TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

MECHANICAL MAINTENANCE INSTRUCTION 102

RIGGING EQUIPMENT PROGRAM

Approved: _____
Plant Manager

Date: January 13, 1981
General Revision

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*Revision 4/81

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TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT

MECHANICAL MAINTENANCE INSTRUCTION 102

RIGGING EQUIPMENT PROGRAM

1.0 Scope

This instruction establishes the program for inspecting, testing and the storing of rigging equipment.

2.0 Applicability

This instruction is applicable for slings (wire rope, fiber web, chains and fiber rope), strongbacks, lifting frames, chain hoists, rigging apparatus (shackles, eyebolts and turnbuckles) and special task or equipment rigging accessories which are available for use on site and not those pieces of rigging equipment in warehouse or power stores storage.

3.0 References

* DPM N74M15

DPM N78S2, Section VI, Part SW4

Handbook of Rigging, by W. E. Rossnagel

Care and Inspection of Wire Rope, National Safety Council, Data Sheet 667, 1977

Rigger's Handbook, by Broderick & Boscom Rope Company

Rigging Manual, by Construction Safety Association of Ontario

ANSI B30.9 - 1971 Slings

ANSI B30.16 - 1973 Overhead hoists

ANSI/ASME N45.2.2 - 1978 Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants

4.0 Precautions

1. Hand and eye protection should be worn when inspecting rigging equipment.
2. Caution should be exercised during load testing of equipment.
* 3. The use of piping systems as temporary supports shall adhere to the restrictions listed in DPM N74M15, Section 3.8.2, page 51.

5.0 Preparation for Maintenance

Annually all DNP employees involved with rigging operations and safety inspections will attend a training course in safety precautions and inspection criteria used to identify defective equipment.

*Revisions JRP

6.0 Temporary Conditions

Not Applicable

7.0 Program Outline

This instruction establishes control over the use, storage, and inspection of rigging equipment.

7.1 Storage

The rigging equipment mentioned in this instruction is to be stored in designated locations throughout the plant. These storage areas can be designated by the responsible supervisor. The areas are selected to protect the rigging equipment from mechanical damage, excessive heat, sparks, moisture, acid fumes, or other harmful environmental exposures.

The inventories of the storage areas are determined by the responsible supervisor and kept on file with the data sheets from this instruction. Attachment A has the storage area inventory form.

The storage areas will contain "tagged" rigging equipment such as slings, chains, lifting frames, strongbacks, chainhoist and special task or equipment rigging accessories plus "untagged" equipment such as shackles, turnbuckles, eyebolts and fiber rope.

7.2 Rigging Equipment Tagging

The tagged equipment are those pieces of equipment that requires records to be kept which indicates storage location, identification number, proof-load testing requirements, and the responsible supervisor. Attachment B has the format for such records. This equipment will have a metal tag attached which will indicate the following:

a. Identification number
b. Storage location
c. Type of material
d. Size

7.2 Rigging Equipment Tagging (Continued)

**e. Strand number
f. Rated Capacity
g. Plant component designed to handle (required only on all special task or equipment rigging accessories such as lifting frames, strongbacks, etc.)

**Required for slings only

* Attachment C has the suggested formats for these tags. Tagged equipment includes slings, portable hoists (all types) and special rigging accessories (strongbacks, lifting frames, etc.)
The untagged equipment are those pieces of equipment that do not require records to be kept as in tagged equipment. Generally, these items are those in which the manufacturer supplies safe working load ratings, which are typically industry standards and where physical deformation would render the equipment inoperative. Fiber rope is also considered untagged equipment, but there are special considerations governing its' use. Fiber rope is not to be used for lifting equipment when other lifting devices are available such as wire rope, web slings or hoists, unless an investigation by a craft foreman, consulting with a safety engineer or cognizant engineer guarantees personnel and equipment safety.
* Untagged equipment includes shackles, eyebolts, turnbuckles, and fiber rope.

7.3 Proof Testing Requirements

The proof testing requirements depends on the type equipment being tested. The following values for proof testing comes from applicable ANSI standards.

Item to be tested	Proof load (% of rated capacity)
Slings	
Wire rope	200
Alloy steel chain	200
Metal mesh	150
Synthetic webbing	Done by mfr. only
[1]Overhead Hoists	125
* Lifting Frames (Special rigging accessories)	125

[1]For hoist incorporating overload devices which prevent the lifting of 125% of rated load, a load test shall be accomplished with at least 100% of rated load. After which the function of the overload device shall be tested.

*Revision JRB

7.3 Proof Testing Requirements (Continued)

Defective equipment that has been repaired shall be prooftested prior to returning to service. Attachment D has safe working loads of various slings and ropes.

7.4 Inspections

* The storage areas will be inspected annually by an inspector(s) designated by the responsible supervisor, (see Attachment F for listing of authorized inspectors) for inventory and condition of rigging equipment. The inspector(s) will be familiar with the inspection criteria as shown in Attachment E plus the use of rigging equipment. Attachment A will serve as the inspection data sheet for the various storage locations and will be kept on file by the responsible supervisor. Rigging equipment shall be visually inspected prior to use on each shift. Equipment that is determined defective by the criteria in Attachment E will be identified with a "Defective Equipment Tag", TVA Form 18004. Disposition of defective equipment will be handled as follows:

Tagged equipment (those pieces of equipment with permanent metal I. D. tags) will either be repaired or disposed of at the discretion of the responsible supervisor. Repaired equipment must be prooftested before re-entering into inventory for work. Tagged defective equipment replacement is the responsibility of the responsible supervisor. The records which are kept by the responsible supervisor must reflect defective equipment and the equipment's resolution. If the equipment is disposed of, the replacement equipment must have a different identification number than the original because the identification number is unique to each piece of equipment.

Untagged equipment (those pieces of equipment without permanent metal I. D. tags) will be disposed of. Replacement of this equipment is the responsibility of the inspector.

The method of disposal will be to get a health physics survey of the equipment, if not contaminated, then place either in scrap metal container or trash container. If equipment is contaminated, then deliver to radwaste for disposal.

Equipment that is found to be missing from the storage location per the inventory will be handled as follows:

Tagged equipment that is found to be missing from a storage location will be replaced after a thorough search for the equipment is made. Replacement of missing tagged equipment is the responsibility of the responsible supervisor. In the event that a missing tagged item is discovered after a replacement has been added to the inventory, then the missing item will be returned to the inventory of the storage location and the replacement item will be left in the inventory of the storage location. The responsible supervisor's records shall reflect any equipment that is missing and adjust his inventory records accordingly.

Untagged equipment that is found missing from a storage location will be replaced. Replacement of missing untagged equipment is the responsibility of the inspector. No inventory change is required.

* Equipment found during the annual inspection of a storage area that is not on the inventory list of that particular storage area will be handled as follows:

Tagged equipment found in the wrong storage area will be returned.

*Revisions MM

to the correct area. This is the responsibility of the inspector.

Untagged equipment found in the wrong storage location will be left in that location but not added to the inventory. This will cause the inventory to be minimum equipment requirements.

Equipment found in storage areas that are not tagged but should be, will be removed from the storage location, surveyed by health physics and if uncontaminated, returned to the storage warehouse or power stores storage, but if the item is contaminated then the equipment must be tagged and entered into the inventory of a contaminated storage location. Tagging this equipment and adding it to a contaminated storage location is the responsibility of the responsible supervisor.

8.0 Do's

* Shoulders of eyebolts shall be in full contact with the load to be lifted or spacers must be placed between the eyebolt and the load.

Use softeners (spacer blocks) to pad sharp corners in order to protect slings and chokers.

Balance and equally distribute loads on legs of slings.

Secure loose-load material to prevent slippage.

Maintain as small an angle as possible between the sling leg and vertical.

Ensure that slings are entirely free when releasing loads.

* Center the crane on hoist over the load to prevent excessive swinging when lifted.

Use tag lines as needed to prevent load swing.

Cover or blunt the protruding ends of strands on slings or bridles.

Use three full tucks on wire rope strands when making eye splices, to maintain original strength of wire rope.

Keep hands away from pinch points.

Attach chain and ratchet hoist to building structures that will support the intended load.

Use chain and ratchet hoist whose hooks have safety latches.

Center the load properly in the throat of the hook.

9.0 Don'ts

Use job or shop hooks, eyes, links or makeshift fasteners.

Use the chain on hoists or come-alongs as a sling.

Use an extension or cheater on a come-along handle.

Use slings that are kinked, twisted, or knotted.

Use knots to secure wire rope.

*

*Revision JAB

*THIS PAGE IS TO BE DELETED.

*Revision 11

Attachment A

Rigging Equipment

Storage Area Inventory Form

_____
Storage Area

_____ _____
Date Responsible Supervisor

Contaminated Rigging Equipment (Yes/No)

Storage Area Inventory

*Identification Number	Type Equipment (Including Size and Capacity)	Remarks

*For Untagged Equipment Enter N/A for Identification Number

Attachment B

Rigging Equipment Record

Type of Equipment

Equipment Number

Storage Location

Type of Material

Prooftest Weight

Size/Strand Number

Date Last Prooftested

Rated Capacity

Responsible Supervisor

Plant Component Designed to Handle

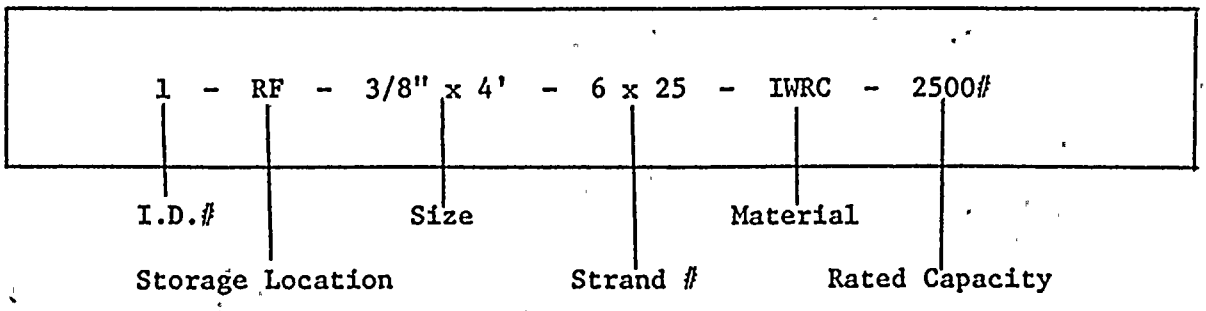
Remarks

Attachment C

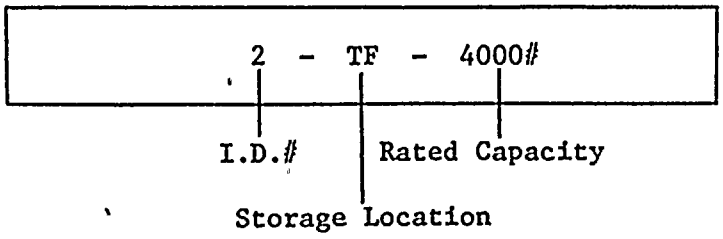
Rigging Equipment

Suggested Format for Equipment Tags

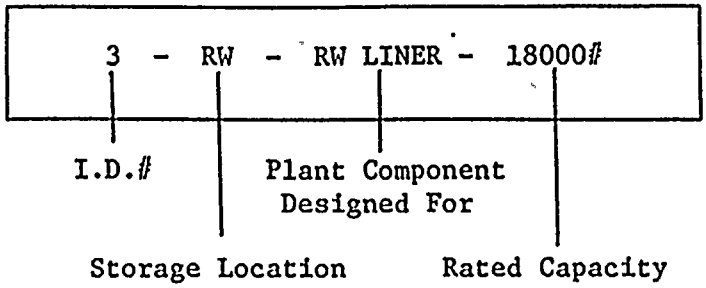
Sling Tag



Lifting Frame, Strongback, Chain Hoist Tag (for unspecified equipment rigging)



Rigging Equipment for Special Task or Equipment



ATTACHMENT D

RATED CAPACITIES FOR SINGLE LEG SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Rope Dia (Inches)	Rope Const	Rated Capacities, Tons (2,000 lb)								
		Vertical			Choker			Vertical Basket*		
		HT	MS	S	HT	MS	S	HT	MS	S
1/4	6 x 19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
5/16	6 x 19	0.76	0.79	0.85	0.57	0.59	0.64	1.5	1.6	1.7
3/8	6 x 19	1.1	1.1	1.2	0.80	0.85	0.91	2.1	2.2	2.4
7/16	6 x 19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
1/2	6 x 19	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3
9/16	6 x 19	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
5/8	6 x 19	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
3/4	6 x 19	3.9	4.4	4.8	2.9	3.3	3.6	7.8	8.8	9.5
7/8	6 x 19	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	6 x 19	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1-1/8	6 x 19	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1-1/4	6 x 37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1-3/8	6 x 37	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1-1/2	6 x 37	14.0	16.0	17.0	10.0	12.0	13.0	28.0	32.0	35.0
1-5/8	6 x 37	16.0	18.0	21.0	12.0	14.0	15.0	33.0	37.0	41.0
1-3/4	6 x 37	19.0	21.0	24.0	14.0	16.0	18.0	38.0	43.0	48.0
2	6 x 37	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

HT - Hand Tucked Splice and Hidden Tuck Splice
For hidden tuck splice (IWRC) use values in HT columns.
MS - Mechanical Splice
S - Swaged or Zinc Poured Socket

*These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where:
D Diameter of curvature around which the body of the sling is bent.
d Diameter of rope.

TABLE 4
RATED CAPACITIES FOR SINGLE LEG SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Rope Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb) Vertical HT	Vertical MS	Vertical S	Choker HT	Choker MS	Choker S	Vertical Basket* HT	Vertical Basket* MS	Vertical Basket* S
1/4	6 x 19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	6 x 19	0.81	0.87	0.92	0.61	0.65	0.69	1.6	1.7	1.8
3/8	6 x 19	1.1	1.2	1.3	0.86	0.93	0.98	2.3	2.5	2.6
7/16	6 x 19	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
1/2	6 x 19	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	6 x 19	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	6 x 19	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
3/4	6 x 19	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	6 x 19	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	6 x 19	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1-1/8	6 x 19	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1-1/4	6 x 37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1-3/8	6 x 37	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1-1/2	6 x 37	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1-5/8	6 x 37	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1-3/4	6 x 37	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	6 x 37	26.0	30.0	33.0	20.0	23.0	25.0	53.0	61.0	66.0

HT = Hand Tucked Splice
For hidden tuck splice (IWRC) use Table 1 values in HT column.
MS = Mechanical Splice.
S = Swaged or Zinc Poured Socket.
*These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S Slings is 20 or greater where:
D = Diameter of curvature around which the body of the sling is bent.
d = Diameter of rope.

TABLE 5
RATED CAPACITIES FOR SINGLE LEG SLINGS
CABLE LAID ROPE – MECHANICAL SPLICE ONLY
7 x 7 x 7 & 7 x 7 x 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
7 x 6 x 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

Rope Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb) Vertical	Choker	Vertical Basket*
1/4	7 x 7 x 7	0.50	0.38	1.0
3/8	7 x 7 x 7	1.1	0.81	2.0
1/2	7 x 7 x 7	1.8	1.4	3.7
5/8	7 x 7 x 7	2.8	2.1	5.5
3/4	7 x 7 x 7	3.8	2.9	7.6
5/8	7 x 7 x 19	2.9	2.2	5.8
3/4	7 x 7 x 19	4.1	3.0	8.1
7/8	7 x 7 x 19	5.4	4.0	11.0
1	7 x 7 x 19	6.9	5.1	14.0
1-1/8	7 x 7 x 19	8.2	6.2	16.0
1-1/4	7 x 7 x 19	9.6	7.4	20.0
3/4	7 x 6 x 19 IWRC	3.8	2.8	7.6
7/8	7 x 6 x 19 IWRC	5.0	3.8	10.0
1	7 x 6 x 19 IWRC	6.4	4.8	13.0
1-1/8	7 x 6 x 19 IWRC	7.7	5.8	15.0
1-1/4	7 x 6 x 19 IWRC	9.2	6.9	18.0
1-5/16	7 x 6 x 19 IWRC	10.0	7.5	20.0
1-3/8	7 x 6 x 19 IWRC	11.0	8.2	22.0
1-1/2	7 x 6 x 19 IWRC	13.0	9.6	26.0

*These values only apply when the D/d ratio is 10 or greater where:
D = Diameter of curvature around which the body of the sling is bent.
d = Diameter of rope.

RATED CAPACITIES FOR SINGLE LEG SLINGS
8-PART AND 6-PART BRAIDED ROPE
6 x 7 AND 6 x 19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE
7 x 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Ropes		Rated Capacities, Tons (2,000 lb)					
		Vertical		Choker		Basket, Vertical to 30 degree*	
Diameter (Inches)	Constr	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6 x 7	0.42	0.32	0.32	0.24	0.74	0.55
1/8	6 x 7	0.76	0.57	0.57	0.42	1.3	0.98
3/16	6 x 7	1.7	1.3	1.3	0.94	2.9	2.2
3/32	7 x 7	0.51	0.39	0.38	0.29	0.89	0.67
1/8	7 x 7	0.95	0.71	0.71	0.53	1.6	1.2
3/16	7 x 7	2.1	1.5	1.5	1.2	3.6	2.7
3/16	6 x 19	1.7	1.3	1.3	0.98	3.0	2.2
1/4	6 x 19	3.1	2.3	2.3	1.7	5.3	4.0
5/16	6 x 19	4.8	3.6	3.6	2.7	8.3	6.2
3/8	6 x 19	6.8	5.1	5.1	3.8	12.0	8.9
7/16	6 x 19	9.3	6.9	6.9	5.2	16.0	12.0
1/2	6 x 19	12.0	9.0	9.0	6.7	21.0	15.0
9/16	6 x 19	15.0	11.0	11.0	8.5	26.0	20.0
5/8	6 x 19	19.0	14.0	14.0	10.0	32.0	24.0
3/4	6 x 19	27.0	20.0	20.0	15.0	46.0	35.0
7/8	6 x 19	36.0	27.0	27.0	20.0	62.0	47.0
1	6 x 19	47.0	35.0	35.0	26.0	81.0	61.0

*These values only apply when the D/d ratio is 20 or greater where:
D = Diameter of curvature around which the body of the sling is bent.
d = Diameter of component rope.

RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Rope		Rated Capacities, Tons (2,000 lb)											
		2-Leg Bridle Slings						3-Leg Bridle Slings					
		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree	
Dia (Inches)	Constr	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6 x 19	0.85	0.88	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.76
5/16	6 x 19	1.3	1.4	1.1	1.1	0.76	0.79	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6 x 19	1.8	1.9	1.5	1.6	1.1	1.1	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6 x 19	2.5	2.6	2.0	2.2	1.4	1.5	3.7	4.0	3.0	3.2	2.1	2.3
1/2	6 x 19	3.2	3.4	2.6	2.8	1.8	2.0	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6 x 19	4.0	4.3	3.2	3.5	2.3	2.5	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6 x 19	4.8	5.3	4.0	4.4	2.8	3.1	7.3	8.0	5.9	6.5	4.2	4.6
3/4	6 x 19	6.8	7.6	5.5	6.2	3.9	4.4	10.0	11.0	8.3	9.3	5.8	6.6
7/8	6 x 19	8.9	10.0	7.3	8.4	5.1	5.9	13.0	15.0	11.0	13.0	7.7	8.9
1	6 x 19	11.0	13.0	9.4	11.0	6.7	7.7	17.0	20.0	14.0	16.0	10.0	11.0
1-1/8	6 x 19	14.0	16.0	12.0	13.0	8.4	9.5	22.0	24.0	18.0	20.0	13.0	14.0
1-1/4	6 x 37	17.0	19.0	14.0	16.0	9.8	11.0	25.0	29.0	21.0	23.0	15.0	17.0
1-3/8	6 x 37	20.0	23.0	17.0	19.0	12.0	13.0	31.0	35.0	25.0	28.0	18.0	20.0
1-1/2	6 x 37	24.0	27.0	20.0	22.0	14.0	16.0	36.0	41.0	30.0	33.0	21.0	24.0
1-5/8	6 x 37	28.0	32.0	23.0	26.0	16.0	18.0	43.0	48.0	35.0	39.0	25.0	28.0
1-3/4	6 x 37	33.0	37.0	27.0	30.0	19.0	21.0	49.0	56.0	40.0	45.0	28.0	32.0
2	6 x 37	43.0	48.0	35.0	39.0	25.0	28.0	64.0	72.0	52.0	59.0	37.0	41.0

HT = Hand Tucked Splice.
MS = Mechanical Splice

RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 x 19 and 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Rope Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb) 2-Leg Bridle Sling: Vert 30 degree Horz 60 degree HT	MS	45 degree Angle HT	MS	Vert 60 degree Horz 30 degree HT	MS	3-Leg Bridle Sling: Vert 30 degree Horz 60 degree HT	MS	45 degree Angle HT	MS	Vert 60 degree Horz 30 degree HT	MS
1/4	6 x 19	0.92	0.97	0.75	0.79	0.53	0.56	1.4	1.4	1.1	1.2	0.79	0.84
5/16	6 x 19	1.4	1.5	1.1	1.2	0.81	0.87	2.1	2.3	1.7	1.8	1.2	1.3
3/8	6 x 19	2.0	2.1	1.6	1.8	1.1	1.2	3.0	3.2	2.4	2.6	1.7	1.9
7/16	6 x 19	2.7	2.9	2.2	2.4	1.5	1.7	4.0	4.4	3.3	3.6	2.3	2.5
1/2	6 x 19	3.4	3.8	2.8	3.1	2.0	2.2	5.1	5.7	4.2	4.6	3.0	3.3
9/16	6 x 19	4.3	4.8	3.5	3.9	2.5	2.7	6.4	7.1	5.2	5.8	3.7	4.1
5/8	6 x 19	5.2	5.9	4.2	4.8	3.0	3.4	7.8	8.8	6.4	7.2	4.5	5.1
3/4	6 x 19	7.3	8.4	5.9	6.9	4.2	4.9	11.0	13.0	8.9	10.0	6.3	7.3
7/8	6 x 19	9.6	11.0	7.8	9.3	5.5	6.6	14.0	17.0	12.0	14.0	8.3	9.9
1	6 x 19	12.0	15.0	10.0	12.0	7.2	8.5	19.0	22.0	15.0	18.0	11.0	13.0
1-1/8	6 x 19	16.0	18.0	13.0	15.0	9.0	10.0	23.0	27.0	19.0	22.0	13.0	16.0
1-1/4	6 x 37	18.0	21.0	15.0	17.0	10.0	12.0	27.0	32.0	22.0	26.0	16.0	18.0
1-3/8	6 x 37	22.0	25.0	18.0	21.0	13.0	15.0	33.0	38.0	27.0	31.0	19.0	22.0
1-1/2	6 x 37	26.0	30.0	21.0	25.0	15.0	17.0	39.0	45.0	32.0	37.0	23.0	26.0
1-5/8	6 x 37	31.0	35.0	25.0	29.0	18.0	20.0	46.0	53.0	38.0	43.0	27.0	31.0
1-3/4	6 x 37	35.0	41.0	29.0	33.0	20.0	24.0	53.0	61.0	43.0	50.0	31.0	35.0
2	6 x 37	46.0	53.0	37.0	43.0	26.0	30.0	68.0	79.0	56.0	65.0	40.0	46.0

HT = Hand Tucked Splice
MS = Mechanical Splice

RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
CABLE LAID ROPE – MECHANICAL SPLICE ONLY
7 x 7 x 7 AND 7 x 7 x 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
7 x 6 x 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

Rope Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb) 2-Leg Bridle Sling: Vert 30 deg Horz 60 deg	45 degree Angle	Vert 60 deg Horz 30 deg	3-Leg Bridle Sling: Vert 30 deg Horz 60 deg	45 degree Angle	Vert 60 deg Horz 30 deg
1/4	7 x 7 x 7	0.87	0.71	0.50	1.3	1.1	0.75
3/8	7 x 7 x 7	1.9	1.5	1.1	2.8	2.3	1.6
1/2	7 x 7 x 7	3.2	2.6	1.8	4.8	3.9	2.8
5/8	7 x 7 x 7	4.8	3.9	2.8	7.2	5.9	4.2
3/4	7 x 7 x 7	6.6	5.4	3.8	9.9	8.1	5.7
5/8	7 x 7 x 19	5.0	4.1	2.9	7.5	6.1	4.3
3/4	7 x 7 x 19	7.0	5.7	4.1	10.0	8.6	6.1
7/8	7 x 7 x 19	9.3	7.6	5.4	14.0	11.0	8.1
1	7 x 7 x 19	12.0	9.7	6.9	18.0	14.0	10.0
1-1/8	7 x 7 x 19	14.0	12.0	8.2	21.0	17.0	12.0
1-1/4	7 x 7 x 19	17.0	14.0	9.9	26.0	21.0	15.0
3/4	7x6x19 IWRC	6.6	5.4	3.8	9.9	8.0	5.7
7/8	7x6x19 IWRC	8.7	7.1	5.0	13.0	11.0	7.5
1	7x6x19 IWRC	11.0	9.0	6.4	17.0	13.0	9.6
1-1/8	7x6x19 IWRC	13.0	11.0	7.7	20.0	16.0	11.0
1-1/4	7x6x19 IWRC	16.0	13.0	9.2	24.0	20.0	14.0
1-5/16	7x6x19 IWRC	17.0	14.0	10.0	26.0	21.0	15.0
1-3/8	7x6x19 IWRC	19.0	15.0	11.0	28.0	23.0	16.0
1-1/2	7x6x19 IWRC	22.0	18.0	13.0	33.0	27.0	19.0

RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS
8-PART AND 6-PART BRAIDED ROPE
6 x 7 AND 6 x 19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE
7 x 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Rope		Rated Capacities, Tons (2,000 lb)											
		2-Leg Bridle Slings						3-Leg Bridle Slings					
		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree		Vert 30 degree Horz 60 degree		45 degree Angle		Vert 60 degree Horz 30 degree	
Dia (Inches)	Constr	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6 x 7	0.74	0.55	0.60	0.45	0.42	0.32	1.1	0.83	0.90	0.68	0.64	0.48
1/8	6 x 7	1.3	0.98	1.1	0.80	0.76	0.57	2.0	1.5	1.6	1.2	1.1	0.85
3/16	6 x 7	2.9	2.2	2.4	1.8	1.7	1.3	4.4	3.3	3.6	2.7	2.5	1.9
3/32	7 x 7	0.89	0.67	0.72	0.55	0.51	0.39	1.3	1.0	1.1	0.82	0.77	0.58
1/8	7 x 7	1.6	1.2	1.3	1.0	0.95	0.71	2.5	1.8	2.0	1.5	1.4	1.1
3/16	7 x 7	3.6	2.7	2.9	2.2	2.1	1.5	5.4	4.0	4.4	3.3	3.1	2.3
3/16	6 x 19	3.0	2.2	2.4	1.8	1.7	1.3	4.5	3.4	3.7	2.8	2.6	1.9
1/4	6 x 19	5.3	4.0	4.3	3.2	3.1	2.3	8.0	6.0	6.5	4.9	4.6	3.4
5/16	6 x 19	8.3	6.2	6.7	5.0	4.8	3.6	12.0	9.3	10.0	7.6	7.1	5.4
3/8	6 x 19	12.0	8.9	9.7	7.2	6.8	5.1	18.0	13.0	14.0	11.0	10.0	7.7
7/16	6 x 19	16.0	12.0	13.0	9.8	9.3	6.9	24.0	18.0	20.0	15.0	14.0	10.0
1/2	6 x 19	21.0	15.0	17.0	13.0	12.0	9.0	31.0	23.0	25.0	19.0	18.0	13.0
9/16	6 x 19	26.0	20.0	21.0	16.0	15.0	11.0	39.0	29.0	32.0	24.0	23.0	17.0
5/8	6 x 19	32.0	24.0	26.0	20.0	19.0	14.0	48.0	36.0	40.0	30.0	28.0	21.0
3/4	6 x 19	46.0	35.0	38.0	28.0	27.0	20.0	69.0	52.0	56.0	42.0	40.0	30.0
7/8	6 x 19	62.0	47.0	51.0	38.0	36.0	27.0	94.0	70.0	76.0	57.0	54.0	40.0
1	6 x 19	81.0	61.0	66.0	50.0	47.0	35.0	122.0	91.0	99.0	74.0	70.0	53.0

RATED CAPACITIES FOR STRAND LAID GROMMET – HAND TUCKED
IMPROVED PLOW STEEL GRADE ROPE

ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	 Vertical	 Choker	 Vertical Basket*
1/4	7 x 19	0.85	0.64	1.7
5/16	7 x 19	1.3	1.0	2.6
3/8	7 x 19	1.9	1.4	3.8
7/16	7 x 19	2.6	1.9	5.2
1/2	7 x 19	3.3	2.5	6.7
9/16	7 x 19	4.2	3.1	8.4
5/8	7 x 19	5.2	3.9	10.0
3/4	7 x 19	7.4	5.6	15.0
7/8	7 x 19	10.0	7.5	20.0
1	7 x 19	13.0	9.7	26.0
1-1/8	7 x 19	16.0	12.0	32.0
1-1/4	7 x 37	18.0	14.0	37.0
1-3/8	7 x 37	22.0	16.0	44.0
1-1/2	7 x 37	26.0	19.0	52.0

* These values only apply when the D/d ratio is 5 or greater where:
D = Diameter of curvature around which rope is bent.
d = Diameter of rope body.

RATED CAPACITIES FOR CABLE LAID GROMMET – HAND TUCKED 7 × 6 × 7 AND 7 × 6 × 19 CONSTRUCTIONS IMPROVED PLOW STEEL GRADE ROPE 7 × 7 × 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
3/8	7 × 6 × 7	1.3	0.95	2.5
9/16	7 × 6 × 7	2.8	2.1	5.6
5/8	7 × 6 × 7	3.8	2.8	7.6
3/8	7 × 7 × 7	1.6	1.2	3.2
9/16	7 × 7 × 7	3.5	2.6	6.9
5/8	7 × 7 × 7	4.5	3.4	9.0
5/8	7 × 6 × 19	3.9	3.0	7.9
3/4	7 × 6 × 19	5.1	3.8	10.0
15/16	7 × 6 × 19	7.9	5.9	16.0
1-1/8	7 × 6 × 19	11.0	8.4	22.0
1-5/16	7 × 6 × 19	15.0	11.0	30.0
1-1/2	7 × 6 × 19	19.0	14.0	39.0
1-11/16	7 × 6 × 19	24.0	18.0	49.0
1-7/8	7 × 6 × 19	30.0	22.0	60.0
2-1/4	7 × 6 × 19	42.0	31.0	84.0
2-5/8	7 × 6 × 19	56.0	42.0	112.0

* These values only apply when the D/d ratio is 5 or greater where:
D = Diameter of curvature around which cable body is bent.
d = Diameter of cable body.

RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS-MECHANICAL JOINT IMPROVED PLOW STEEL GRADE ROPE

ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	6 × 19 IWRC	0.92	0.69	1.8
3/8	6 × 19 IWRC	2.0	1.5	4.1
1/2	6 × 19 IWRC	3.6	2.7	7.2
5/8	6 × 19 IWRC	5.6	4.2	11.0
3/4	6 × 19 IWRC	8.0	6.0	16.0
7/8	6 × 19 IWRC	11.0	8.1	21.0
1	6 × 19 IWRC	14.0	10.0	28.0
1-1/8	6 × 19 IWRC	18.0	13.0	35.0
1-1/4	6 × 37 IWRC	21.0	15.0	41.0
1-3/8	6 × 37 IWRC	25.0	19.0	50.0
1-1/2	6 × 37 IWRC	29.0	22.0	59.0

* These values only apply when the D/d ratio is 5 or greater where:
D = Diameter of curvature around which rope is bent.
d = Diameter of rope body.

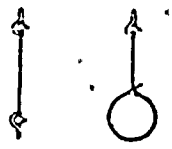
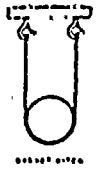
RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS-MECHANICAL JOINT
7 x 7 x 7 AND 7 x 7 x 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
7 x 6 x 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)		
Dia (Inches)	Constr	 Vertical	 Choker	 Vertical Basket*
1/4	7 x 7 x 7	0.83	0.62	1.6
3/8	7 x 7 x 7	1.8	1.3	3.5
1/2	7 x 7 x 7	3.0	2.3	6.1
5/8	7 x 7 x 7	4.5	3.4	9.1
3/4	7 x 7 x 7	6.3	4.7	12.0
5/8	7 x 7 x 19	4.7	3.5	9.5
3/4	7 x 7 x 19	6.7	5.0	13.0
7/8	7 x 7 x 19	8.9	6.6	18.0
1	7 x 7 x 19	11.0	8.5	22.0
1-1/8	7 x 7 x 19	14.0	10.0	28.0
1-1/4	7 x 7 x 19	17.0	12.0	33.0
3/4	7 x 6 x 19 IWRC	6.2	4.7	12.0
7/8	7 x 6 x 19 IWRC	8.3	6.2	16.0
1	7 x 6 x 19 IWRC	10.0	7.9	21.0
1-1/8	7 x 6 x 19 IWRC	13.0	9.7	26.0
1-1/4	7 x 6 x 19 IWRC	16.0	12.0	31.0
1-3/8	7 x 6 x 19 IWRC	18.0	14.0	37.0
1-1/2	7 x 6 x 19 IWRC	22.0	16.0	43.0

* These values only apply when the D/d value is 5 or greater where:
D = Diameter of curvature around which cable body is bent.
d = Diameter of cable body.

METAL MESH

RATED CAPACITIES
(lb)

SLING WIDTH IN INCHES	 VERTICAL OR CHOKER	 VERTICAL BASKET	EFFECT OF ANGLE ON RATED CAPACITIES IN BASKET HITCH		
			 30 deg Vertical 60 deg Horizontal	 45 deg Vertical 45 deg Horizontal	 60 deg Vertical 30 deg Horizontal
35-CS and 35-SS					
2	1,500	3,000	2,600	2,100	1,500
3	2,700	5,400	4,700	3,800	2,700
4	4,000	8,000	6,900	5,600	4,000
6	6,000	12,000	10,400	8,400	6,000
8	8,000	16,000	13,800	11,300	8,000
10	10,000	20,000	17,000	14,100	10,000
12	12,000	24,000	20,700	16,900	12,000
14	14,000	28,000	24,200	19,700	14,000
16	16,000	32,000	27,700	22,500	16,000
18	18,000	36,000	31,100	25,400	18,000
20	20,000	40,000	34,600	28,200	20,000
43-CS and 43-SS					
2	1,350	2,700	2,300	1,900	1,400
3	2,000	4,000	3,500	2,800	2,000
4	2,700	5,400	4,700	3,800	2,700
6	4,500	9,000	7,800	6,400	4,500
8	6,000	12,000	10,400	8,500	6,000
10	7,500	15,000	13,000	10,600	7,500
12	9,000	18,000	15,600	12,700	9,000
14	10,500	21,000	18,200	14,800	10,500
16	12,000	24,000	20,800	17,000	12,000
18	13,500	27,000	23,400	19,100	13,500
20	15,000	30,000	26,000	21,200	15,000
59-CS and 59-SS					
2	900	1,800	1,600	1,300	900
3	1,400	2,800	2,400	2,000	1,400
4	2,000	4,000	3,500	2,800	2,000
6	3,000	6,000	5,200	4,200	3,000
8	4,000	8,000	6,900	5,700	4,000
10	5,000	10,000	8,600	7,100	5,000
12	6,000	12,000	10,400	8,500	6,000
14	7,000	14,000	12,100	9,900	7,000
16	8,000	16,000	13,900	11,300	8,000
18	9,000	18,000	15,600	12,700	9,000
20	10,000	20,000	17,300	14,100	10,000

POLYPROPYLENE ROPE SLINGS

ROPE DIAMETER Nominal In Inches	Nominal Weight Per 100 ft In Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor = 6)											
			EYE AND EYE SLING						ENDLESS SLING					
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH			
					Angle of Rope to Horizontal						Angle of Rope to Horizontal			
					90 deg	60 deg	45 deg	30 deg			90 deg	60 deg	45 deg	30 deg
					Angle of Rope to Vertical						Angle of Rope to Vertical			
					0 deg	30 deg	45 deg	60 deg			0 deg	30 deg	45 deg	60 deg
1/2	4.7	3,990	650	350	1,300	1,200	950	650	1,200	600	2,400	2,100	1,700	1,200
9/16	6.1	4,845	800	400	1,600	1,400	1,100	800	1,500	750	2,900	2,500	2,100	1,500
5/8	7.5	5,890	1,000	500	2,000	1,700	1,400	1,000	1,800	900	3,500	3,100	2,500	1,800
3/4	10.7	8,075	1,300	700	2,700	2,300	1,900	1,300	2,400	1,200	4,900	4,200	3,400	2,400
13/16	12.7	9,405	1,600	800	3,100	2,700	2,200	1,600	2,800	1,400	5,600	4,900	4,000	2,800
7/8	15.0	10,925	1,800	900	3,600	3,200	2,600	1,800	3,300	1,600	6,600	5,700	4,600	3,300
1	18.0	13,300	2,200	1,100	4,400	3,800	3,100	2,200	4,000	2,000	8,000	6,900	5,600	4,000
1 1/16	20.4	15,200	2,500	1,300	5,100	4,400	3,600	2,500	4,600	2,300	9,100	7,900	6,500	4,600
1 1/8	23.7	17,385	2,900	1,500	5,800	5,000	4,100	2,900	5,200	2,600	10,500	9,000	7,400	5,200
1 1/4	27.0	19,950	3,300	1,700	6,700	5,800	4,700	3,300	6,000	3,000	12,000	10,500	8,500	6,000
1 5/16	30.5	22,325	3,700	1,900	7,400	6,400	5,300	3,700	6,700	3,400	13,500	11,500	9,500	6,700
1 1/2	38.5	28,215	4,700	2,400	9,400	8,100	6,700	4,700	8,500	4,200	17,000	14,500	12,000	8,500
1 5/8	47.5	34,200	5,700	2,900	11,500	9,900	8,100	5,700	10,500	5,100	20,500	18,000	14,500	10,500
1 3/4	57.0	40,850	6,800	3,400	13,500	12,000	9,600	6,800	12,500	6,100	24,500	21,000	17,500	12,500
2	69.0	49,400	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2 1/8	80.0	57,950	9,700	4,800	19,500	16,500	13,500	9,700	17,500	8,700	35,000	30,100	24,500	17,500
2 1/4	92.0	65,550	11,000	5,500	22,000	19,000	15,500	11,000	19,500	9,900	39,500	34,000	28,000	19,500
2 1/2	107.0	76,000	12,500	6,300	25,500	22,000	18,000	12,500	23,000	11,500	45,500	39,500	32,500	23,000
2 5/8	120.0	85,500	14,500	7,100	28,500	24,500	20,000	14,500	25,500	13,000	51,500	44,500	36,500	25,500

POLYESTER ROPE SLINGS

ROPE DIAMETER Nominal In Inches	Nominal Weight Per 100 ft In Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor = 9)											
			EYE AND EYE SLING						ENDLESS SLING					
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH			
					Angle of Rope to Horizontal						Angle of Rope to Horizontal			
					90 deg	60 deg	45 deg	30 deg			90 deg	60 deg	45 deg	30 deg
					Angle of Rope to Vertical						Angle of Rope to Vertical			
					0 deg	30 deg	45 deg	60 deg			0 deg	30 deg	45 deg	60 deg
1/2	8.0	6,080	700	350	1,400	1,200	950	700	1,200	600	2,400	2,100	1,700	1,200
9/16	10.2	7,600	850	400	1,700	1,500	1,200	850	1,500	750	3,000	2,600	2,200	1,500
5/8	13.0	9,500	1,100	550	2,100	1,800	1,500	1,100	1,900	950	3,800	3,300	2,700	1,900
3/4	17.5	11,875	1,300	650	2,600	2,300	1,900	1,300	2,400	1,200	4,800	4,100	3,400	2,400
13/16	21.0	14,725	1,600	800	3,300	2,800	2,300	1,600	2,900	1,500	5,900	5,100	4,200	2,900
7/8	25.0	17,100	1,900	950	3,800	3,300	2,700	1,900	3,400	1,700	6,800	5,900	4,800	3,400
1	30.5	20,900	2,300	1,200	4,600	4,000	3,300	2,300	4,200	2,100	8,400	7,200	5,900	4,200
1 1/16	34.5	24,225	2,700	1,300	5,400	4,700	3,800	2,700	4,800	2,400	9,700	8,400	6,900	4,800
1 1/8	40.0	28,025	3,100	1,600	6,200	5,400	4,400	3,100	5,600	2,800	11,000	9,700	7,900	5,600
1 1/4	46.3	31,540	3,500	1,800	7,000	6,100	5,000	3,500	6,300	3,200	12,500	11,000	8,900	6,300
1 5/16	52.5	35,625	4,000	2,000	7,900	6,900	5,600	4,000	7,100	3,600	14,500	12,500	10,000	7,100
1 1/2	66.8	44,460	4,900	2,500	9,900	8,600	7,000	4,900	8,900	4,400	18,000	15,500	12,500	8,900
1 5/8	82.0	54,150	6,000	3,000	12,000	10,400	8,500	6,000	11,000	5,400	21,500	19,000	15,500	11,000
1 3/4	98.0	64,410	7,200	3,600	14,500	12,500	10,000	7,200	13,000	6,400	26,000	22,500	18,000	13,000
2	118.0	76,000	8,400	4,200	17,000	14,500	12,000	8,400	15,000	7,600	30,500	26,500	21,500	15,000
2 1/8	135.0	87,400	9,700	4,900	19,500	17,000	13,500	9,700	17,500	8,700	35,000	30,500	24,500	17,500
2 1/4	157.0	101,650	11,500	5,700	22,500	19,500	16,000	11,500	20,500	10,000	40,500	35,000	29,000	20,500
2 1/2	181.0	115,900	13,000	6,400	26,000	22,500	18,000	13,000	23,000	11,500	46,500	40,000	33,000	23,000
2 5/8	205.0	130,150	14,500	7,200	29,000	25,000	20,500	14,500	26,000	13,000	52,000	45,000	37,000	26,000

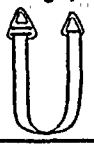
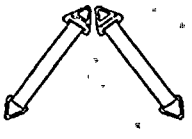
NYLON ROPE SLINGS

ROPE DIAMETER Nominal In Inches	Nominal Weight Per 100 ft In Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor = 9)											
			EYE AND EYE SLING						ENDLESS SLING					
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH			
					Angle of Rope to Horizontal						Angle of Rope to Horizontal			
					90 deg	60 deg	45 deg	30 deg			90 deg	60 deg	45 deg	30 deg
					Angle of Rope to Vertical						Angle of Rope to Vertical			
					0 deg	30 deg	45 deg	60 deg			0 deg	30 deg	45 deg	60 deg
1/2	6.5	6,080	700	350	1,400	1,200	950	700	1,200	600	2,400	2,100	1,700	1,200
9/16	8.3	7,600	850	400	1,700	1,500	1,200	850	1,500	750	3,000	2,600	2,200	1,500
5/8	10.5	9,880	1,100	550	2,200	1,900	1,600	1,100	2,000	1,000	4,000	3,400	2,800	2,000
3/4	14.5	13,490	1,500	750	3,000	2,600	2,100	1,500	2,700	1,400	5,400	4,700	3,800	2,700
13/16	17.0	16,150	1,800	900	3,600	3,100	2,600	1,800	3,200	1,600	6,400	5,600	4,600	3,200
7/8	20.0	19,000	2,100	1,100	4,200	3,700	3,000	2,100	3,800	1,900	7,600	6,600	5,400	3,800
1	26.0	23,750	2,600	1,300	5,300	4,600	3,700	2,600	4,800	2,400	9,500	8,200	6,700	4,800
1 1/16	29.0	27,360	3,000	1,500	6,100	5,300	4,300	3,000	5,500	2,700	11,000	9,500	7,700	5,500
1 1/8	34.0	31,350	3,500	1,700	7,000	6,000	5,000	3,500	6,300	3,100	12,500	11,000	8,900	6,300
1 1/4	40.0	35,625	4,000	2,000	7,900	6,900	5,600	4,000	7,100	3,600	14,500	12,500	10,000	7,100
1 5/16	45.0	40,850	4,500	2,300	9,100	7,900	6,400	4,500	8,200	4,100	16,500	14,000	12,000	8,200
1 1/2	55.0	50,350	5,600	2,800	11,000	9,700	7,900	5,600	10,000	5,000	20,000	17,500	14,000	10,000
1 5/8	68.0	61,750	6,900	3,400	13,500	12,000	9,700	6,900	12,500	6,200	24,500	21,500	17,500	12,500
1 3/4	83.0	74,100	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2	95.0	87,400	9,700	4,900	19,500	17,000	13,500	9,700	17,500	8,700	35,000	30,500	24,500	17,500
2 1/8	109.0	100,700	11,000	5,600	22,500	19,500	16,000	11,000	20,000	10,000	40,500	35,000	28,500	20,000
2 1/4	129.0	118,750	13,000	6,600	26,500	23,000	18,500	13,000	24,000	12,000	47,500	41,000	33,500	24,000
2 1/2	149.0	133,000	15,000	7,400	29,500	25,500	21,000	15,000	26,500	13,500	53,000	46,000	37,500	26,500
2 5/8	168.0	153,900	17,100	8,600	34,000	29,500	24,000	17,000	31,000	15,500	61,500	53,500	43,500	31,000

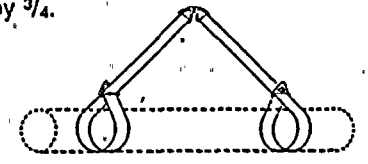
MANILA ROPE SLINGS

ROPE DIAMETER. Nominal In inches	Nominal Weight Per 100 ft in Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor - 5)											
			EYE AND EYE SLING						ENDLESS SLING					
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH			
					Angle of Rope to Horizontal						Angle of Rope to Horizontal			
					90 deg	60 deg	45 deg	30 deg			90 deg	60 deg	45 deg	30 deg
					Angle of Rope to Vertical						Angle of Rope to Vertical			
					0 deg	30 deg	45 deg	60 deg			0 deg	30 deg	45 deg	60 deg
1/2	7.5	2,650	550	250	1,100	900	750	550	950	500	1,900	1,700	1,400	950
9/16	10.4	3,450	700	350	1,400	1,200	1,000	700	1,200	600	2,500	2,200	1,800	1,200
5/8	13.3	4,400	900	450	1,800	1,500	1,200	900	1,600	800	3,200	2,700	2,200	1,600
3/4	16.7	5,400	1,100	550	2,200	1,900	1,500	1,100	2,000	950	3,900	3,400	2,800	2,000
13/16	19.5	6,500	1,300	650	2,600	2,300	1,800	1,300	2,300	1,200	4,700	4,100	3,300	2,300
7/8	22.5	7,700	1,500	750	3,100	2,700	2,200	1,500	2,800	1,400	5,600	4,800	3,900	2,800
1	27.0	9,000	1,800	900	3,600	3,100	2,600	1,800	3,200	1,600	6,500	5,600	4,600	3,200
1 1/16	31.3	10,500	2,100	1,100	4,200	3,600	3,000	2,100	3,800	1,900	7,600	6,600	5,400	3,800
1 1/8	36.0	12,000	2,400	1,200	4,800	4,200	3,400	2,400	4,300	2,200	8,600	7,500	6,100	4,300
1 1/4	41.7	13,500	2,700	1,400	5,400	4,700	3,800	2,700	4,900	2,400	9,700	8,400	6,900	4,900
1 5/16	47.9	15,000	3,000	1,500	6,000	5,200	4,300	3,000	5,400	2,700	11,000	9,400	7,700	5,400
1 1/2	59.9	18,500	3,700	1,850	7,400	6,400	5,200	3,700	6,700	3,300	13,500	11,500	9,400	6,700
1 5/8	74.6	22,500	4,500	2,300	9,000	7,800	6,400	4,500	8,100	4,100	16,000	14,000	11,500	8,100
1 3/4	89.3	26,500	5,300	2,700	10,500	9,200	7,500	5,300	9,500	4,800	19,000	16,500	13,500	9,500
2	107.5	31,000	6,200	3,100	12,500	10,500	8,800	6,200	11,000	5,600	22,500	19,500	16,000	11,000
2 1/8	125.0	36,000	7,200	3,600	14,500	12,500	10,000	7,200	13,000	6,500	26,000	22,500	18,500	13,000
2 1/4	146.0	41,000	8,200	4,100	16,500	14,000	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2 1/2	166.7	46,500	9,300	4,700	18,500	16,000	13,000	9,300	16,500	8,400	33,500	29,000	23,500	16,500
2 5/8	190.8	52,000	10,500	5,200	21,000	18,000	14,500	10,500	18,500	9,500	37,500	32,500	26,500	18,500

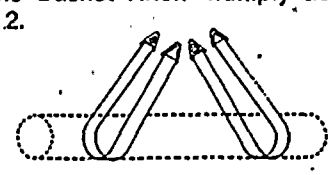
DACRON WEB SLINGS
(5000 lb/in Material)

Web Width (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (SAFETY FACTOR = 5) (Eye & Eye, Twisted Eye, Triangle Fittings, Choker Fittings)					
	Single Vertical Hitch 	Single Choker Hitch 	Single Basket Hitch (Vertical Legs) 	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined  		
				60°	45°	30°
1	1,000	750	2,000	1,730	1,400	1,000
2	2,000	1,500	4,000	3,460	2,830	2,000
3	3,000	2,250	6,000	5,200	4,250	3,000
4	4,000	3,000	8,000	6,950	5,650	4,000
5	5,000	3,750	10,000	8,660	7,070	5,000
6	6,000	4,500	12,000	10,400	8,500	6,000
7	7,000	5,250	14,000	12,100	9,900	7,000
8	8,000	6,000	16,000	13,850	11,300	8,000
9	9,000	6,750	18,000	15,600	12,700	9,000
10	10,000	7,500	20,000	17,350	14,100	10,000
11	11,000	8,250	22,000	19,100	15,500	11,000
12	12,000	9,000	24,000	20,800	17,000	12,000

If used with Choker Hitch multiply above values by 3/4.



For Double Basket Hitch multiply above values by 2.



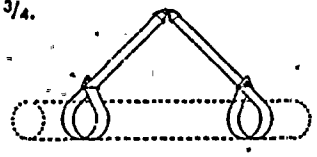
Note: For Safe Working Loads of Endless or Grommet Slings, Multiply Above Values by 2.

*These are approximate values. Each sling should have manufacturer's tag showing safe working loads.

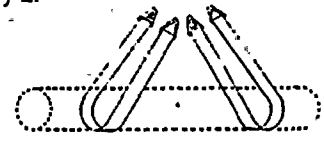
NYLON WEB SLINGS
(6000 lb/in Material)

Web Width (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (SAFETY FACTOR = 5) (Eye & Eye, Twisted Eye, Triangle Fittings, Choker Fittings)					
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Legs)	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined		
				60°	45°	30°
1	1,200	900	2,400	2,080	1,700	1,200
2	2,400	1,800	4,800	4,160	3,400	2,400
3	3,600	2,700	7,200	6,240	5,100	3,600
4	4,800	3,600	9,600	8,300	6,800	4,800
5	6,000	4,500	12,000	10,400	8,500	6,000
6	7,200	5,400	14,400	12,500	10,200	7,200
7	8,400	6,300	16,800	14,550	11,900	8,400
8	9,600	7,200	19,200	16,600	13,600	9,600
9	10,800	8,100	21,600	18,700	15,300	10,800
10	12,000	9,000	24,000	20,800	17,000	12,000
11	13,200	9,900	26,400	22,900	18,650	13,200
12	14,400	10,800	28,800	25,000	20,400	14,400

If used with Choker Hitch multiply above values by 3/4.



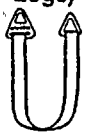
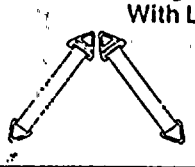
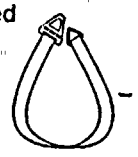
For Double Basket Hitch multiply above values by 2.



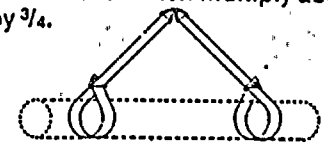
Note: For Safe Working Loads of Endless or Grommet Slings, Multiply Above Values by 2.

**These are approximate values. Each sling should have manufacturer's tag showing safe working loads.

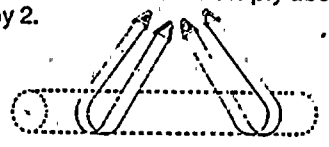
NYLON WEB SLINGS
(8000 lb/in Material)

Web Width (Inches)	MAXIMUM SAFE WORKING LOADS — POUNDS (SAFETY FACTOR = 5) (Eye & Eye, Twisted Eye, Triangle Fittings, Choker Fittings)					
	Single Vertical Hitch 	Single Choker Hitch 	Single Basket Hitch (Vertical Legs) 	2-Leg Bridle Hitch & Single Basket Hitch With Legs Inclined  		
				60°	45°	30°
1	1,600	1,200	3,200	2,770	2,260	1,600
2	3,200	2,400	6,400	5,550	4,520	3,200
3	4,800	3,600	9,600	8,300	6,800	4,800
4	6,400	4,800	12,800	11,100	9,050	6,400
5	8,000	6,000	16,000	13,850	11,300	8,000
6	9,600	7,200	19,200	16,600	13,600	9,600
7	11,200	8,400	22,400	19,400	15,800	11,200
8	12,800	9,600	25,600	22,200	18,100	12,800
9	14,400	10,800	28,800	25,000	20,400	14,400
10	16,000	12,000	32,000	27,700	22,600	16,000
11	17,600	13,200	35,200	30,500	24,900	17,600
12	19,200	14,400	38,400	33,300	27,200	19,200

If used with Choker Hitch multiply above values by 3/4.



For Double Basket Hitch multiply above values by 2.



Note: For Safe Working Loads of Endless or Grommet Slings, Multiply Above Values by 2.

**These are approximate values. Each sling should have manufacturer's tag showing safe working loads.

Attachment E

1.0 Wire Rope Sling Criteria

Wire rope slings are to be disposed of if any of the following conditions are found.

1. Broken Wires (See Figures 1.1 and 1.2)

   a. Six randomly distributed broken wires in one lay.

   b. Three broken wires in one strand in one lay.

   c. Two or more broken wires within one lay of a swaged or zinced-on fitting.

   d. Snagged, nicked, or severely bent wires are to count as broken wires.

   e. Any IWRC wire breakage or interior rope wire breakage.

2. Reduction of outside wire diameter by 1/3 of its' original diameter. (See Figure 1.3)

3. Corrosion or Rusting

   a. Discoloration of the wires.

   b. Pitting on surface of outside wires.

   c. Rusting of any extent.

4. Distorted wire strands (See Figures 1.4 and 1.5)

   a. Crushed rope or strands.

   b. Kinked rope.

   c. High stranding.

   d. Bird caging.

   e. Gaps or excessive clearance between strands.

5. Heat Damage

   a. Electric arc strikes.

   b. Torch burns.

6. Reduction in rope diameter (See Figure 1.6)

   a. Any marked (noticeable) reduction in area along the rope length.

   b. Any marked (noticeable) increase of lay length.

c. Diameter (rope) reduced by following amounts.

Rope Diameters (inches)	Maximum Diameter Reduction (inches)
up to 3/4	3/64
7/8 to 1 1/8	1/16
1 1/4 to 1 1/2	3/32

7. Damaged or inadequate splices, eyes, and end attachments (See Figure 1.7)

   a. Broken wires (same criteria as condition #1 above).

   b. Worn outside wires (same criteria as condition #2 above).

   c. Distorted, pinched, jammed or loose strands.

   d. Cracked fittings.

   e. Tucked strands coming loose.

   f. Thimble biting into rope.

   g. Thimble or fitting (end attachment) distorted.

   h. Strand or wire slippage on end attachment.

8. Core Protrusion (See Figure 1.8)

Broken wire ends should be removed from the rope by bending the broken ends backwards and forwards with a pair of pliers. In this way, the wire is more likely to break inside the rope where the ends are tucked away between the strands where they will do no harm. If broken wires are removed from a wire rope then the data sheets shall reflect how many broken wires and their approximate location along the length of the sling from the tagged end's eye splice. This is the responsibility of the inspector.

1.1 Wire Rope Sling Definitions

Lay - The length measured along a rope in which it takes a single strand to make one complete revolution about the rope. (See Figure 1.9)

Strand - A collection of individual rope items (wires or rope fiber) that are wound together in a common assemble. Strands are then wound together to produce a rope. (See Figure 1.12)

Thimble - Metal sleeve in the eye of a sling.

Rope Diameter - The diameter of rope measured at its' widest point (See Figure 1.10)

Wire Diameter - The diameter of a single individual wire that makes up a wire rope.

IWRC - Independent Wire Rope Core - The core of a wire rope that is composed of a separate and independent wire rope strand.

Lang Lay - Denotes when the individual wires in a strand are wound in the same direction as the strands are about a wire rope core. (See Figure 1.11)

Regular Lay - Denotes when the individual wires in a strand are wound in the opposite direction as the strands are about a wire rope core. (See Figure 1.11)

Strand Classification - The system by which wire rope is classified according to strand composition and number of strands.

Figure 1.1 Wire Breaks Inside a Rope

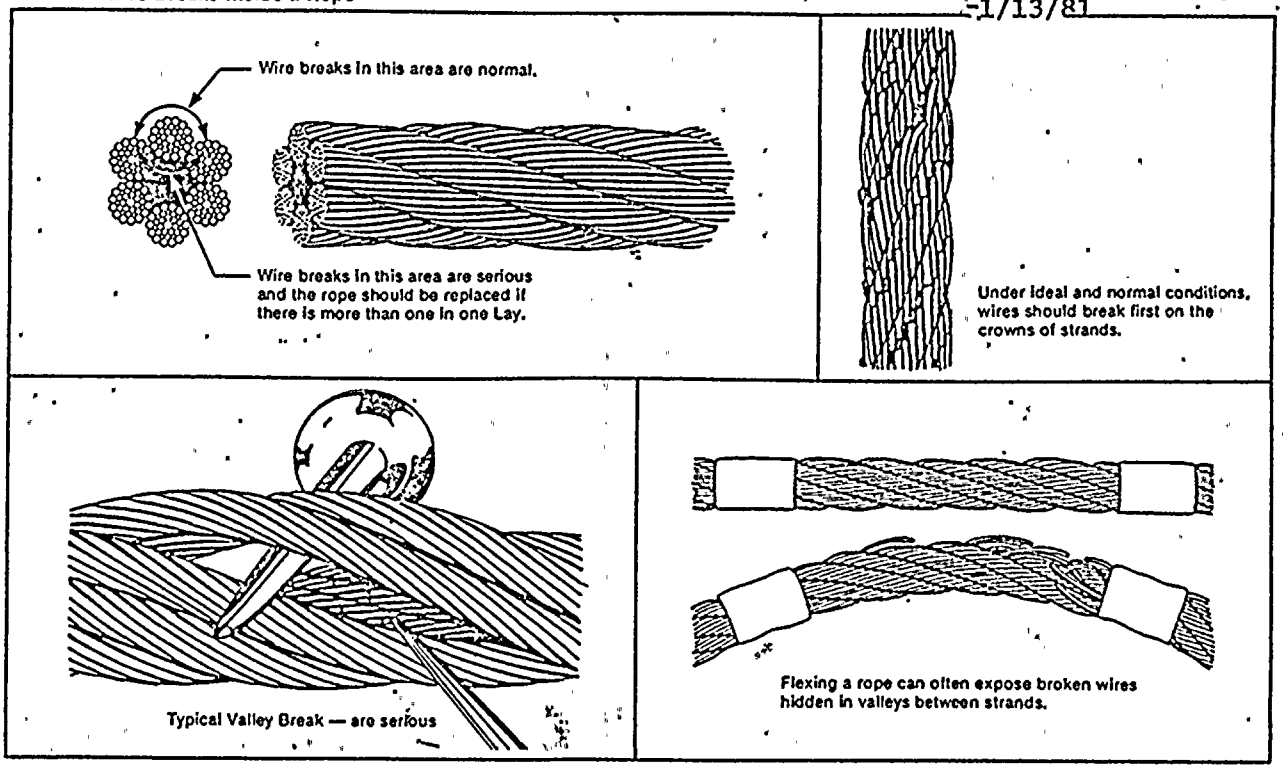


Figure 1.2 Broken Wires Near Fittings

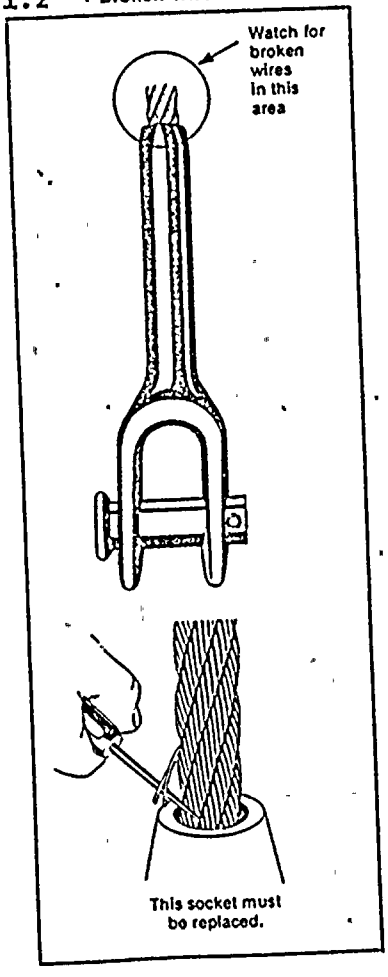
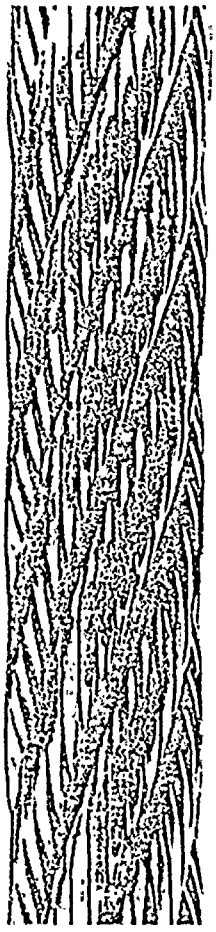
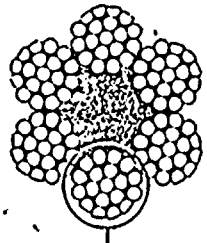


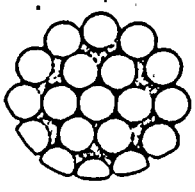
Figure 1.3 Worn and Abraded Ropes



Normal Surface Wear

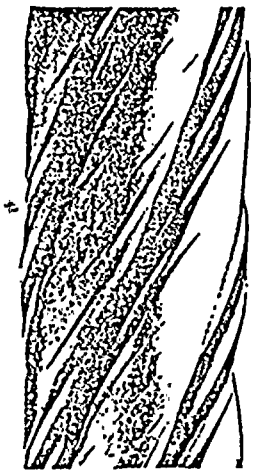


Section Through Worn Section



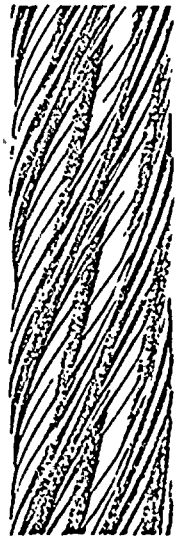
Enlarged View of Single Strand

When the surface wires are worn by 1/3 or more of their diameter the rope must be replaced.



Severe wear in Langs Lay, caused by abrasion at cross-over points on multi-layer drum windings.

Severe wear and protrusion of core caused by high bearing pressure on drum and sheaves.

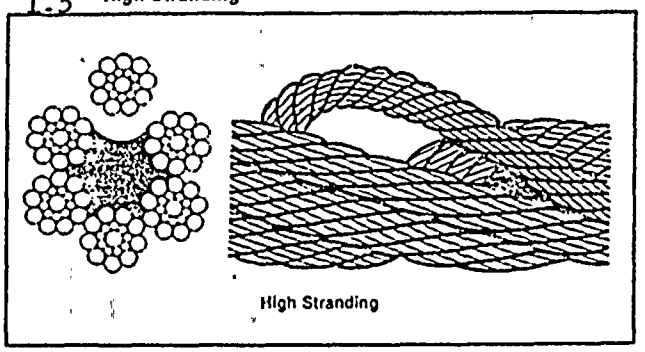


Normal surface wear of 1/3 outer wire dia. on Langs Lay rope.

Normal surface wear of 1/3 outer wire dia. on Regular Lay rope.

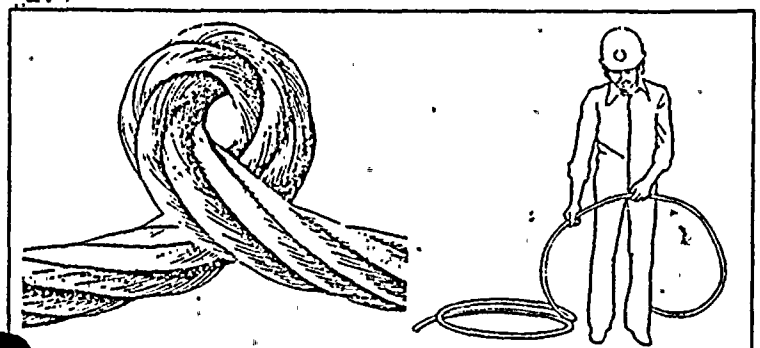
Rope strand indicating the result of severe surface wear and inter-strand nicking, caused by excessive rope loading.

Figure 1.5 High Stranding

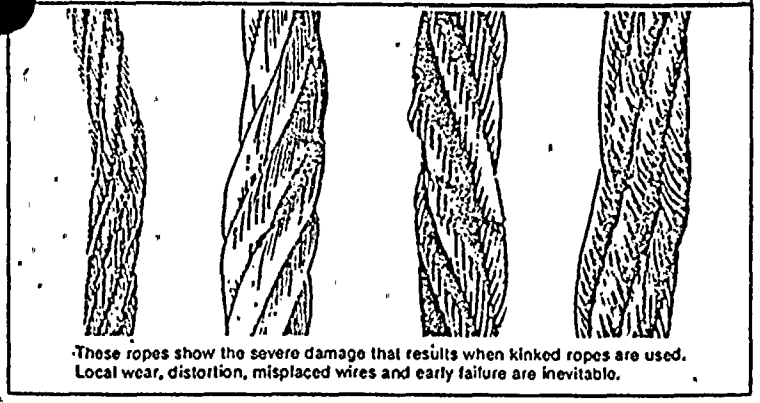


High Stranding

Figure 1.4 Rope Kinks

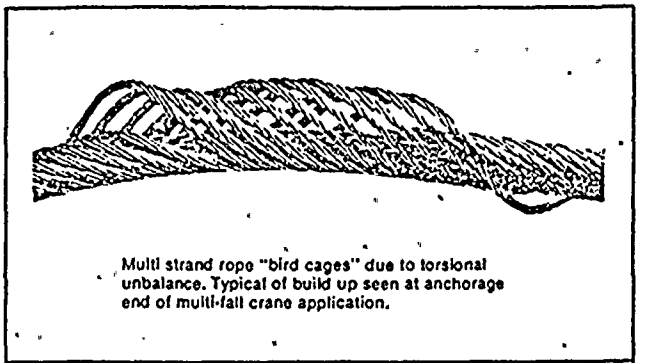


An open kink such as this is often caused by improper handling and uncoiling as shown.

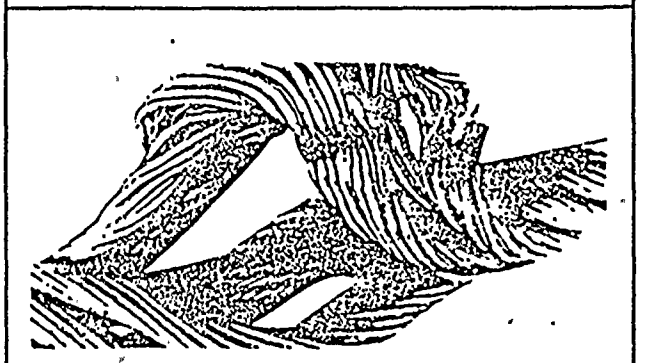


These ropes show the severe damage that results when kinked ropes are used. Local wear, distortion, misplaced wires and early failure are inevitable.

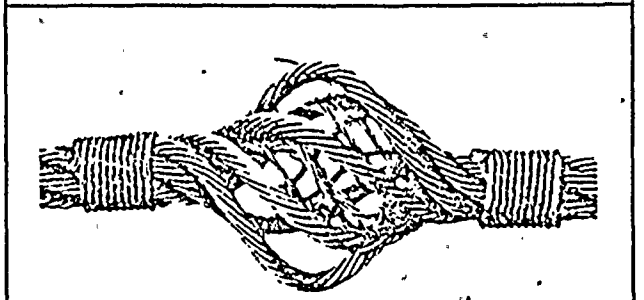
"Bird Cages"



Multi strand rope "bird cages" due to torsional unbalance. Typical of build up seen at anchorage end of multi-fall crane application.

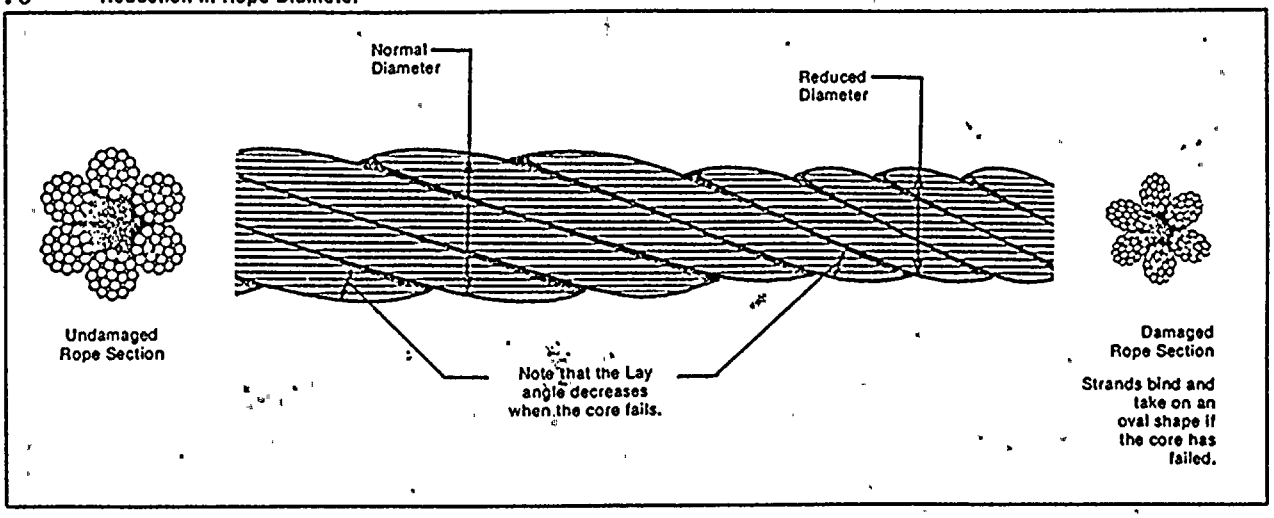


A "bird cage" which has been forced through a tight sheave.



A "bird cage" caused by sudden release of tension and resultant rebound of rope from overloaded condition. These strands and wires will not return to their original positions.

Figure 1.6 Reduction In Rope Diameter



Rope Stretch

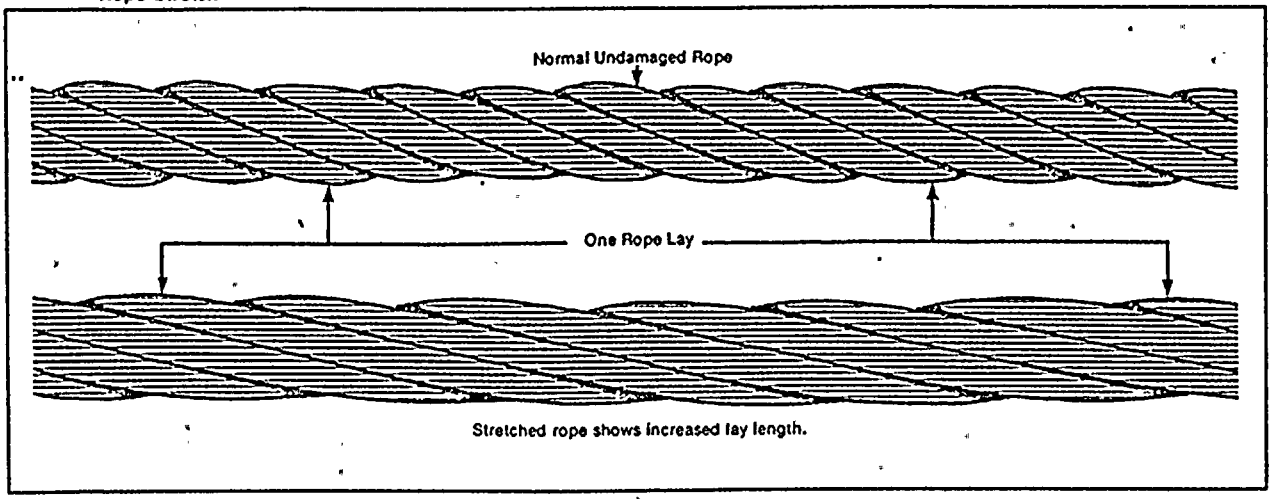
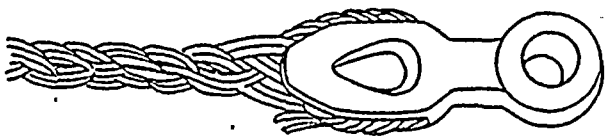


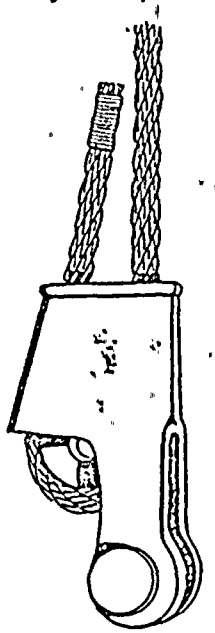
Figure 1.7 Damaged Splice



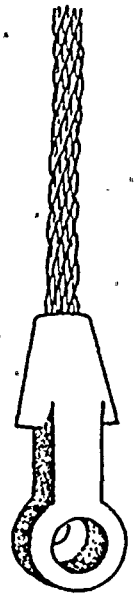
HAND SPLICE
Failure may occur at the first splice tuck.

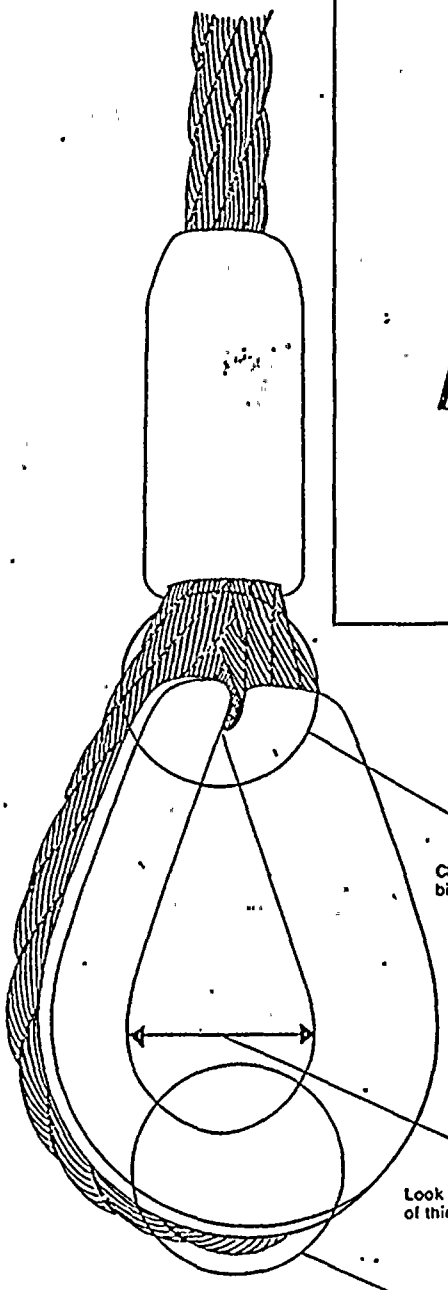
Damaged End Fittings

WEDGE SOCKET
This type of fitting will usually fail at the socket bowl.



POURED ZINC SOCKET
Failure frequently starts at the socket base where the wire enters the fitting.





SWAGED SOCKETS
Failure may occur at the base of the swaged fitting in this area.

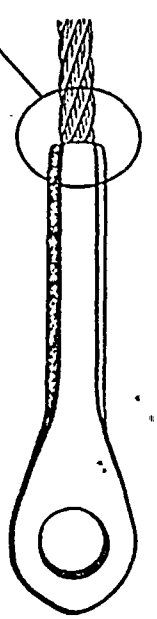


Figure 1.8 Core Protrusion

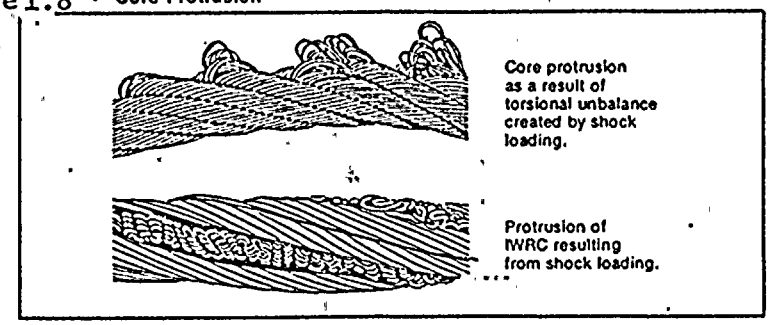
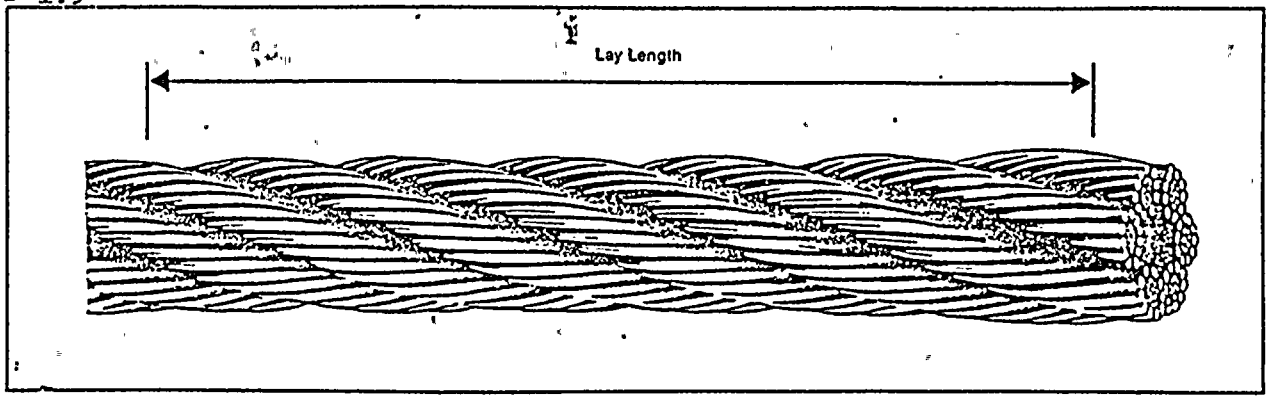


Figure 1.9 Measurement of Ropes Lay Length



Regular Lay Rope — Wires and Strands Laid in Opposite Directions

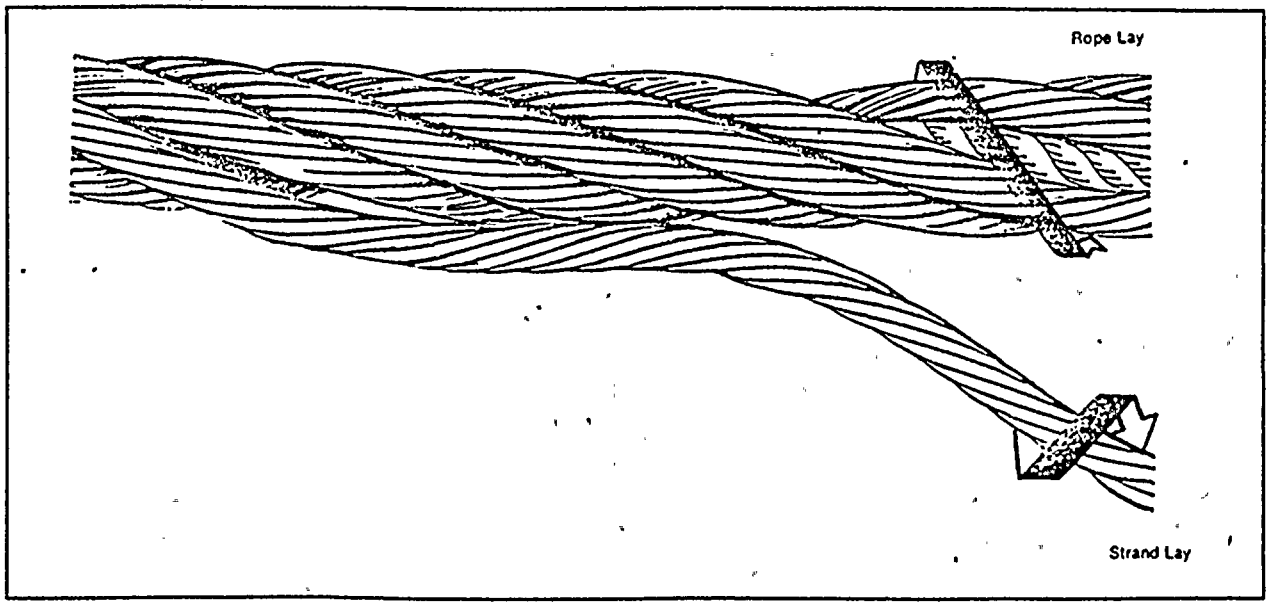


Figure 1.10 Measurement of Rope Diameter

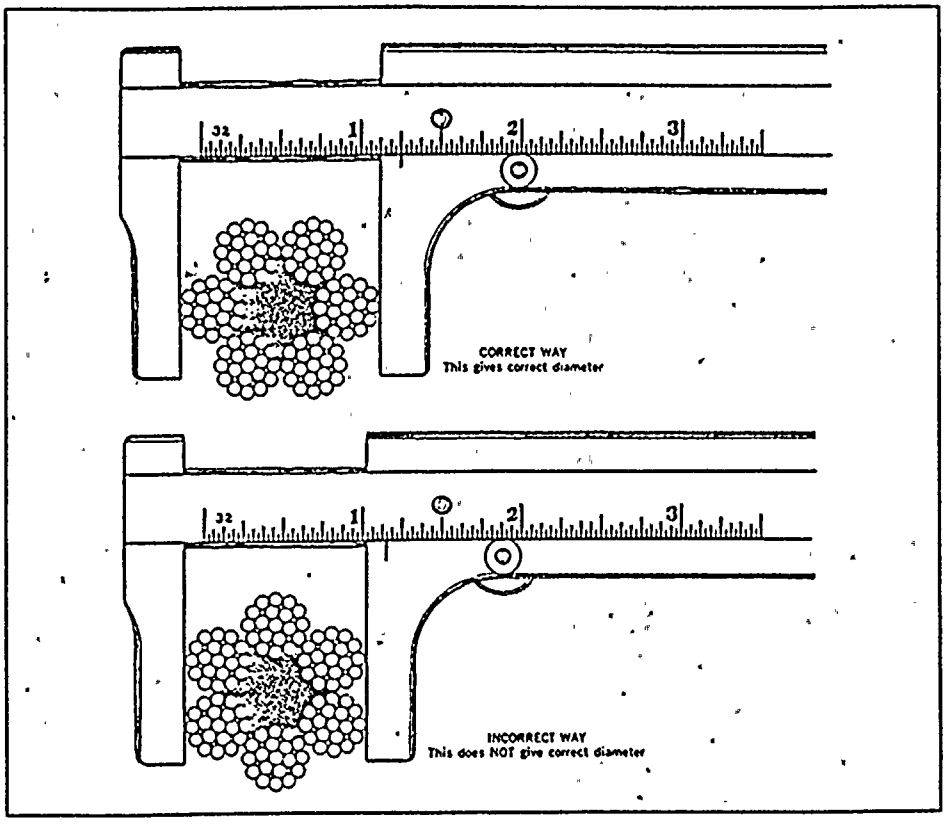


Figure 1.11 Rope Lay

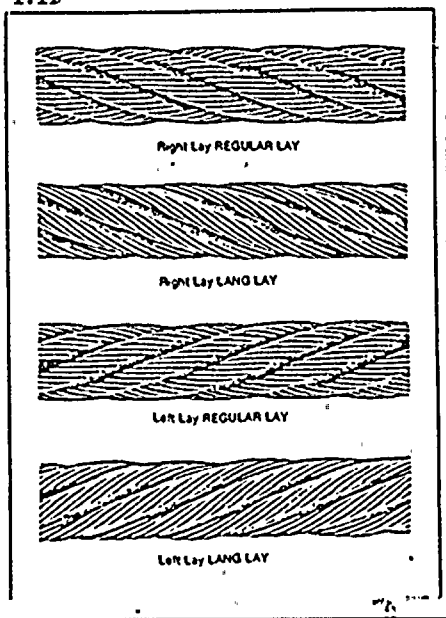
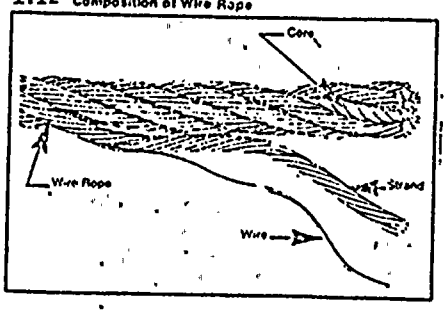


Figure 1.12 Composition of Wire Rope



2.0 Fiber Rope - Synthetic (Nylon) and Natural (Manila) - Criteria

Fiber rope inspection procedure and criteria is as follows.

1. Examine the outside of the rope for cuts, nicks, signs of abrasion, burns, unlaying strands and marked area reduction. Rope should be discarded when a cut, nick, or wear is found that reduces the diameter of a single strand by 25 to 30%, when any burns or local discoloration is found, when strand unlaying is found or local reduction in area is discovered. Rope should also be discarded when diameter reduction due to stretching is 25% less than original diameter. Excessive oil on new rope indicates overloading, further checks will indicate condition of rope. (See Figure 2.1)
2. Examine splices for loose tucks and eye thimbles. These items should be replaced, repaired or discarded.
3. If the rope is large enough, open up a strand and attempt to pull out any loose yarn which indicates overloading. If yarn is easily pulled from the strand then discard the rope.
4. Open up the inside of the rope by carefully untwisting the rope, taking care not to kink the strands. Check for an accumulation of powderlike dust which indicates internal wear or broken yarns. The interior should be bright and clean.
5. On ropes with a core, gently try and pull out the core. A broken core indicates overloading, requiring rope replacement.
6. If possible pull individual yarns from end of rope and attempt to pull them apart by hand. If they break easily then replace the rope.
7. If any of the following is found then discard the rope. (See Figure 2.2)

a. Inside of rope dirty.

b. Strands beginning to inlay.

c. Rope lost its stiffness and elasticity.

d. Rope is high stranded.

e. Core protrudes through outer strands, or

f. Discoloration indicating heat or acid contact.

8. General Notes:

Knots significantly reduce the original strength of a rope. A load should not be left suspended on a fiber rope, especially manila. (See Figure 2.4)

2.1 Fiber Rope - Definitions

Fiber - The individual segments of the raw material which make up a rope. (See Figure 2.3)

Yarn - Fiber that is spun into strands. (See Figure 2.3)

Stiffness - Resistance to bending.

Elasticity - Ability to absorb shock loading and return to its' normal unloaded dimension.

Figure 2.1 Typical Rope Damage to Watch for During Inspections

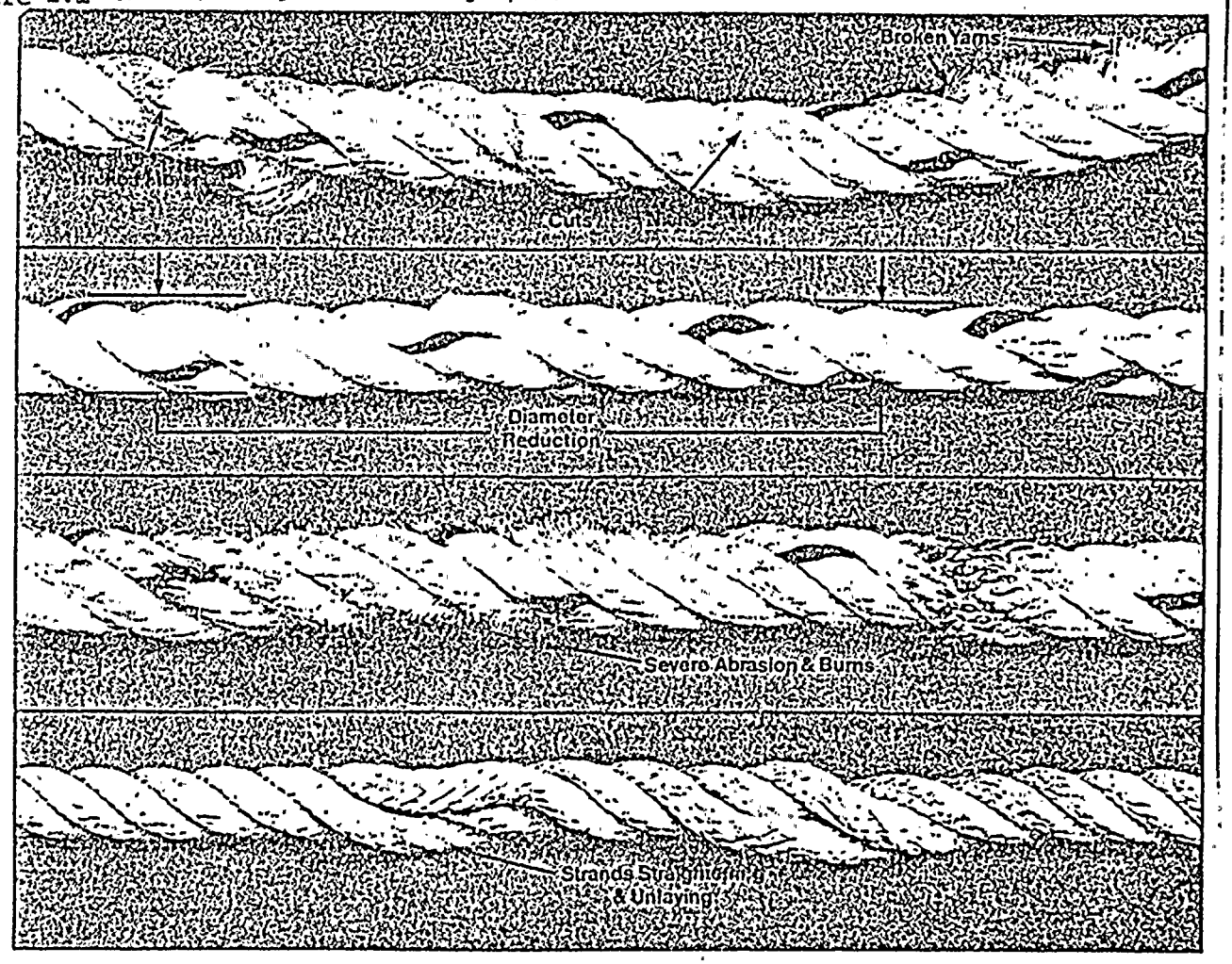


Figure 2.2 High Stranded Rope

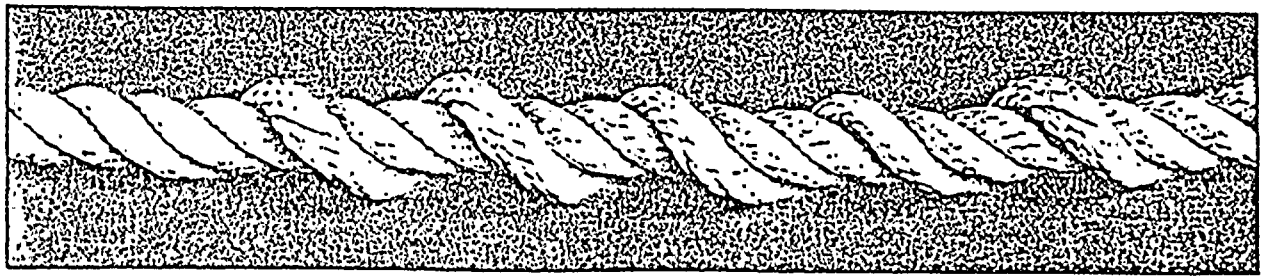
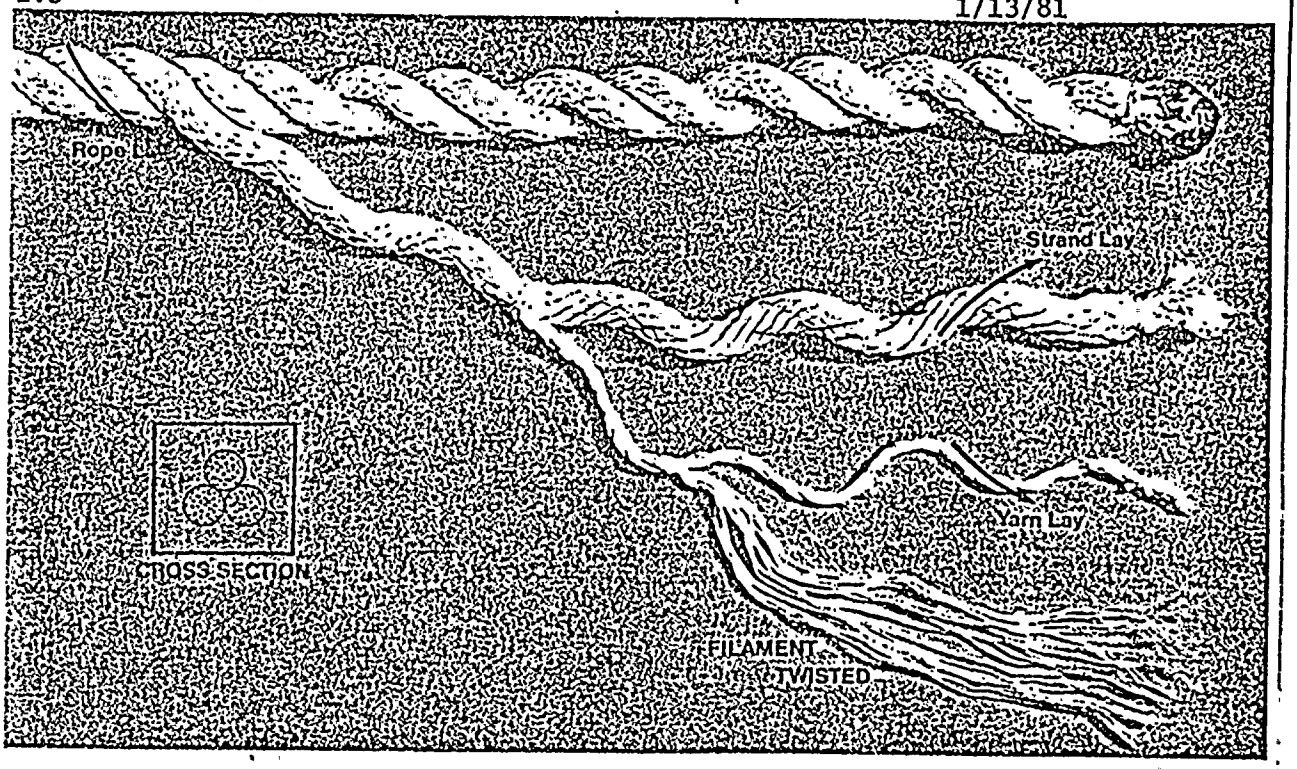


Figure 2.3 3-Strand Fibre Rope Construction



Difference Between Natural Fibre & Synthetic Fibre Ropes

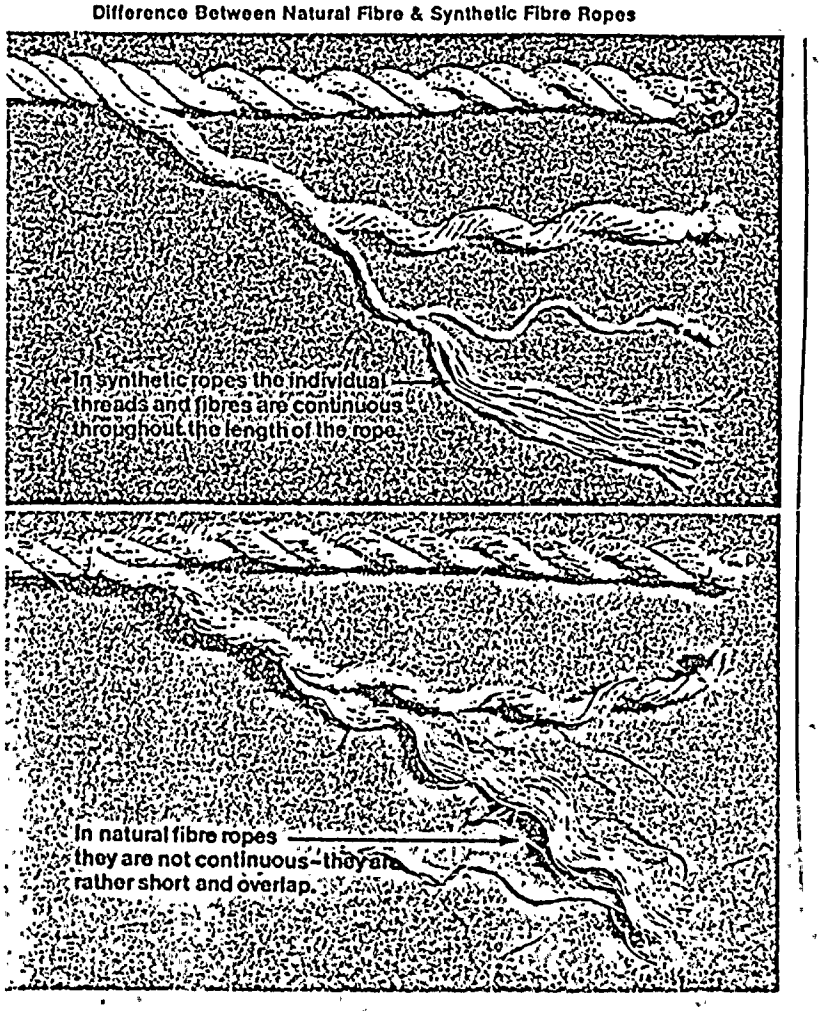
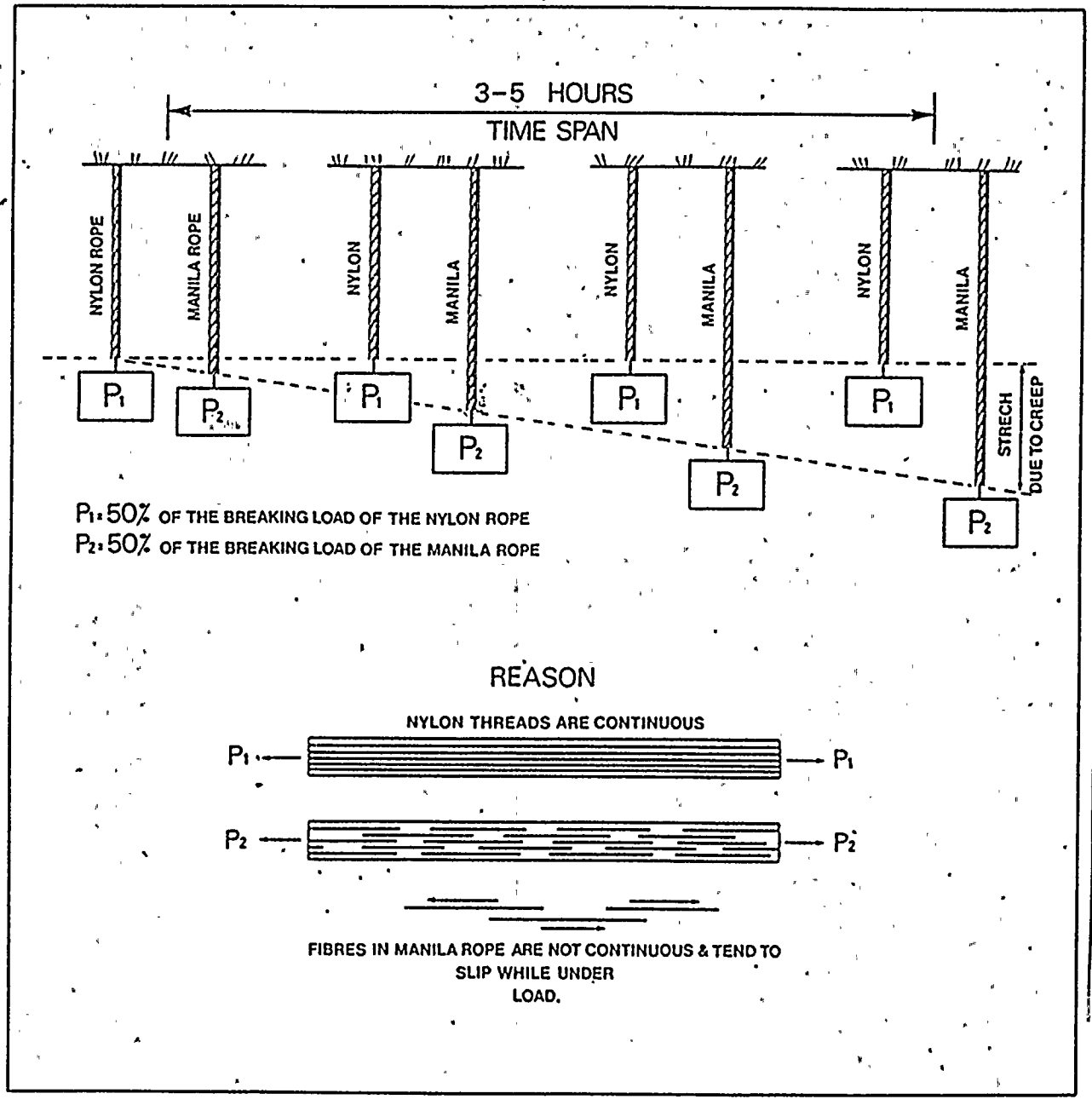


Figure 2.4 Comparison of Nylon Rope and Manilla Rope Under Heavy Sustained Load



3.0 Synthetic Web Slings Criteria

Web slings shall be removed from service if the following conditions are found.

1. Damaged Sling Eyes - slings which have fabric reinforced eyes that are worn or cut; that reduces the cross-sectional area of the eye material by 25% shall be replaced. Fabric eyes which are not reinforced shall be replaced at the first sign of wear or a cut.

   Metal eyes which are worn enough to reduce the cross-sectional area by 25% or that are cracked or metal eyes that are bent or distorted from their original shape shall be justification for replacing the sling.

2. Damaged web - cuts, local wear or local frayed material, or a combination of these, that occupies 10% of the surface area of a sling or that extends to a depth of 25% of the web thickness shall be justification for replacing the sling. Local edge damage to a sling that extends into the web by an amount equal to the thickness of the web will also be justification for replacement.

   Broken stitching and acid, caustic or heat burns are justification for replacement.

4.0 Chain Sling Criteria

There are many types of chain available for hoisting and rigging. The safeworking load varies significantly for the various types of

load rating for that particular chain shall be determined from the following load rating, Table 4.1, for various type chains. If the links are not welded then the load rating for iron chain shall be used for the unidentified chain. If the links are welded, then the minimum load rating, excluding iron chain load rating, for the size in question, shall be used for the unidentified chain.

The following is an inspection procedure and criteria for chain slings.

1. Clean the chain as necessary to ensure a thorough link by link inspection. The inspection area should be well lit and the inspector should use a magnifying glass for examining small suspected defects.
2. Look for elongated or stretched links. When the links are severly stretched, they tend to close up so that the links bind or the chain won't hang perfectly straight. Any chain that binds or hangs crooked shall be removed from service. See Figure 4.1. Any chain that is suspected to be stretched shall be checked for elongation. By pulling taut and measuring the exact length of a given number of links and comparing this dimension with the measurement of the same number of links of a new chain of the same type and size, the permanent stretch can be determined. When the permanent stretch of a chain exceeds 3% as determined by the above procedure, then the chain shall be replaced.
3. Look for bent, twisted or distorted links that may occur when the chain sling is used to lift an object having sharp unprotected edges. Chains that have links as described above shall be replaced. See Figure 4.2.

4. Look for cracked links. The presence of any size crack means that the chain is unsafe and must be replaced. Nondestructive testing should be used if necessary to identify suspected cracked links. (See Figure 4.3)

5. Look for gouges, chips, scores or cuts in each link. If the depth of these defects is such that the link size is reduced below that listed in the following table (4.2) for chain wear, then the chain must be replaced. Also, if the surface area of these defects is as large as the cross-sectional area of the link, then the chain must be replaced. If the above defects are found, but the chain is still considered safe by the above criteria, then the defect will be examined by liquid dye penetrant testing for the presence of any cracks. Any cracked link requires the chain to be replaced.

6. Look for small dents, peen marks and bright surfaces on the links. These usually indicate that the chain has been work hardened or fatigued. These suspected work hardened areas will not be in a worn or bearing area. These suspected defects will be evaluated by the responsible supervisor and his decision noted on the equipment record.

7. Look for lifted fins at welds. This indicates severe overloading which requires the chain to be replaced.

8. Look for severe corrosion resulting in measurable material loss or severe pitting. This is reason for chain replacement.

9. Look carefully at the bearing points between links for wear. Use a caliper to measure this wear. Compare this measurement with the values in the following table of allowable wear, Table 4.2. This table allows for derating a chain depending on

the amount of wear. If a chain is found to be worn, but not to the point of being removed from service, then the responsible supervisor can have a new tag issued which reflects the derated capacity per the following table of allowable wear. The equipment record must reflect any changes to capacity (See Figure 4.4)

5.0 Chain Hoist Criteria

The following is an inspection procedure and criteria for chain hoist.

1. By design the hooks on a chain hoist are the weakest component of a hoist. The lower hook is the weaker of the two hooks. Because of this, special attention should be given the hooks.
   a. Check that the lower hook has a safety latch. If the latch is missing or damaged then either repair it or replace it.
   b. Inspect for wear in the saddle (bottom of hook) area of the hook. The loss of material due to wear shall not exceed a reduction in the hook's section depth by 5%, as measured at the point in question, if it does the hook shall be condemned. (See Figure 5.1)
   c. Inspect for cracks, severe corrosion and twisting of the hook body. Hooks shall be liquid dye penetrant examined. Any crack, severe corrosion or side twisting of the hook body by more than 10 degrees from it's original shape is justification for replacing the hook.
   d. Check for the hook throat opening up. Throat dimensions are given in the following table (5.1)

for standard size hooks. If a hook has a different original throat opening supplied by a vendor then it will be noted on the equipment record. If the throat dimension has opened up by more than 10% then the hook shall be replaced and the chain thoroughly inspected per the appropriate procedures in this instruction.

e. Hook retaining nuts or collars and pins, welds or rivets used to secure the retaining membershall be inspected and repairs made as necessary. If parts are replaced a load test is required prior to returning to service.

2. The hoisting chain that has chain links, shall be inspected per the procedure in this instruction on chain slings. The hoisting chain that had roller chain will be inspected for stretch, wear and damaged or broken parts. See section 10.

3. Come-alongs will be inspected for proper operation, i.e., ratching up and down, free feeding up and down. Any com-along that does not perform it's intended functions shall be removed from service for repair. The repaired equipment shall be load tested prior to returning to service. Equipment that is beyond repair can be used for spare parts but not for hoisting operations. The equipment record shall reflect the findings and disposition of defective come-alongs.

4. Inspect braking mechanism for evidence of slippage and worn, glazed, or oil contaminated friction discs, worn pawls, cams or ratchet, and corroded, stretched or broken pawl springs. If repairs or adjustments are made to braking mechanism then a load test shall be performed prior to returning to service. Load test will be a 100 to 125% rated capacity load suspended by hoist hook, with actuating force (hand chain or electric motor) removed; check to insure that brake automatically

engages and holds load.

Worn, cracked or distorted parts such as hood blocks, suspension housing, outriggers, hand chain wheels, chain attachments, clevises, yokes, suspension bolts, shafts, gears and bearings shall be repaired or replaced. A load test is required after repairs prior to returning to service.

5.1 Chain Hoist - Definitions

Come-along - A portable chain hoist with a ratcheting handle.

Throat - The opening in a hook where objects are placed in order for them to be lifted.

Saddle - The bottom most part of a hook where the lifting load is normally applied.

Section Depth - The depth of a hook section that is perpendicular to the action line or direction of the applied lifting force.

Figure 4.1 Look for Chain Stretch During Inspections

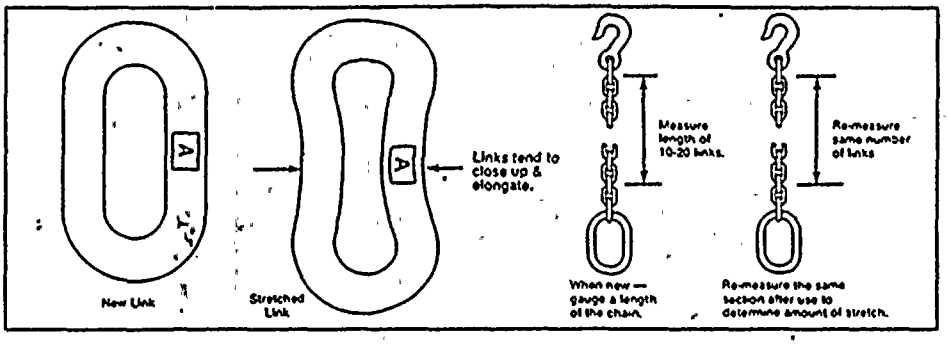


Figure 4.2 Inspect All Links for Bends, Twists and Damage

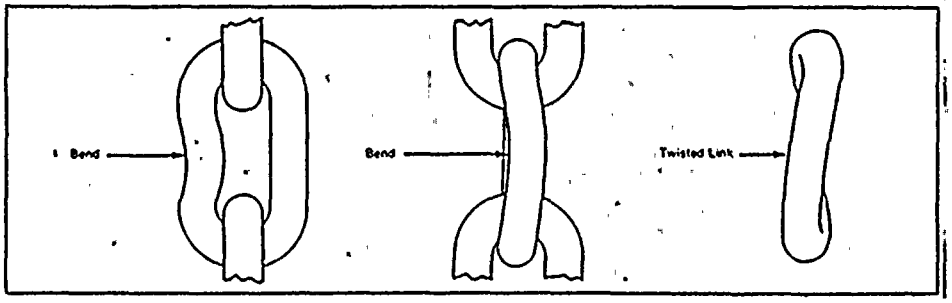


Figure 4.3 Inspect All Links for Gouges, Chips and Cuts

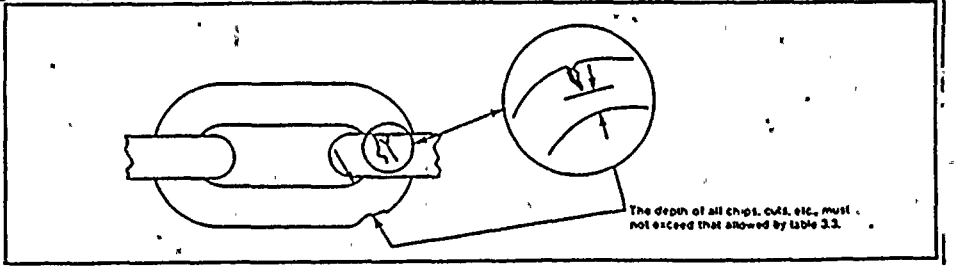


Figure 4.4 Inspect All Links for Wear at the Bearing Surfaces

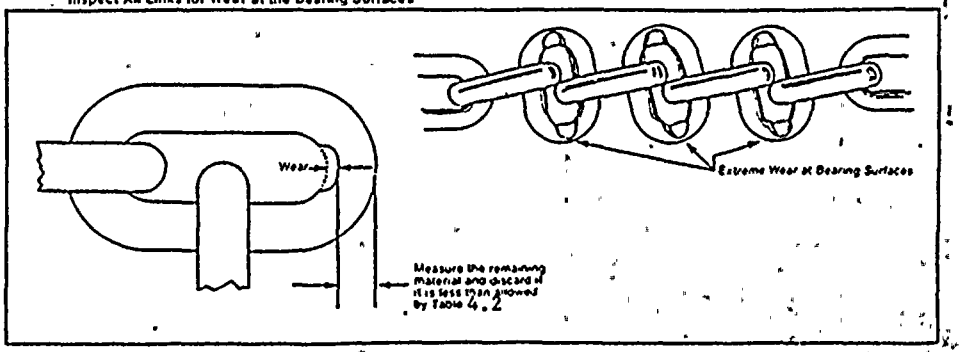


Table 4.1

RATED CAPACITY (WORKING LOAD LIMIT), FOR ALLOY STEEL CHAIN SLINGS*
RATED CAPACITY (WORKING LOAD LIMIT), POUNDS

Chain Size, Inches	Single Branch Sling – 90 degree Loading	Double Sling Vertical Angle (1) 30 degree / 45 degree / 60 degree Horizontal Angle (2) 60 degree	45 degree	30 degree	Triple and Quadruple Sling (3) Vertical Angle (1) 30 degree / 45 degree / 60 degree Horizontal Angle (2) 60 degree	45 degree	30 degree
1/4	3,250	5,650	4,550	3,250	8,400	6,800	4,000
3/8	6,600	11,400	9,300	6,600	17,000	14,000	9,900
1/2	11,250	19,500	15,900	11,250	29,000	24,000	17,000
5/8	16,500	28,500	23,300	16,500	43,000	35,000	24,500
3/4	23,000	39,800	32,500	23,000	59,500	48,500	34,500
7/8	28,750	49,800	40,600	28,750	74,500	61,000	43,000
1	38,750	67,100	54,800	38,750	101,000	82,000	58,000
1-1/8	44,500	77,000	63,000	44,500	115,500	94,500	66,500
1-1/4	57,500	99,500	81,000	57,500	149,000	121,500	86,000
1-3/8	67,000	116,000	94,000	67,000	174,000	141,000	100,500
1-1/2	80,000	138,000	112,500	80,000	207,000	169,000	119,500
1-3/4	100,000	172,000	140,000	100,000	258,000	210,000	150,000

(1) Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure 5.

(2) Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure 5.

(3) Quadruple sling rating is same as triple sling because normal lifting practice may not distribute load uniformly to all 4 legs.

* Other grades of proof tested steel chain include Proof Coil, BBB Coil and Hi-Test Chain. These grades are not recommended for overhead lifting and therefore are not covered by this code.

Table 4.2

MAXIMUM ALLOWABLE WEAR AT ANY POINT OF LINK

Chain Size, Inches	Maximum Allowable Wear, Inch
1/4	3/64
3/8	5/64
1/2	7/64
5/8	9/64
3/4	5/32
7/8	11/64
1	3/16
1-1/8	7/32
1-1/4	1/4
1-3/8	9/32
1-1/2	5/16
1-3/4	11/32

Table 5.1

EYE HOOKS, SHANK HOOKS, SWIVEL HOOKS FORGED ALLOY STEEL (SAFETY FACTOR = 5)

Throat Opening (Inches)	Maximum Safe Working Load (Pounds)
5/8	600
11/16	800
1	1,500
1 1/16	2,000
1 1/8	2,500
1 1/4	4,000
1 3/8	4,500
1 13/32	5,000
1 1/2	5,500
1 17/32	6,000
1 11/16	6,800
1 25/32	8,000
1 7/8	8,400
1 15/16	10,000
2 1/16	10,400
2 1/8	11,000
2 1/4	12,500
2 5/16	13,000
2 1/2	16,000
2 9/16	18,000
3	19,200
3 1/16	20,000
3 3/8	24,000
3 7/16	26,000
4	33,400

TYPICAL SORTING HOOK FORGED ALLOY STEEL

I.D. of Eye	1 1/4"
Opening at Top of Hook	2 13/16"
Safe Working Load 2 1/2" From Tip	2 Tons
Safe Working Load at Bottom of Hook	7 1/2 Tons

CHAIN GRAB HOOKS (CLEVIS TYPE AND EYE TYPE) FORGED ALLOY STEEL

Throat Opening (Inches)	For Size of Chain (Inches)	Maximum Safe Working Load (Pounds)
11/32	1/4	2,750
7/16	5/16	4,300
1/2	3/8	5,250
9/16	7/16	7,000
21/32	1/2	9,000
25/32	5/8	13,500
15/16	3/4	19,250
1 1/16	7/8	26,000
1 3/16	1	34,000

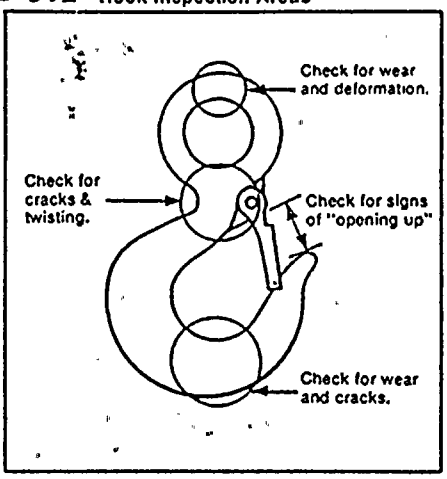
CHAIN SLIP HOOKS (CLEVIS TYPE AND EYE TYPE) FORGED ALLOY STEEL (SAFETY FACTOR = 4)

Throat Opening (Inches)	For Size of Chain (Inches)	Maximum Safe Working Load (Pounds)
15/16	1/4	2,750
1 1/16	5/16	4,300
1 5/16	3/8	5,250
1 9/16	7/16	7,000
1 11/16	1/2	9,000
2	5/8	13,500
2 1/8	3/4	19,250
2 3/4	7/8	26,000
3	1	34,000

SLIDING CHOKER HOOKS FORGED ALLOY STEEL (SAFETY FACTOR = 5)

Throat Opening (Inches)	For Rope Size (Inches)	Maximum Safe Working Load (Pounds)
1/2	1/4 - 5/16	1,500
5/8	3/8	2,600
7/8	1/2	3,400
1 1/8	5/8	5,100
1 1/8	3/4	8,000
1 7/16	7/8 - 1	15,000
1 3/4	1 1/8 - 1 1/4	23,000
2 3/16	1 3/8 - 1 1/2	30,000

Figure 5.1 Hook Inspection Areas



6.0 Shackles Criteria

The following criteria will be used for inspecting shackles.

1. Measure the distance between the eyes of the shackle and compare with the values in the following table (6.1). If this measurement exceeds the value in the table then destroy the shackle. See note, definitions, and Figure 6.1.
2. Check for straightness of pin. If pin is bent then replace the pin or destroy the shackle.
3. Shackles worn in the crown or pin by more than 10% of the original diameter will be destroyed.

NOTE: A shackle is sized by the diameter of the steel in the bow section rather than by the pin size.

6.1 Shackle - Definitions

Crown - Portion of shackle bow opposite the end of the pin.

Bow - The u-shaped section of a shackle.

Destroy - To make the equipment permanently inoperable and to discard the equipment in a trash container.

7.0 Eyebolts

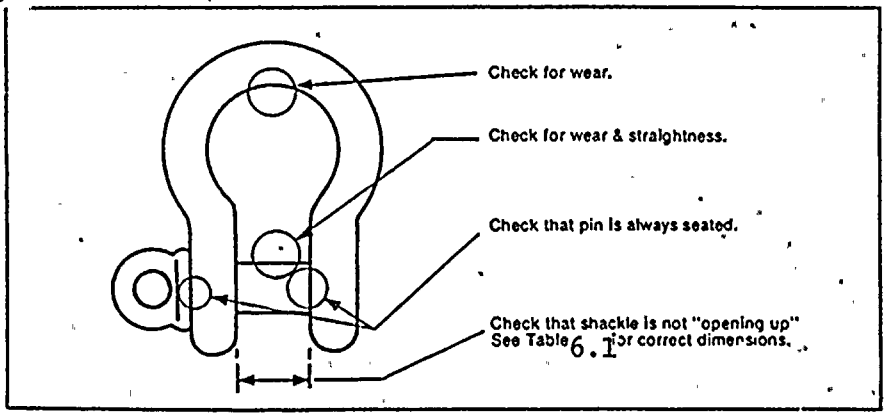
The following criteria will be used in inspecting eyebolts.

1. Inspect the bolt shank for any bending and the plane of the eye for skewing. Any distortion of an eyebolt is reason to destroy it.
2. Visually inspect the eye and bolt shank for cracks. Any eyebolt with cracks will be destroyed.

Table 6.1

SHACKLES (ALL TYPES) — Weldless Construction — Forged Alloy Steel		
Stock Diameter (Inches)	Inside Width At Pin (Inches)	Max. Safe Working Load Single Vertical Pull (Pounds)
3/16	3/8	665
1/4	15/32	1,000
5/16	17/32	1,500
3/8	21/32	2,000
7/16	23/32	3,000
1/2	13/16	4,000
5/8	1 1/16	6,500
3/4	1 1/4	9,500
7/8	1 7/16	13,000
1	1 11/16	17,000
1 1/8	1 13/16	19,000
1 1/4	2 1/32	24,000
1 3/8	2 1/4	27,000
1 1/2	2 3/8	34,000
1 3/4	2 7/8	50,000
2	3 1/4	70,000
2 1/2	4 1/8	100,000
3	5	150,000
3 1/2	5 3/4	200,000
4	6 1/2	260,000

Figure 6.1 Shackle Inspection Areas



8.0 Turnbuckle Criteria

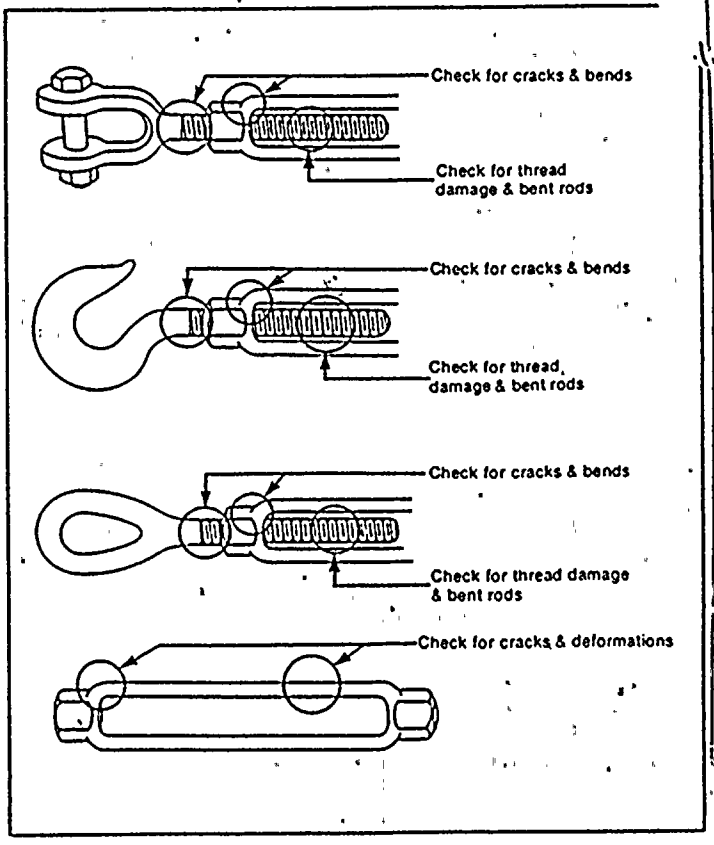
The following criteria will be used in inspecting turnbuckles.

1. Inspect for cracks in the end fittings and around the internally threaded section of the turning nut. Any turnbuckle found to have cracks will be destroyed.
2. Check for bent or deformed end fittings, threaded shanks and turning nuts. Destroy any turnbuckle found to be distorted or bent from it's original position.
3. Inspect all threads for damage and destroy any turnbuckle found with damaged threads.

8.1 Turnbuckle - Definitions

Turning Nut - The section of a turnbuckle that has the two internally threaded nuts which the end fittings are threaded into.

Figure 7.1 Turnbuckle Inspection Areas



9.0 Lifting Frames and Strongbacks

The following criteria will be used in inspecting lifting frames.

1. Visually inspect the lifting frame for component damage.
   a. Structural components - I beams, channel beams, angle beams, pipe, plate - inspect for deformed structural components. Any structural damage found will require the lifting frame to be removed from service and repaired or replaced.
   b. Rigging hardware - hooks, shackles, turnbuckles, slings, eyebolts - refer to the appropriate section in this instruction for the inspection program. Hook criteria will be found in the section on chain hoist.
2. Inspect bolted joints for tightness. Any loose joints will be tightened before the lifting frame is accepted for service.
3. Visually inspect welded sections for weld surface defects. Liquid dye penetrant examination will be used to verify suspected defects. A lifting frame with identified defects in welded sections will be repaired prior to being accepted for service.
4. Safety devices such as, but not limited to, wheel locks shall be demonstrated to be operable. Lifting frames with defective safety equipment will be removed from service until it is repaired.

NOTE: The equipment record shall reflect equipment degradation condition as well as the equipment disposition.

10.0 Roller Chain Inspection Criteria

The following is an inspection procedure and criteria for roller chain hoist.

1. Test the hoist under load in hoisting and lowering directions and observe the operation of the chain and sprockets. The chain

10.0 Roller Chain Inspection Criteria (Continued)

1. Continued

should feed smoothly into and away from the sprockets. If operation is not smooth then determine if both or either chain and/or sprocket is worn or damaged. Inspection procedure for chain is in following steps.

2. With a load of approximately 50 pounds syspended by chain, check for elongation. The chain can be checked by determining the nominal pitch and measuring a 12 inch section of chain that normally travels over the load sprocket. Using a vernier caliper check the dimension from the edge of one chain pin to the corresponding edge of another pin for the number of pitches per foot. If elongation exceeds 1/4 inch in 12 inches, the chain shall be replaced. For example, a 1/4 inch pitch chain should measure 12 inches over 16 pitches. Chain shall be rejected if measurement over 16 pitches exceeds 12 1/4 inches.
3. Check the chain for twist. The chain shall be replaced if the twist in any five foot section exceeds 15 degrees.
4. Check for camber. A chain which has a side bow exceeding 1/4 inch in a five foot section shall be replaced.
5. Replace chain if pins are found to be turned from their original position.
6. Replace chain if rollers are found that do not turn freely with light finger pressure.
7. Replace chain if joints are found that can not be flexed easily by hand.
8. Replace chain if side plates are found to be spread open.
9. Replace chain at signs of corrosion, gouges, nicks or weld splatter.

10.1 Roller Chain Inspection Criteria (Continued)

If chain is replaced in hoist, inspect mating sprockets and guides for wear. A proof load will be performed prior to returning to service if chain is replaced.

ATTACHMENT F

Listing of Authorized Rigging
Equipment Inspectors

Ollie E. Gooch	Ironworker
Billy G. Powell	Ironworker
James D. Newton	Ironworker
Allen T. Gandy	Engineer
Phil A. Smith	Boilermaker
Verna McBay	Boilermaker

Mechanical Maintenance Foreman and Dualrates

*Addendum