Basic Lift Engineering

Every Lift Uses 1 of 3 Basic Hitches

STRAIGHT OR VERTICAL, attachment, is simply using a sling to connect a lifting hook to a load. Full rated lifting capacity of the sling may be utilized, but must not be exceeded. Whenever a single sling is used in this manner, a tagline should be used to prevent load rotation which may cause damage to the sling.

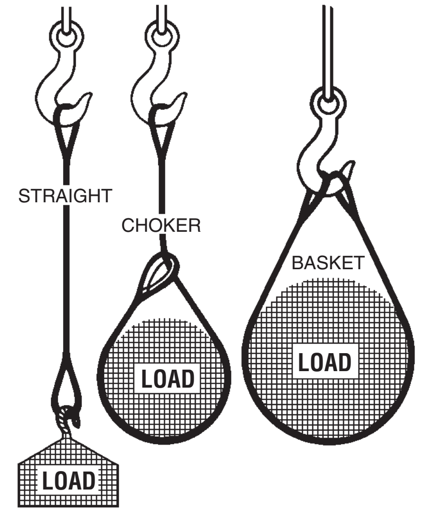
When two or more slings are attached to the same lifting hook in straight, or vertical, manner, the total hitch becomes, in effect, a lifting bridle, and the load is distributed among the individual slings.

CHOKER hitches reduce lifting capability of a sling, since this method of rigging affects ability of the wire rope components to adjust during the lift. A choker is used when the load will not be seriously damaged by the sling body—or the sling damaged by the load, and when the lift requires the sling to snug up against the load.

The diameter of the bend where the sling contacts the load should keep the point of choke against the sling BODY — never against a splice or the base of the eye. When a choke is used, the sling rated capacity must be adjusted downward to compensate for loss of capability.

A choker hitch should be pulled tight before a lift is made—NOT PULLED DOWN DURING THE LIFT. It is also dangerous to use only one choker hitch to lift a load which might shift or slide out of the choke.

BASKET hitches distribute a load between the two legs of a sling —within limitations described below. Capacity of a sling used in a basket is affected by the bend, or curvature, where the sling body comes in contact with the load— just as any sling is affected and limited by bending action, as over a sheave.



Calculating the Load on Each Leg of a Sling

As the horizontal angle between the legs of a sling decreases, the load on each leg increases. The effect is the same whether a single sling is used as a basket, or two slings are used with each in a straight pull, as with a 2-legged bridle.

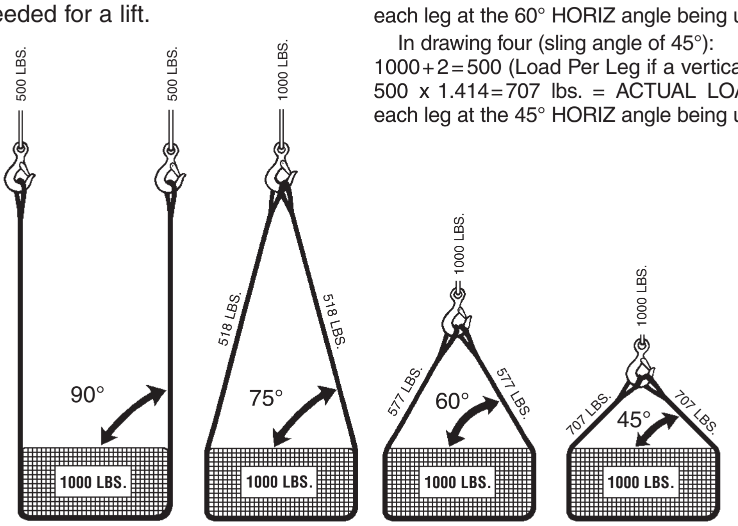
Anytime pull is exerted at an angle on a leg—or legs—of a sling, the load per leg can be determined by using the data in the table at right. Proceed as follows to calculate this load—and determine the rated capacity required of the sling, or slings, needed for a lift.

1. First, divide the total load to be lifted by the number of legs to be used. This provides the load per leg if the lift were being made with all legs lifting vertically.
2. Determine the angle.
3. Then MULTIPLY the load per leg (as computed in No. 1 above) by the Load Factor for the leg angle being used (from the table at right) – to compute the ACTUAL LOAD on each leg for this lift and angle. THE ACTUAL LOAD MUST NOT EXCEED THE RATED SLING CAPACITY.

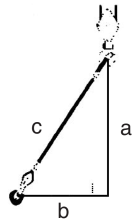
Thus, in drawing three (sling angle at 60°):
1000+2=500 (Load Per Leg if a vertical lift)
500 x 1.154=577 lbs. = ACTUAL LOAD on each leg at the 60° HORIZ angle being used.

In drawing four (sling angle of 45°):
1000+2=500 (Load Per Leg if a vertical lift)
500 x 1.414=707 lbs. = ACTUAL LOAD on each leg at the 45° HORIZ angle being used.

LEG ANGLE (Degrees)	LOAD FACTOR
90°	**1.000**
85°	**1.003**
80°	**1.015**
75°	**1.035**
70°	**1.064**
65°	**1.103**
60°	**1.154**
55°	**1.220**
50°	**1.305**
45°	**1.414**



Finding the Hypotenuse

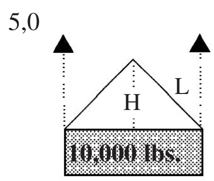


To find c (hypotenuse)

Given: $a^2 + b^2 = c^2$

Example: $4^2 + 3^2 = c^2$; $16 + 9 = c^2$; $\sqrt{25} = 5$

Load Angle Factors



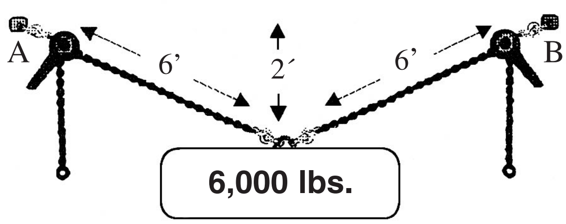
H = 10´ L = 15´

$\frac{L}{H}$ = LAF *(Load Angle Factor)* Example: $\frac{15}{10}$ = 1.5 *(LAF)*

Tension in L = $\frac{L}{H}$ x L's share of the load

Tension in L = $\frac{15}{10}$ x 5,000; 1.5 x 5,000 Ten. = 7,500 lbs.

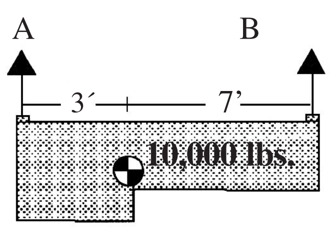
Tension in Overhead Hoists



Ten. in A = $\frac{6}{2}$ x 3,000 Ten. in A = 9,000 lbs.

(As load moves tension changes)

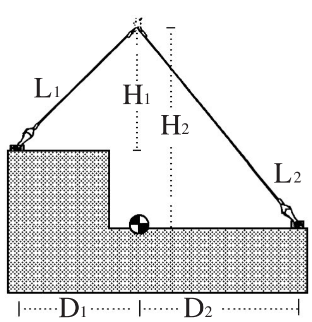
Off-set Center of Gravity (Share of the Load)



Inverse Proportion To Distance

Lift Point A	Lift Point B
7 + 3 = 10, $\frac{\quad}{10}$ = .70	7 + 3 = 10, $\frac{\quad}{10}$ = .30
.70 x 10,000 = 7,000 lbs.	.30 x 10,000 = 3,000 lbs.

Off-level Lift Points



$$TL_1 = \frac{W \times D_2 \times L_1}{(D_2 \times H_1) + (D_1 \times H_2)}$$

$$TL_2 = \frac{W \times D_1 \times L_2}{(D_2 \times H_1) + (D_1 \times H_2)}$$

LEGEND

- W = Load Weight
- L_1 = Length Leg 1
- L_2 = Length Leg 2
- H_1 = Vertical Height 1
- H_2 = Vertical Height 2
- D_1 = Horizontal Distance 1
- D_2 = Horizontal Distance 2