

What this primer is not:

1. This is not a book on rigging.
2. This is not an instruction manual.
3. This is not all **inclusive**. (There may be errors of omission, for which the authors will not be responsible. Consult a competent rigger.)

What this primer is:

1. A reference providing basic rigging facts and practices.
2. Simple information to help you make intelligent choices
3. A compilation of data from manufacturers' data sheets.

### **Do you know how HEAVY it is??**

**If not, how can you decide on the proper suspension devices?**

#### **A. Shackles**

##### **1. orientation**

The shackle pin always goes in the eye.

The pin is up only when using the bell of the shackle for connecting more than one device to a single point.

Pin down helps to prevent the shackle from tumbling

When choking, the pin goes into the eye formed end of the sling, not along the outside of the sling.

Shackles are not designed to allow the load and the shackle pin to be parallel (no side loads)

##### **2. load ratings: Crosby Anchor Shackles, Screw Pin**

1/4" 1000 lb. safe working load

3/8" 2000 lb. safe working load

CM Theatrical Shackles

1/2" 2 ton working load limit

5/8" 3.25 ton working load limit

3/4" 5 ton working load limit

##### **3. safety inspection**

No cracks, fractures, or deformations

Correct pin for shackle ( no bolts allowed)

#### **B. wire rope slings**

##### **1. load ratings: 1/16" aircraft cable can break under a 480 lb. load, safe load = 70 lb.**

1/8" aircraft cable can break under a 2000 lb. load, safe load =290 lb.

( from Handbook for Riggers - lowest rating shown for that size )

verticalsingle choke

1/4" 1000 lb. 750 lb.

3/8" 2200 lb. 1650 lb.

1/2" 4000 lb. 3000 lb.

5/8" 6400 lb. 4800 lb.

##### **2. bridles:**

equal legs, even division of load

unequal legs, uneven division of load

effect of the angle of bridle: derate capacity by 10% for a 20° angle, 20% for a 30° angle, 40% for a 50° angle, 50% for a 60° angle, and 70% for a 70° angle.

3. safety inspection: See a wire rope manual / catalog for details

#### C. Spanset ( a trade name for round slings)

1. load ratings: Spansets are tagged and color coded with their load ratings.  
Theatrical slings are special ordered black and the rating tag must be referred to or safe working load. (E30 vertical load = 2650 lb., E60 vertical load = 5300 lb., E90 vertical load = 8400 lb.)
2. joining spansets to devices: Choking derates vertical capacity of sling by 20%  
Loss of sling strength at various angles from axis of pull: 30° = 20%, 50° = 40%, 60° = 50%, and 70° = 70%
3. joining spansets together: Do not tie them together. Use a shackle of the correct size to insure correct bending radius
4. safety inspection. If a hard spot or a bunching up of fibers can be felt through the sheath, the Spanset should be discarded. Refer to a round sling reference for details.

#### D. attachment devices

##### 1. beam clamps

Rated rigging clamps: Do not load beyond rated capacity

Stamped beam clamps: Use with extreme caution, correct set screw, hardware, etc. and no torsional loading ( These devices were designed to hang pipe and conduit from beams in buildings, not as a rigging attachment device.)

"C" clamps DO NOT USE!!!!!!

Side loading affects: Any side loading will derate the capacity of the clamp.

##### 2. eye bolts

Shoulder bolts may have an angular load. Shoulderless bolts are not designed for angular loading.

NOTE: For a shoulder eyebolt to bear it's rated load, the shoulder must bear against whatever the eyebolt is attached to. No threads may be exposed, eyebolt may use shims.

Forged are ok for rigging.

Non-forged may open under load. They should not be used.

Correct loading of eye:

The eye is designed for a pull along the axis of the bolt. Reduce loading for a pull 15 degrees off the axis by 45%, 25 degrees off axis by 60%, and 45 degrees off axis by 75%. No eye is designed for side loading. Rotate eye for correct alignment, shim shoulder to bear load.

##### 3. wire rope clips (information from Crosby)

Minimum number of clips: 1/8 - 7/16 two; 1/2 - 5/8 three; 3/4, 7/8 four

Number of clips based on right regular or lang lay wire rope, 6x19 class or 6x37 class, fibre core or IWRC, IPS or EIPS. Other types may require more clips.

Will hold 80% of rated load SEE CROSBY CHART FOR CORRECT TURN BACK DIMENSIONS

Sequence of events installing clips

- 1 Turn back the specified amount of rope from the thimble. Apply first clip one base width from the dead end of the wire rope ( U-bolt over dead end -- live end rests in clip saddle). Tighten nuts evenly to recommended torque.
2. Apply the next clip as near as the loop as possible. Turn on nuts, but do not tighten.

3. space additional clips, if required, equally between the first two.

Turn on nuts --- take up rope slack --- tighten all nuts evenly on all clips to recommended torque.

NOTICE NOTICE NOTICE

4. Apply the initial load and retighten nuts to the recommended torque.

Rope will stretch and shrink in diameter when loads are applied.

- 4a. wire rope (attatching to a theatre pipe)

- a. Swaged eye with thimble; use a shackle to connect to pipe bracket [clamp] or a shackle and chain to wrap pipe and connect to itself or connect to pipe bracket

- b. No end termination; Full round turn or clove hitch around pipe using wire rope clamps around bitter end and standing part of line.

- 4b. wire rope slings;

Use shackles to connect slings to devices or other slings

5. Swages: Install / assemble swaged fittings according to manufactures' instructions

#### E. Truss connections:

Bolted; ***Only use bolts rated for overhead lifting (grade 8)***

1. Bolts should be correct size for the holes.
2. Washers should be used on both sides.
3. TIGHTEN THE CONNECTING BOLTS ON THE NUT SIDE. The nut will travel over the thread's inclined plane and pull the truss tightly together [ If you tighten on the bolt head side you may have lose connections]
4. The connections should be checked after the truss is hung and before it is raised to trim.

Pinned;

1. All pins need safety clips so they can not come out
2. Safety pin hole should be aligned so that the pin can be inserted