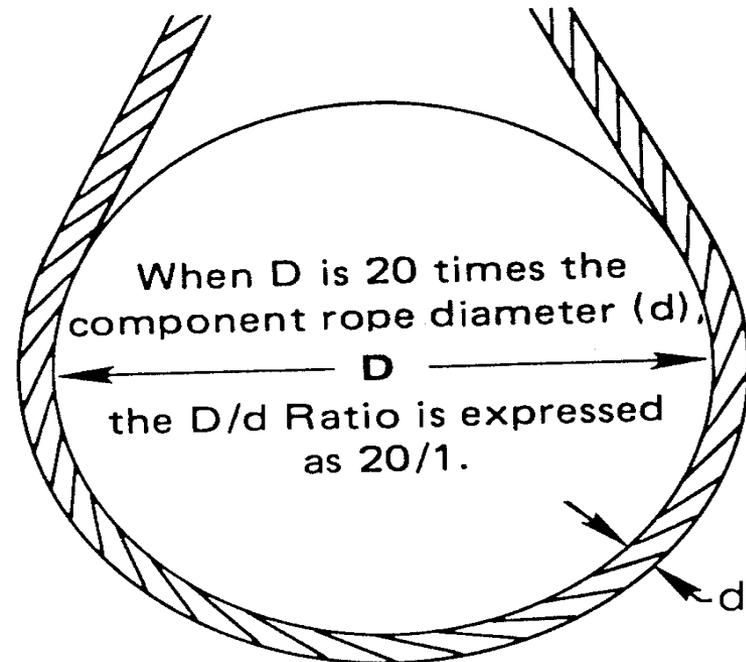
- Spreader beams can be used with a double vertical hitch to handle long loads
- Reduces load tipping
- Each leg will carry one-half the total load
- Spreader beams must be manufactured for that purpose and have a rated capacity indicated

**A wire rope around
An object of equal
Diameter (1/1 d/d)
Will have a breaking
Strength reduced 50%**

**A 4/1 ratio decreases
The strength to 25%**

**A 20/1 ratio has a
0% loss in strength.**

See page # 31



WIRE ROPE CLIPS



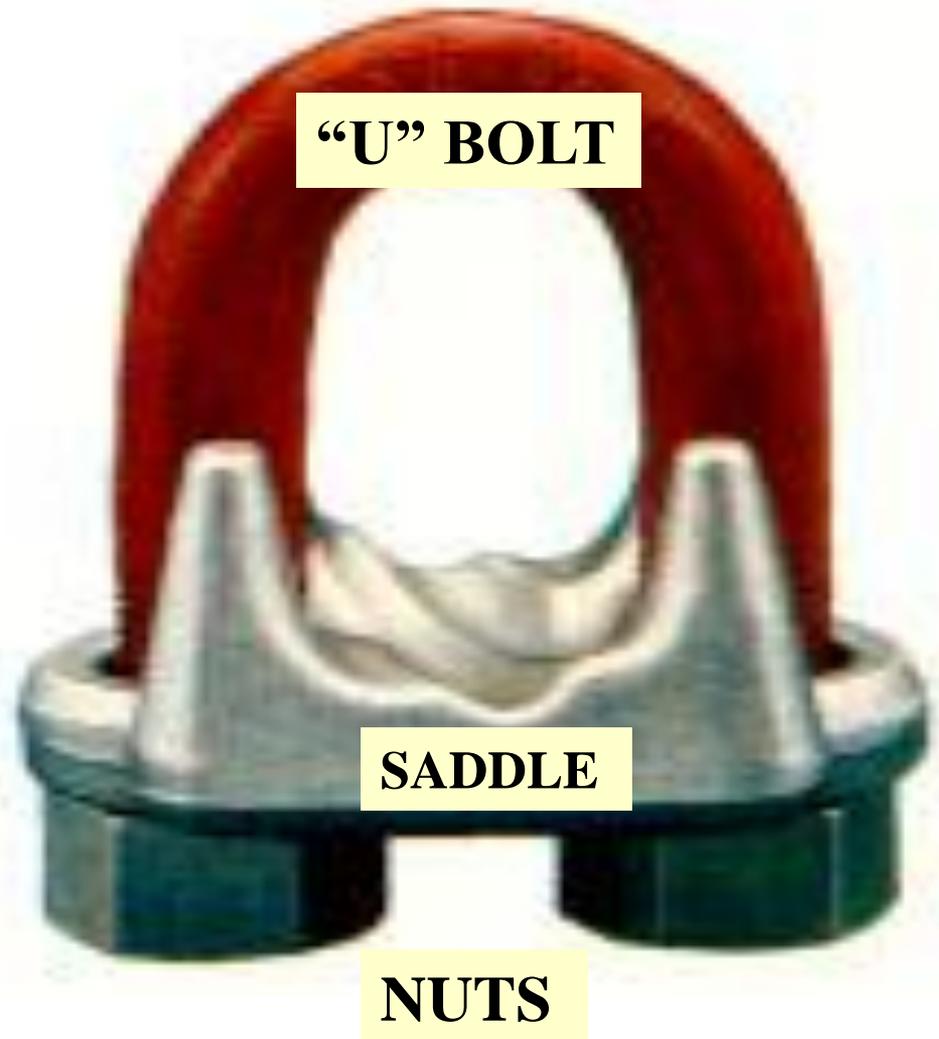
**Most common
type called a
“Crosby Clamp”**

3 Main Parts

SADDLE

“U” Bolt

Nuts





**NEVER SADDLE
A DEAD HORSE!!!**

PROPER USE OF THE WIRE ROPE CLIP



**PAGE 21 OF SAFETY RESOURCE
BOOK FOR APPLYING WIRE ROPE CLIPS**

WEDGE SOCKETS

**PAGES 23 & 24 OF SAFETY RESOURCE
BOOK**

WEDGE SOCKETS



The TERMINATOR™
From Crosby, the first name in lifting products.

US Patent 5,553,350

The new Crosby **TERMINATOR™** wedge socket secures the dead end of a wire rope with a new longer wedge and a Crosby "Red-U-Bolt" wire rope clip. Our innovative design offers a unique approach to termination with a minimum efficiency rating of 80% based on the catalog strength of XXIP grade wire rope. Available to fit wire rope from 3/8" to 1 1/8".

WEDGE SOCKET TERMINATION

- ✓ Eliminates need for extra piece of wire rope on tail.
- ✓ New wedge fits existing Crosby sockets (Beckets).

No other wedge socket offers this unique approach to termination while maintaining a minimum efficiency rating of 80% based on the catalog strength of XXIP grade wire rope. Available to fit wire rope from 3/8" to 1 1/8".

**The TERMINATOR™...
The *last* wedge socket you'll ever need.**

For more information contact your local authorized Crosby Distributor.

the Crosby group, INC.
P.O. Box 3128 • Tulsa, Oklahoma 74101 • 918-834-4611 • Fax: 918-832-0940
Visit our Web Site at: <http://www.industry.net/crosby> • E-Mail: crosbygroup@earthlink.net

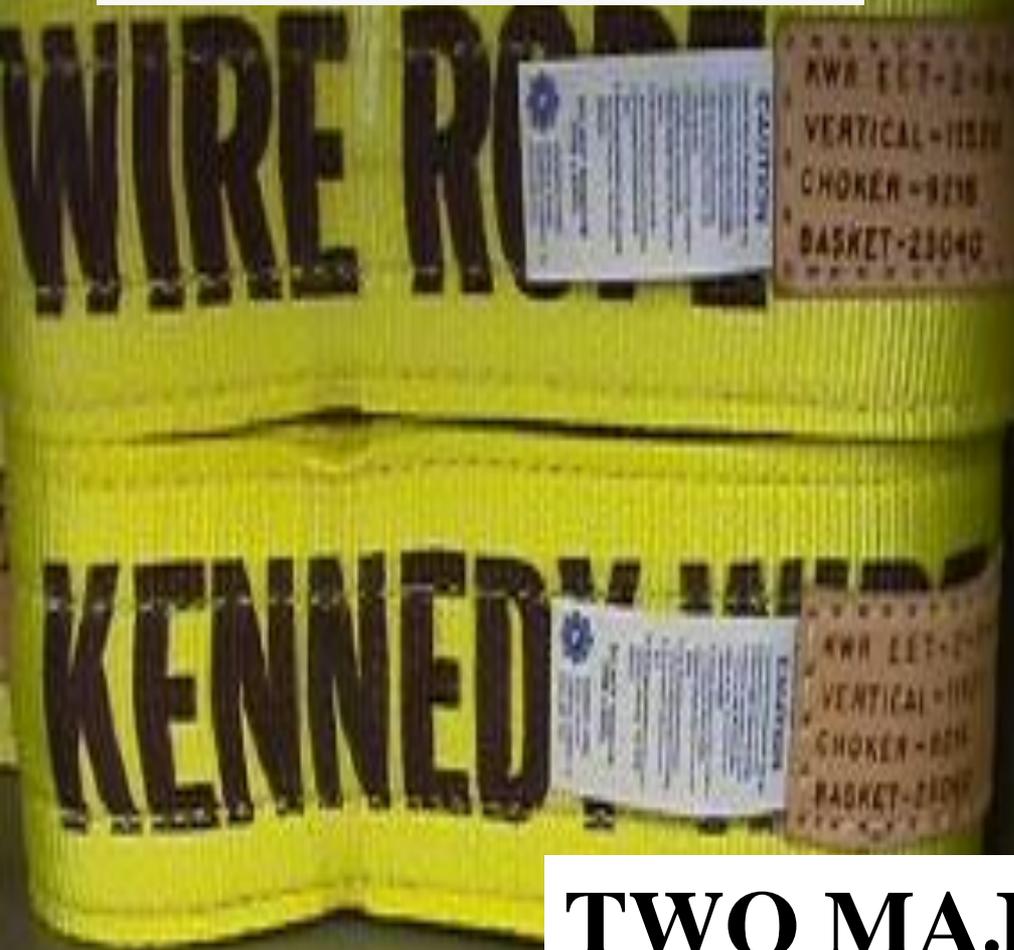
S421TW-TERMINATOR™ Wedge

G450-Red-U-Bolt Wire Rope Clip

the ISO 9001 Certified Company

"When buying Crosby, you're buying more than product, you're buying Quality."

SYNTHETIC WEB SLINGS



SYNTHETIC ROPE SLINGS



TWO MAJOR TYPES

SYNTHETIC SLING CAPACITY



TAG TO ID THE

**Name or trademark
of the manufacturer**

**Rated capacity for
the type of hitch**

**Not to exceed rated
Capacity**



ROUND ROPE SYNTHETIC SLINGS



**RATED CAPACITY IS DETERMINED
BY THE TAG AND COLOR CODE OF
THE OUTER JACKET**

**REPLACE WHEN RED STRIPE WHITE
CORE YARNS ARE VISIBLE**

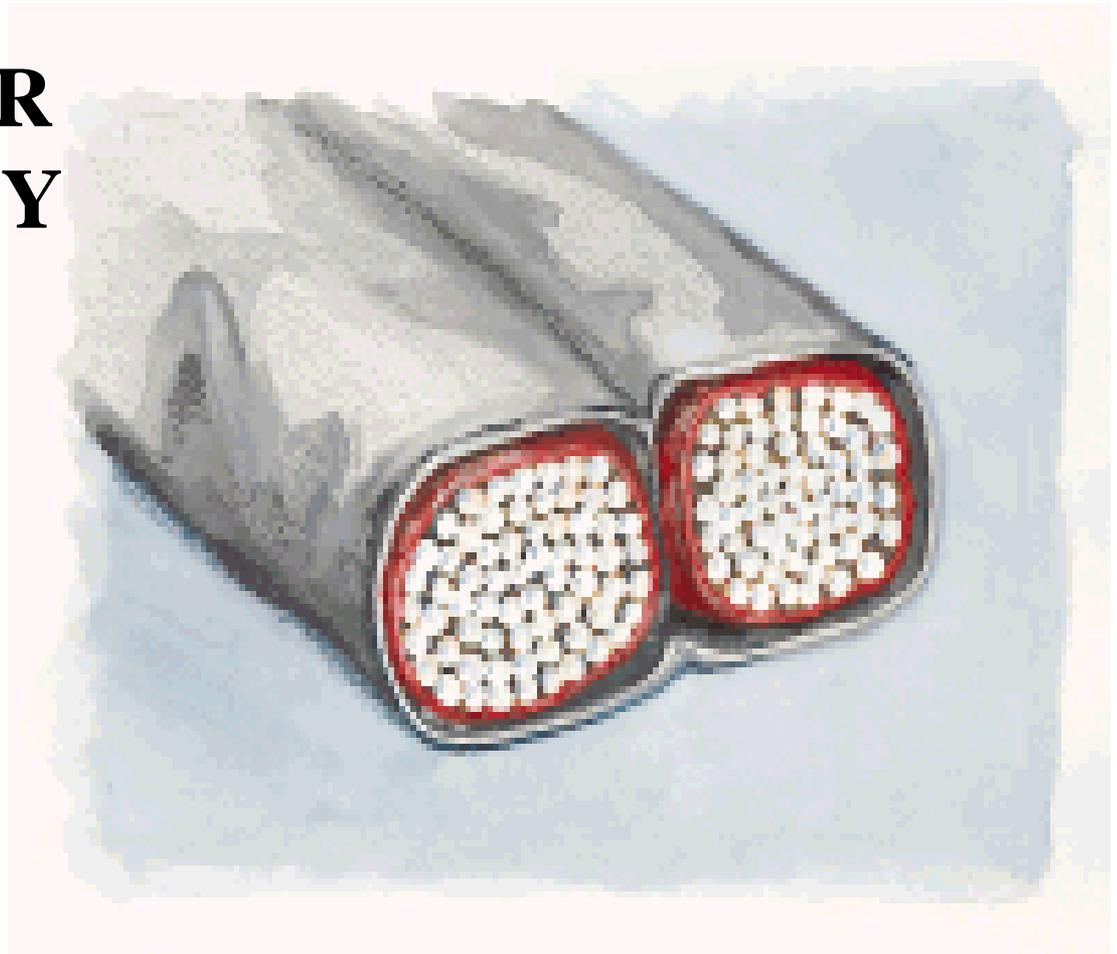
See Pages
41 & 42



ROUND SLING CONSTRUCTION



**SEE PAGE 42 FOR
SLING CAPACITY
COLOR CODES**



DISADVANTAGES SYNTHETIC SLINGS



HEAT SOURCES

ACIDS

CAUSTIC

CUT TEAR EASY



INSPECTING SYNTHETIC SLINGS



ACID BURNS

MELTING MARKS

CUTS, HOLES

TEARS, SNAGS

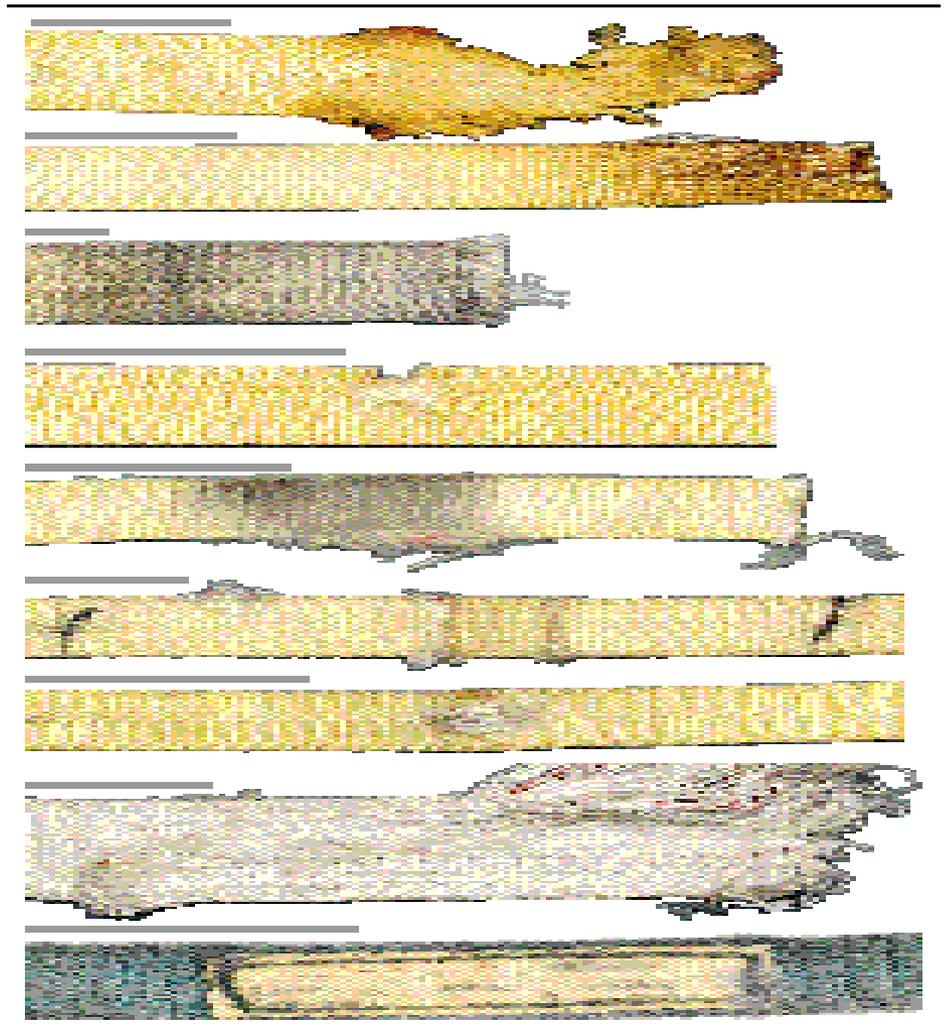
RED WARNING

EXCESSIVE WEAR

NO SWL TAG

UNREADABLE TAG

END ATTACHMENTS



RIGGING HARDWARE



WIRE ROPE CLIPS
HOOKS
SHACKLES
RINGS
LINKS
TURNBUCKLES
EYE BOLTS



TYPES OF HOOKS



HOIST HOOKS

CHAIN GRAB HOOKS

SLING CHOCKER HOOKS

CHAIN SLIP HOOKS

EYE HOOKS

See pages 44 through 54

INSPECTING HOOKS



WEAR OR CRACKS

DEFORMATION OF HOOK

THROAT OPENING 15% MORE

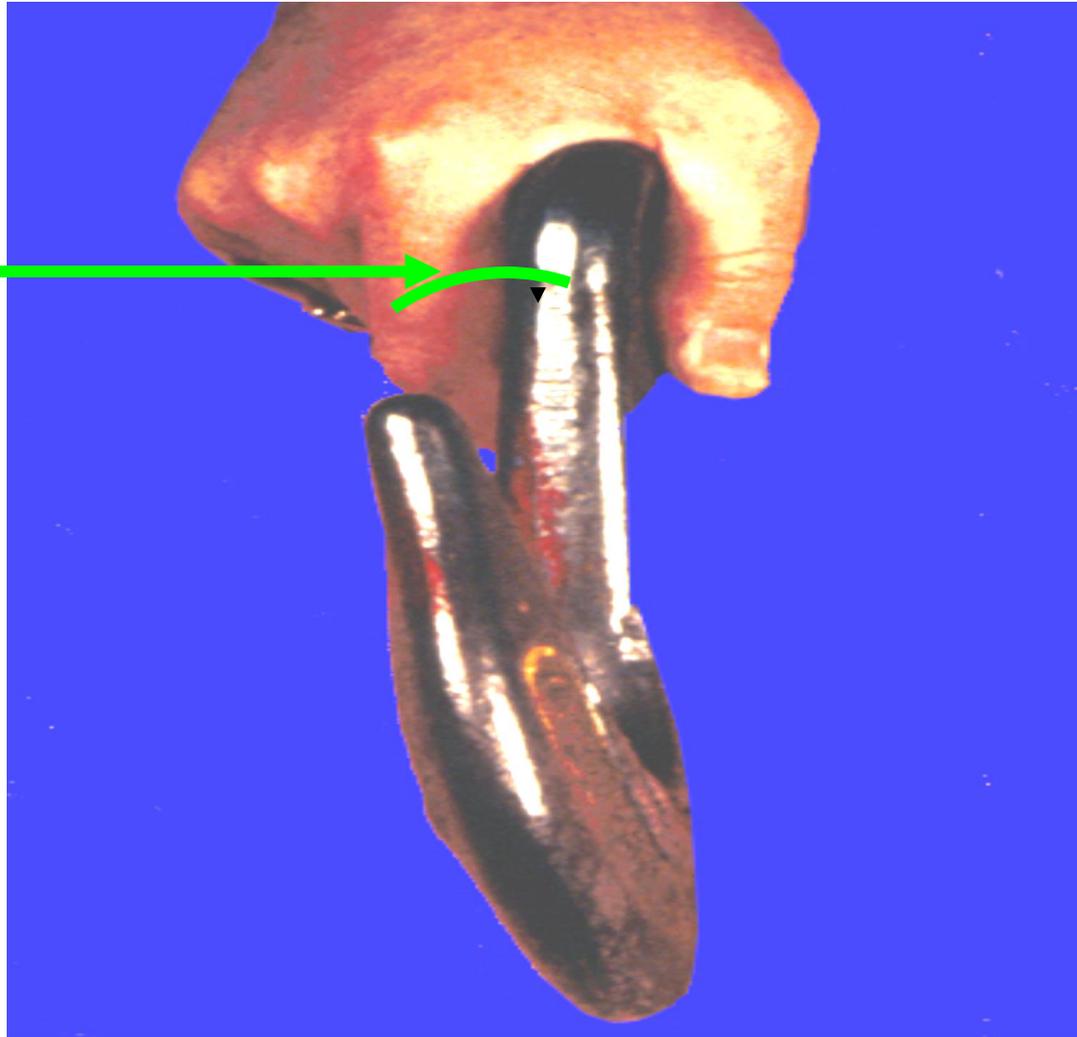
***BENT MORE THAN 10° OUT OF PLANE**

SAFETY LATCH OR MOUSE

**•Page # 45 for deformed hook photo
and COE Appendix “F” page F-5**

Example of Bad Hook

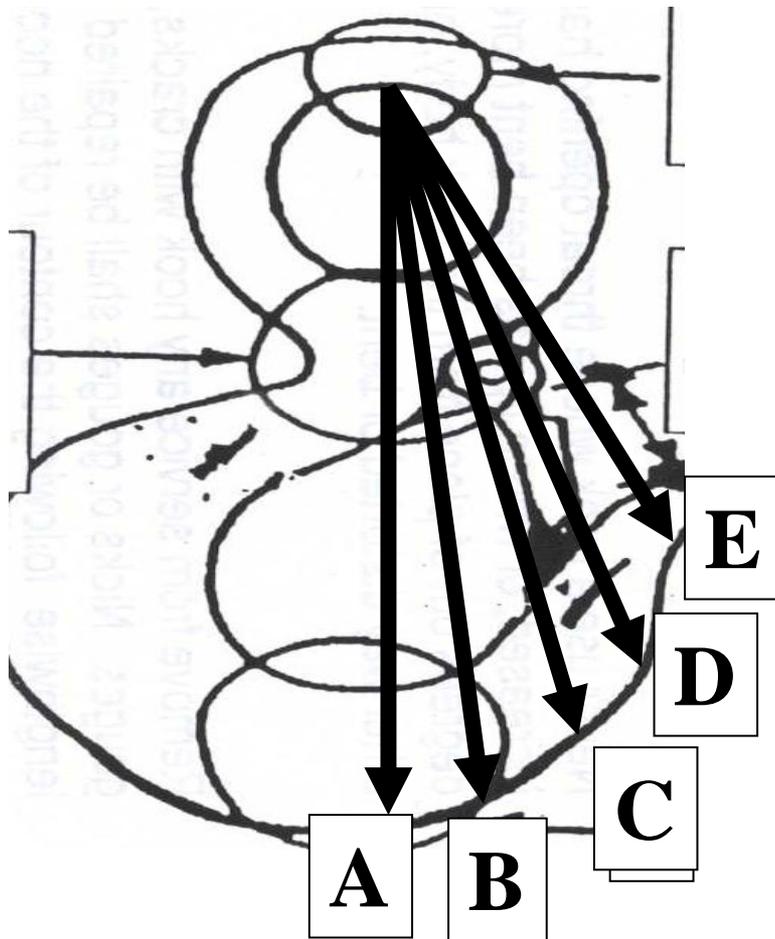
Max twist
10°



- Avoid:**
- Side load
 - Back load
 - Tip load

LIFTING WITH HOOKS

Only foundry hooks are designed for tip loading



Hook/Load Angles

A. Balanced 100%

B. 1/4 off center 86%

C. 1/2 off center 80%

D. 3/4 off center 70%

E. Point loading 40%

SHACKLES

6 MAJOR TYPES

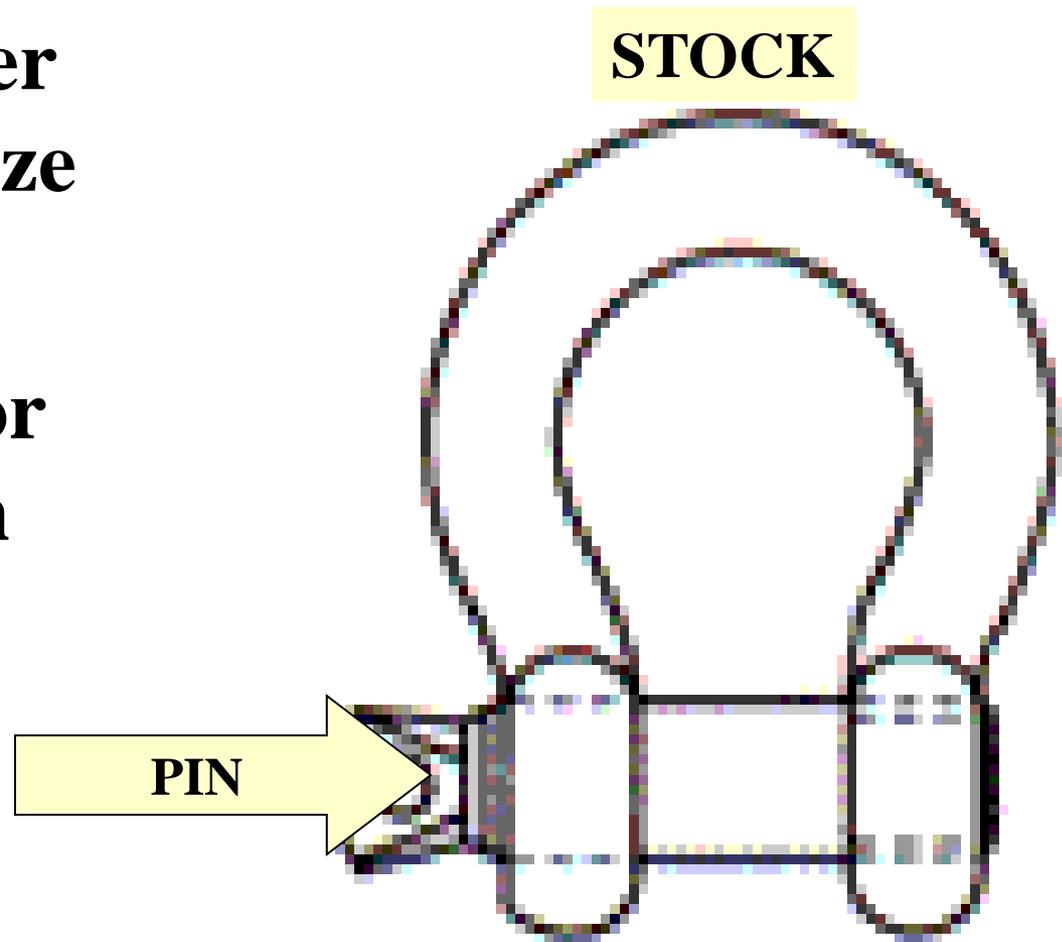
- Screw Pin Anchor**
- Round Pin Anchor**
- Safety Anchor**
- Screw Pin Chain**
- Round Pin Chain**
- Safety Chain**



SHACKLES

**Stock Diameter
Determines Size**

**Safety Type for
high vibration
operations i.e.
pile driving**



SHACKLE RIGGING SAFETY TIPS



Avoid placing running line over the pin.

Never replace shackle pin with a bolt

**A hook on the shackle should be placed
On the stock (round) part of the shackle**

**Look on
Page 47!!!**

SHACKLE INSPECTION RESULTS



- **Unknown SWL
(Shackle not marked)**
- **Different sizes used in one arrangement.**
- **Bolts used for pins.**
- **Shackles welded to spreader bar**
- **Bent/out of shape**
- **Shop fabricated shackle pins**



TURNBUCKLES

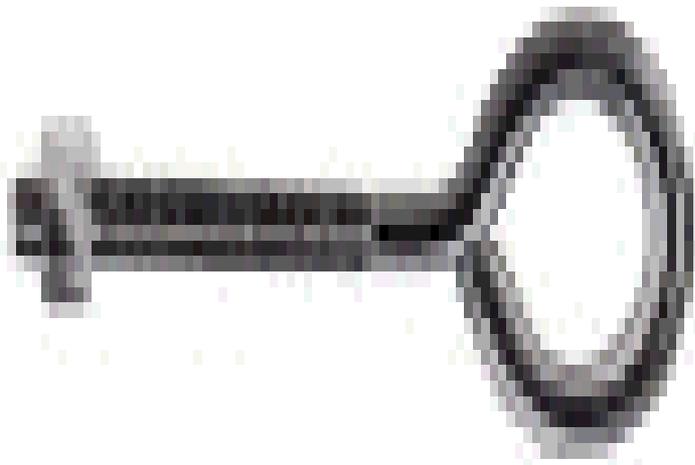


3 TYPES, HOOK, ROUND, CLEVIS END

**Maximum distortion allowed 5%
End or 10% of Hook distortion.**

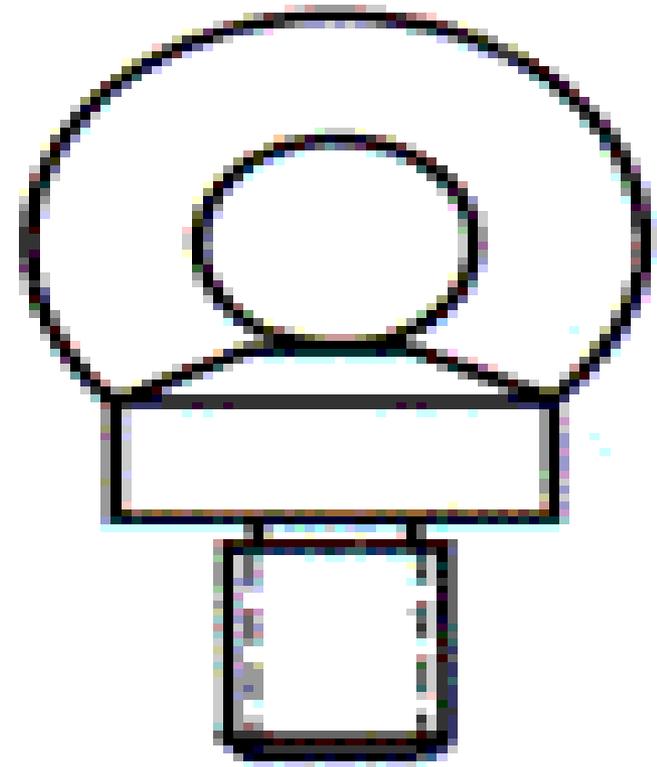
**Go See Pages
52 & 53**

EYE BOLTS



NON-SHOULDER

*Slowly I turned to
Page # 54*



SHOULDER

Angle of Lift is Critical

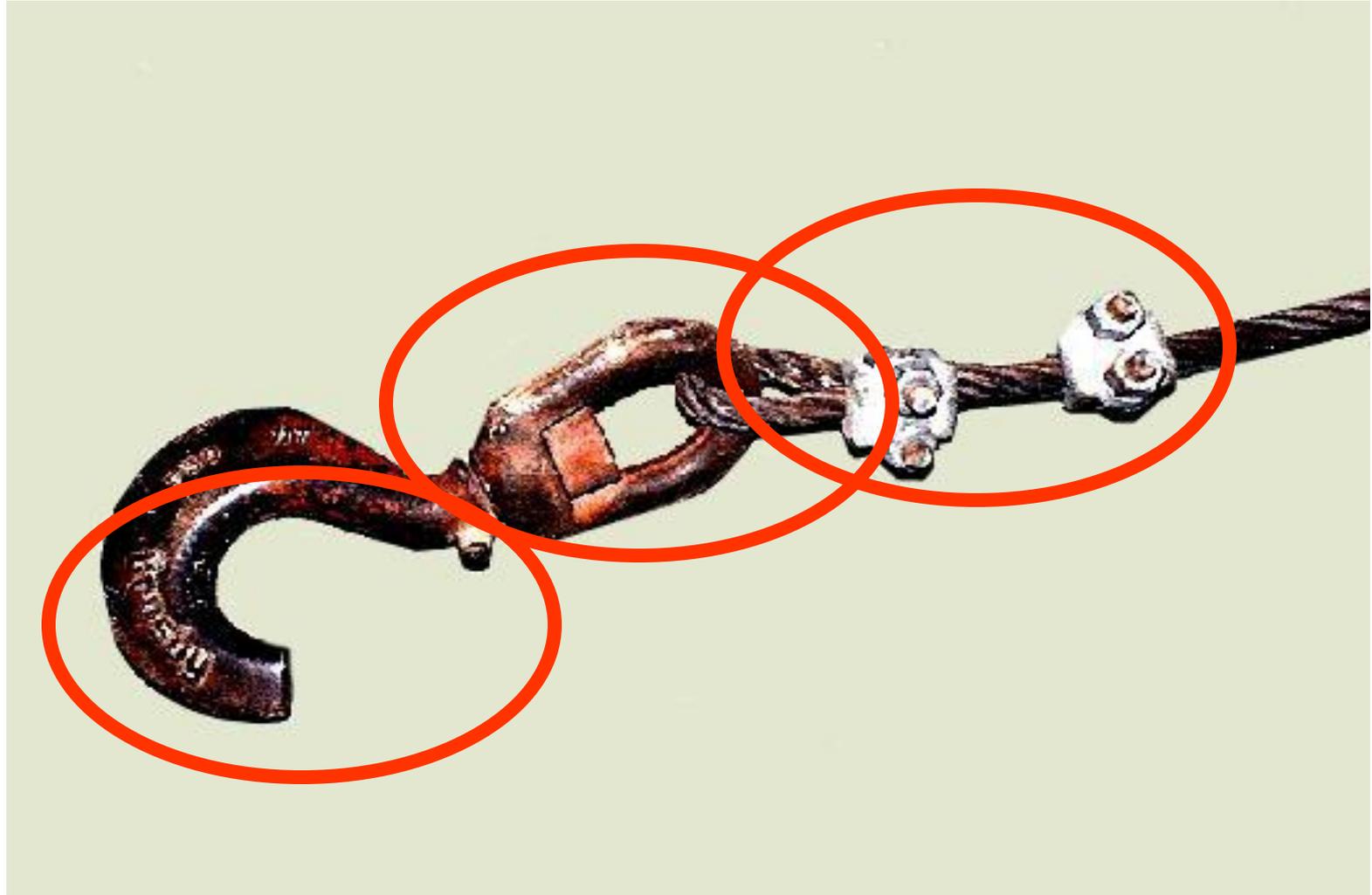
Max 5° for
Non-shoulder
Avoid angular
Loading



HOME MADE LIFTING DEVICE



What's wrong with this?

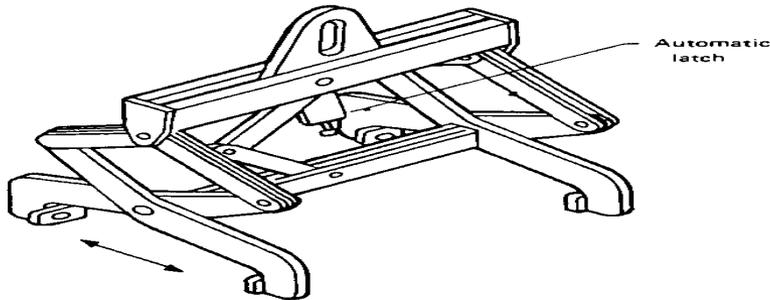


BELOW THE HOOK LIFTING DEVICES

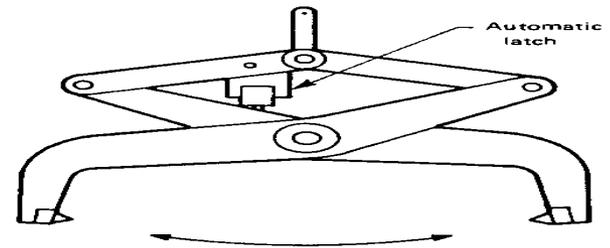


BELOW THE HOOK LIFTING DEVICES

PRESSURE GRIPPING LIFTERS — INDENTATION-TYPE

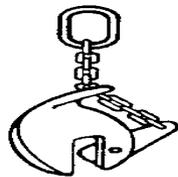


**AUTOMATIC SLAB TONG
(FOUR-POINT)**

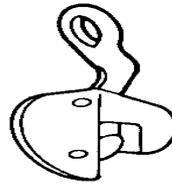


**AUTOMATIC INGOT TONG
(TWO-POINT)**

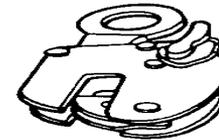
PRESSURE GRIPPING LIFTERS — FRICTION-TYPE



(a)



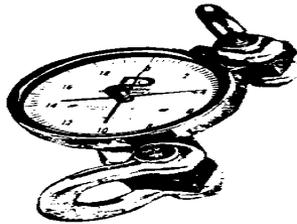
(b)



(c)
[Note (1)]

PLATE CLAMPS

BELOW THE HOOK LIFTING DEVICES

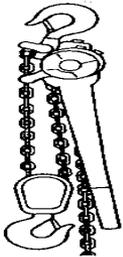


ANALOG

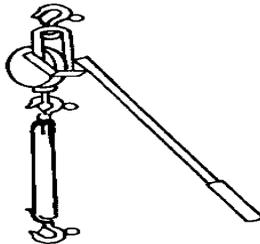
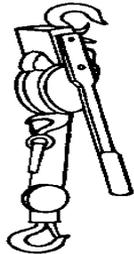


DIGITAL

LOAD INDICATING DEVICES



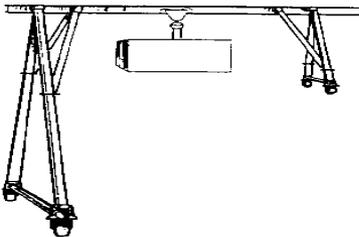
LEVER OPERATED



MANUAL HOISTS



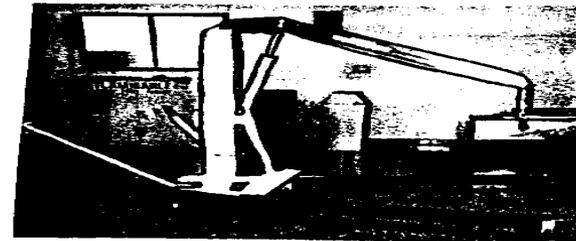
HAND CHAIN OPERATED



PORTABLE GANTRY



MISCELLANEOUS CRANES



FLOOR CRANE

BELOW THE HOOK SAFETY INSPECTIONS



LOAD RATING OF THE DEVICE

Especially In Line items i.e. Come-a-long

SPREADER BARS LIFT RATING?

DEFORMATIONS/USED CORRECTLY



**What does
Manufacture
Data say?**

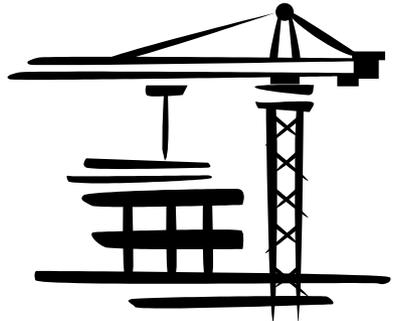
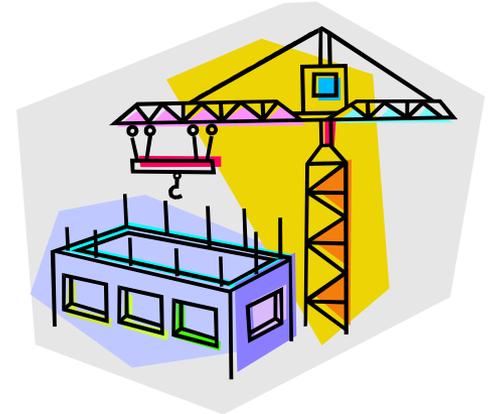
OTHER RIGGING CONSIDERATIONS



CRIBBING

BLOCK & TACKLE

JACKING/BLOCKING



WHAT IS THE WEIGHT OF THE LOAD TO MOVE?



Pages
55-58

Manufacturer's literature

Labels on machine or equipment

Bill of lading from shipping company

Weigh bill from trucking company

Scientific data sheets

Commercial/government scales

Standards of weights and measures

Field measurements & calculations

Estimate & lift (LMI reading)

NAVY CRANE CENTER



<http://portal.navfac.navy.mil/ncc>

DSN: 387-3803

FAX: (757) 967-3808

COMM: (757) 967 3803