Hitches & Connections
Basic Definitions

• Bridle: The use of two or more legs to make a single point. This is used when a beam does not fall directly under the desired point.
• Leg: A single connection to a bridle or hitch.
Sling Angle & Capacity

• Factors effecting sling capacity
  • Sling size
  • Sling composition
  • The hitch
  • The hardware and end fittings
  • Sling angle
Choker Hitch

- Least desirable method of attaching a wire rope to a beam
  - The hitch can become the weakest link in the system.
  - Wire rope is selected for a particular project. The size of the rope is picked for a specific load being lifted, the design factor and the breaking strength of the load being lifted. The design factor using this hitch can be reduced beyond a safe level.
  - The force that is applied is not centered on the web of the beam and puts a twisting force on the structure.
  - Depending on the shackle orientation the pin can be subjected to unscrewing.
  - Another reason the choker is less desirable is that many times the drop line is tied to the end of the wire and must be removed to create the choker. This is dangerous.

PHOTO
Choker Hitch

**Safe**
Excellent choice when choking around a beam.
Only two parts need to be handled.
The shackle pin and the shackle bow.

**Safe**
The only drawback is the rigger has to handle three parts. The pin, shackle bow and the sling.

**Very Dangerous**
This can cause side load on a shackle.
Factors That Affect Capacity

A. Type of wire rope: The stronger the wire rope the stronger the hitch.
B. Design factor: The number you divide into the breaking strength of the wire to obtain the WLL of the wire in a straight pull.
C. Type of fitting on the sling: A swaged thimble eye is rated at 95-100% were a wire rope clip is rated at 80% is properly installed.
D. Choker factor: The bending that takes places at the chocker point. In a normal choke this is 135 deg. This reduces the strength by 20% and is to be applied to all chokes.
E. Choker factor adjustment: If your angle is less than 135 degrees the strength changes considerably.
# Choker Angle

<table>
<thead>
<tr>
<th>Angle of Choke</th>
<th>Reduction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>121-135</td>
<td>.95</td>
</tr>
<tr>
<td>91-120</td>
<td>.82</td>
</tr>
<tr>
<td>61-90</td>
<td>.71</td>
</tr>
<tr>
<td>31-60</td>
<td>.60</td>
</tr>
<tr>
<td>0-30</td>
<td>.48</td>
</tr>
</tbody>
</table>

**Example 1**
Basket Hitch

- Preferred attachment method.
- Most basket hitches are stronger than the wire rope below them.
- The strength is determined by the angle between the two legs. 0deg. Being the strongest. The two legs would supply twice as much strength as a single leg.
- Easy to install. Most setups can be done on the ground.
- By placing an extra wrap around the beam you can obtain more gripping power. (double wrap basket)

PHOTO
Basket Hitch

Safe
Good way however more parts to deal with. You must handle the shackle bow, pin and sling.

Safe
Easy to do and less parts to deal with.

Safe
Only drawback is this is difficult to do. Less parts but more struggling

Safe
Very dangerous shackle is being side loaded
A BASKET WORK LOAD LIMIT OF 10,000 LBS. CHANGES AS THE SLING-TO-LOAD ANGLE CHANGES:
AT 90°-WORK LOAD LIMIT =10,000 LBS.
AT 60°-WORK LOAD LIMIT = 8,660 LBS.
AT 45°-WORK LOAD LIMIT = 7,071 LBS.
AT 30°-WORK LOAD LIMIT = 5,000 LBS.

<table>
<thead>
<tr>
<th>SLING-TO-LOAD ANGLE (DEGREES)</th>
<th>90°</th>
<th>60°</th>
<th>45°</th>
<th>30°</th>
</tr>
</thead>
<tbody>
<tr>
<td>WORK LOAD LIMIT X LOSS FACTOR</td>
<td>10,000 LBS. X 1.000</td>
<td>10,000 LBS. X .866</td>
<td>10,000 LBS. X .7071</td>
<td>10,000 LBS. X .500</td>
</tr>
<tr>
<td>ACTUAL SLING WORK LOAD LIMIT</td>
<td>10,000 LBS.</td>
<td>8660 LBS.</td>
<td>7071 LBS.</td>
<td>5000 LBS</td>
</tr>
</tbody>
</table>
Shackles & Hitches

- It is important to use the proper hardware with the proper sling.
- Always make sure the shackle is at the same as or higher than the rating of the wire rope.
- Consider the shackle orientation to the eye of the wire rope and the ability to shift and cause a dangerous situation.
- Important rule of thumb. Use a 5/8” shackle with 3/8” wire rope and 3/4” shackle with 1/2” wire rope.
Shackle Orientation

- Load shackles in the correct direction. (The long axis of the shackle)
- Never side load the shackle
- Never allow a shackle to spin or twist apart.
- Never wedge a shackle and wire rope.

PHOTO
Shackle Orientation

Safe, Remember to use oversized shackles to prevent slippage.

Dangerous

Dangerous

Using a $\frac{1}{2}$" shackle can slip through the sling if it rotates
Shackle Size

• When using smaller shackle size make sure you keep the pin side down. This will keep the shackle from spinning.
Shackles & Slings

- When using shackles in conjunction with a bridle and connection point pay special attention to your bridle angle and the stress placed on the shackle.
- If your bridle angle is over 90 deg. You must add a pearing ring to your system.
- Too much pull on a side loaded shackle can cause failure.
Hitch Safety

(WHICH IS THE BETTER CHOICE)
Hitch Exercise

(Divide the following into low, medium and high risk groups)
Example 1

• Wire rope is rated for 14,400 lbs.
• Design factor of 7:1
• Swaged end fitting
• Automatic reduction of choker = .8 or 20%
• Choker Angle = 120 degrees. (reduction factor .82)