CREWFORGE

LEVEL 1 · MW-006 · RED SEAL INDUSTRIAL MECHANIC (MILLWRIGHT)

Hitches and Load Control

One sling, four hitches: what each one can lift, and how to keep the load under control

Learner _____

CrewForge textbook chapter · Rigging, Hoisting, Lifting and Moving (IMM-150) · Free edition · CrewForge Rigging Starter
Exam preparation, not a procedure. Always follow the sling tag, the manufacturer's data and your lift plan.

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About this chapter

A sling tag gives its rating in a straight vertical pull. On the job, slings are choked around loads, wrapped under them in a basket, or hung in pairs from one hook. Each of these hitches changes what the same sling can lift. This lesson shows you how to work out the capacity of every common hitch, how to pick the right one, which knots riggers use, and how tag lines keep a load under control.

Every load angle factor here is 1 ÷ sin θ rounded to three decimals. Capacities are rounded to the nearest pound or kilogram.

The question that catches people. One wire rope sling, rated 8,000 lb. Hitch it four ways and its capacity runs from 6,000 lb to 16,000 lb. Wrap that basket around a small pipe and some of that capacity disappears. Same sling, same tag.

What you'll learn

- Explain how the hitch changes a sling's capacity from its vertical rating.
- Calculate the capacity of a choker hitch, including the angle-of-choke reduction, in imperial and metric.
- Calculate the capacity of a basket hitch with vertical or angled legs.
- Apply the D/d factor to a wire rope basket hitch.
- Calculate the capacity of a bridle and apply the two-leg rule.

- Choose a hitch for a load from its shape and its lifting points, and protect the sling at sharp edges.
- Name the knots riggers use most and what each one is for, and the rule about knots in slings.
- Apply the rules for tag lines and load control.

Key terms

Hitch: The way a sling is rigged to the load and the hook: vertical, choker, basket or bridle.

Vertical hitch: One sling leg straight up from the load to the hook. It is rated at the tag's vertical rating.

Choker hitch: The sling passes around the load and through its own eye, closing on the load as it lifts.

Angle of choke: The angle the sling makes where it passes through its own eye in a choker hitch.

Double wrap choker: A choker that goes around the load twice. It grips all the way round and draws a bundle together.

Basket hitch: The sling runs under the load with both eyes on the hook.

Master link: The large forged link at the top of a bridle. It sits in the hook, holds every leg and carries the whole load.

Bridle: Two or more sling legs from one master link to separate lifting points on the load.

Load angle factor (LAF): The multiplier the sling angle puts on leg tension: LAF = 1 ÷ sin θ, θ from horizontal.

D/d ratio: The diameter the sling bends around (D) divided by the sling's own diameter (d).

Softener: A pad or edge guard placed between a sling and a sharp edge of the load.

Bowline: A knot that makes a fixed loop that will not slip, and unties easily after a load.

Clove hitch: A quick knot that ties a line to a pipe or post. It can slip if the pull keeps changing.

Round turn and two half hitches: A knot that ties a line off to a post or ring and holds under steady load.

Timber hitch: A knot that grips a log, pole or pipe so it can be dragged.

Sheet bend: A knot that joins two ropes, even ropes of different sizes.

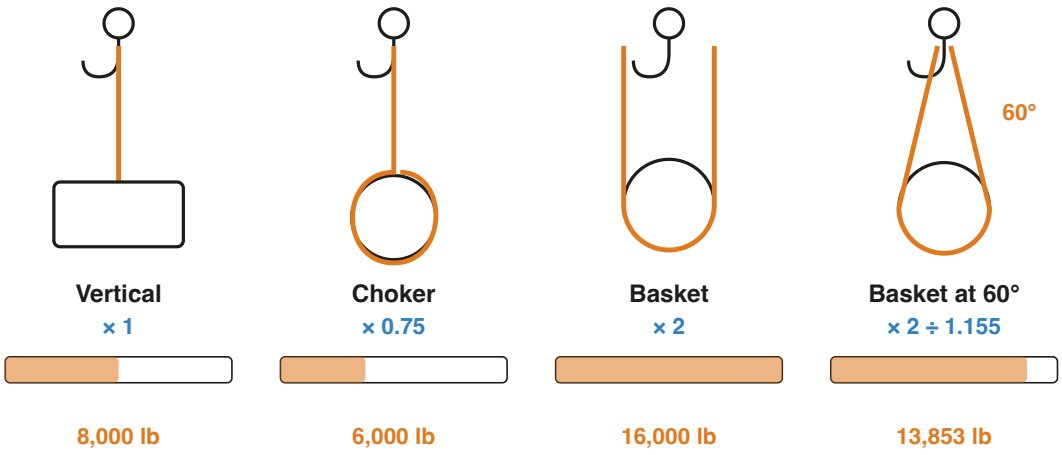
Tag line: A rope tied to the load that a worker uses to stop it swinging or turning.

1 One sling, four hitches

The tag gives one number. The hitch decides how much of it you can use.

A sling's tag gives its working load limit (WLL) in a straight vertical pull. Many tags also list the rating for a choker and a basket. The hitch changes the number because it changes how the sling bends and how many parts of it share the load. A vertical hitch uses the sling the way the tag rates it.

- **Vertical:** one leg, straight up. The sling carries its full vertical rating.
- **Choker:** the sling bends hard where it passes through its own eye. That bend costs strength.
- **Basket:** two parts of the sling share the load, so with vertical legs it can carry twice the vertical rating.
- **Bridle:** two or more legs to separate lifting points, each leg its own sling.



Bars to scale: a full bar is 16,000 lb, twice the vertical rating

The same 8,000 lb wire rope sling in four hitches. The bar shows what each hitch allows, as a part of the vertical rating.

HITCH	CAPACITY (SAME SLING)	WHAT CHANGES IT
Vertical	100 % of WLL	nothing
Choker	75 % wire rope, 80 % chain and synthetic	a sharp angle of choke
Basket, vertical legs	200 % of WLL	wire rope: the D/d ratio
Basket or bridle, angled legs	÷ load angle factor	the sling angle

Choker and basket figures are typical maker values. The tag and the maker's chart come first.

The load angle factor, again

When a basket or a bridle has angled legs, each leg pulls partly sideways. To hold the load up it has to pull harder, so the hitch can lift less. Divide by the load angle factor: 1 ÷ sin θ, with θ measured from horizontal.

```
LAF = 1 ÷ sin θ
Basket = 2 × WLL ÷ LAF Bridle = n × WLL ÷ LAF
```

SLING ANGLE Θ	LAF
90°	1.000
75°	1.035
70°	1.064
65°	1.103
60°	1.155
55°	1.221
50°	1.305
45°	1.414

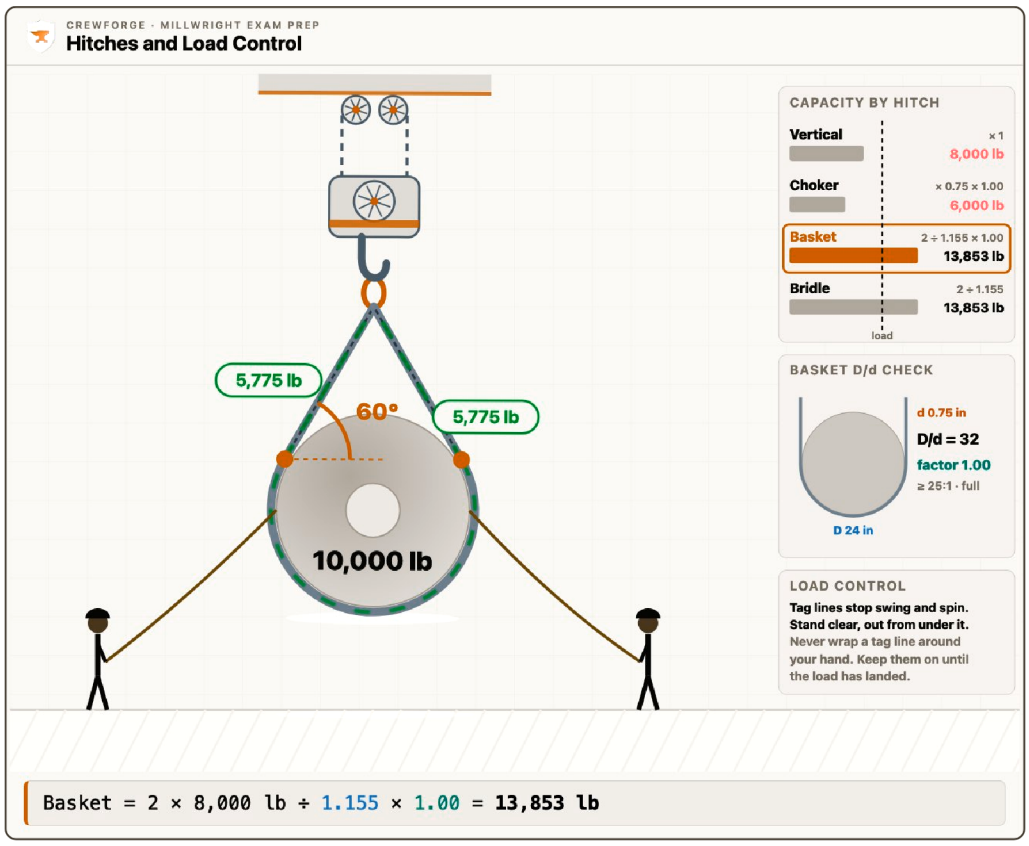
1 ÷ sin θ, rounded to three decimals.

EXAMPLE 1.1 **One sling, every hitch**

A wire rope sling is rated 6,000 lb vertical. What can it lift as a choker with a normal choke, as a basket with vertical legs around a large drum, and as a basket with its legs at 45°?

1. Choker: 6,000 × 0.75 = 4,500 lb
2. Basket, vertical legs: 2 × 6,000 = 12,000 lb
3. Basket at 45°: 12,000 ÷ 1.414 = 8,487 lb

Answer: 4,500 lb choker; 12,000 lb vertical basket; 8,487 lb basket at 45°



The simulator's bars show every hitch for the same 8,000 lb sling, with the basket at 60° highlighted.

EXAMPLE 1.2 **Metric, synthetic**

A synthetic web sling is rated 2,000 kg vertical. What can it lift as a choker, as a basket with vertical legs, and as a basket with its legs at 60°?

1. Choker: 2,000 × 0.80 = 1,600 kg
2. Basket, vertical legs: 2 × 2,000 = 4,000 kg
3. Basket at 60°: 4,000 ÷ 1.155 = 3,463 kg

Answer: 1,600 kg; 4,000 kg; 3,463 kg

CHECK YOUR UNDERSTANDING

1. Which hitch lets one sling lift the most?
2. What does a choker cost a wire rope sling?

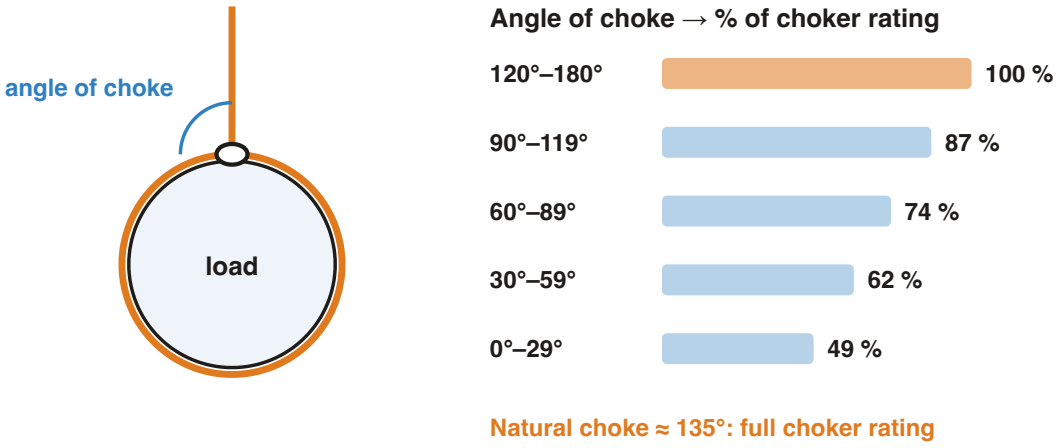
Answers at the back of the chapter.

2 The choker hitch

Rigging a choker by the vertical rating is one of the most common sling overloads.

In a choker hitch, the sling wraps the load and passes through its own eye. As the load lifts, the sling closes on it. The sharp bend at the eye is where a choker loses strength. Its rating starts at 75 % of the vertical rating for wire rope, and 80 % for alloy chain and synthetic slings.

The **angle of choke** is the angle the sling makes where it passes through the eye. Left to seat itself under load, a choke settles at about 135°, and the choker rating stands. If the choke is forced down below 120°, the rating drops again. For wire rope, the table below sets the drop. For synthetic and chain slings, the sling maker's chart does, because their figures differ by maker.



The angle of choke, and the table that sets the reduction. A natural choke near 135° keeps the full choker rating.

ANGLE OF CHOKE	% OF CHOKER RATING
120°–180°	100 %
90°–119°	87 %
60°–89°	74 %
30°–59°	62 %
0°–29°	49 %

Wire rope slings (Certex Table 1; Kennedy Wire Rope & Sling, Capacities and Hitches (PDF p. 1); the 120° edge is Crosby's, catalogue p. 471). Brackets vary slightly between makers.

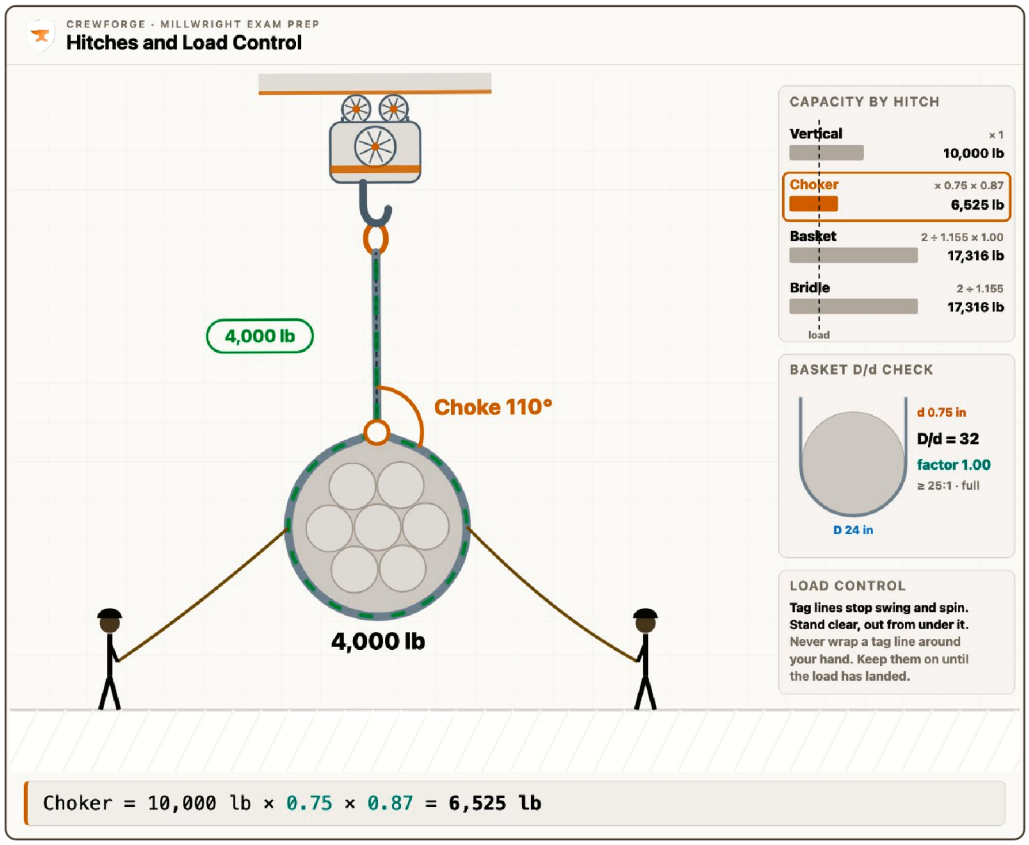
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Choker = WLL × efficiency × angle-of-choke %
efficiency: 0.75 wire rope · 0.80 chain, synthetic
```

EXAMPLE 2.1 Wire rope, forced choke

A wire rope sling rated 10,000 lb vertical is used as a choker. The choke is pulled down to 110°. What is its capacity?

1. Choker rating: 10,000 × 0.75 = 7,500 lb
2. 110° is in the 90°–119° row: 87 %
3. 7,500 × 0.87 = 6,525 lb

Answer: 6,525 lb



Choke forced to 110°: the table slides to the 87 % row, 6,525 lb.

EXAMPLE 2.2 Wire rope, metric

A wire rope sling rated 3,000 kg vertical is used as a choker with a 45° angle of choke. What is its capacity?

1. Choker rating: 3,000 × 0.75 = 2,250 kg
2. 45° is in the 30°–59° row: 62 %
3. 2,250 × 0.62 = 1,395 kg

Answer: 1,395 kg

EXAMPLE 2.3 **Working backwards: what sling do you need?**

A 3,000 lb load is to be lifted with a single wire rope choker, choke left at about 135°. What vertical rating must the sling have?

1. The choker gives 75 % of the vertical rating
2. Vertical rating needed: 3,000 ÷ 0.75 = 4,000 lb

Answer: At least 4,000 lb vertical

EXAMPLE 2.4 **Two chokers on a long load**

A 9,000 lb shaft, CG centred, hangs level from two wire rope chokers that hang straight down, one near each end. What vertical rating must each sling have?

1. Each choker carries half: 9,000 ÷ 2 = 4,500 lb
2. Vertical rating needed: 4,500 ÷ 0.75 = 6,000 lb

Answer: At least 6,000 lb vertical, each

ON THE JOB

Let the choke seat itself

Never force the choke down by hammering the eye toward the load. Place the choke on the body of the sling, not on a fitting or splice, and let it seat as the load comes up. On a bundle, a double wrap choker grips all the way round and draws the pieces together.

EXAM TIP

Exam tip: two factors, one after the other

A choker with a sharp choke takes two reductions: the choker efficiency, then the angle-of-choke percentage. An answer that stops after the first one will be on the answer sheet.

CHECK YOUR UNDERSTANDING

1. A wire rope choker rated 4,000 lb vertical has its choke at 140°. What is its capacity?
2. Which row of the table does a 60° choke fall in?

Answers at the back of the chapter.

3 The basket hitch

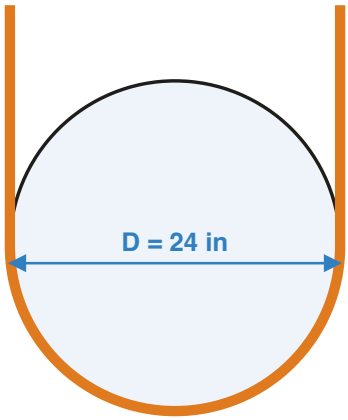
A basket can double a sling's capacity, or lose much of it to the angle and the bend.

In a basket hitch, the sling runs under the load with both eyes on the hook. Two parts of the sling hold the load, so with vertical legs a basket is rated at twice the vertical rating. Once the legs lean in, divide by the load angle factor, exactly as for a bridle. Keep the legs at 30° or more from horizontal: OSHA's sling guidance says not to use horizontal angles under 30° unless the sling maker or a qualified person approves.

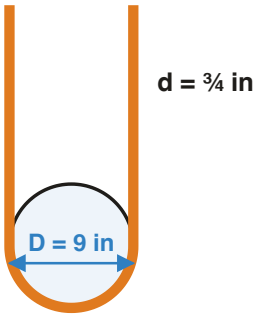
> **`Basket = 2 × WLL ÷ LAF × D/d factor`**

The bend: D over d

Wire rope loses strength when it bends around something small. The tighter the bend, the more it loses. Published basket ratings for wire rope assume the sling bends around something at least 25 times its own diameter. That is a D/d ratio of 25 : 1, where D is the load's diameter and d is the rope's.



24 in ÷ ¾ in = 32 : 1
factor 1.00



9 in ÷ ¾ in = 12 : 1 → 10 : 1 row
factor 0.86

The same rope around a large drum and a small pipe. Below 25 : 1 the basket rating steps down.

D/D	FACTOR
25 : 1	1.00
20 : 1	0.92
15 : 1	0.88
10 : 1	0.86
8 : 1	0.84
6 : 1	0.80
4 : 1	0.75
2 : 1	0.65
1 : 1	0.50

Wire rope basket rating against D/d, 25 : 1 = 1.00 (Purdue University rigging training). Between rows, use the next lower ratio.

Between the printed ratios, use the next lower row. A 12 : 1 bend uses the 10 : 1 row. Synthetic slings and alloy chain are not rated by this table, so check their tags.

EXAMPLE 3.1 **Angled basket around a large drum**

A ¾ in wire rope sling rated 6,000 lb vertical is used as a basket around a 30 in drum, legs at 50°. What is its capacity?

1. D/d = 30 ÷ 0.75 = 40 : 1, over 25 : 1, so the factor is 1.00
2. LAF at 50° = 1 ÷ sin 50° = 1.305
3. Basket = 2 × 6,000 ÷ 1.305 × 1.00 = 9,195 lb

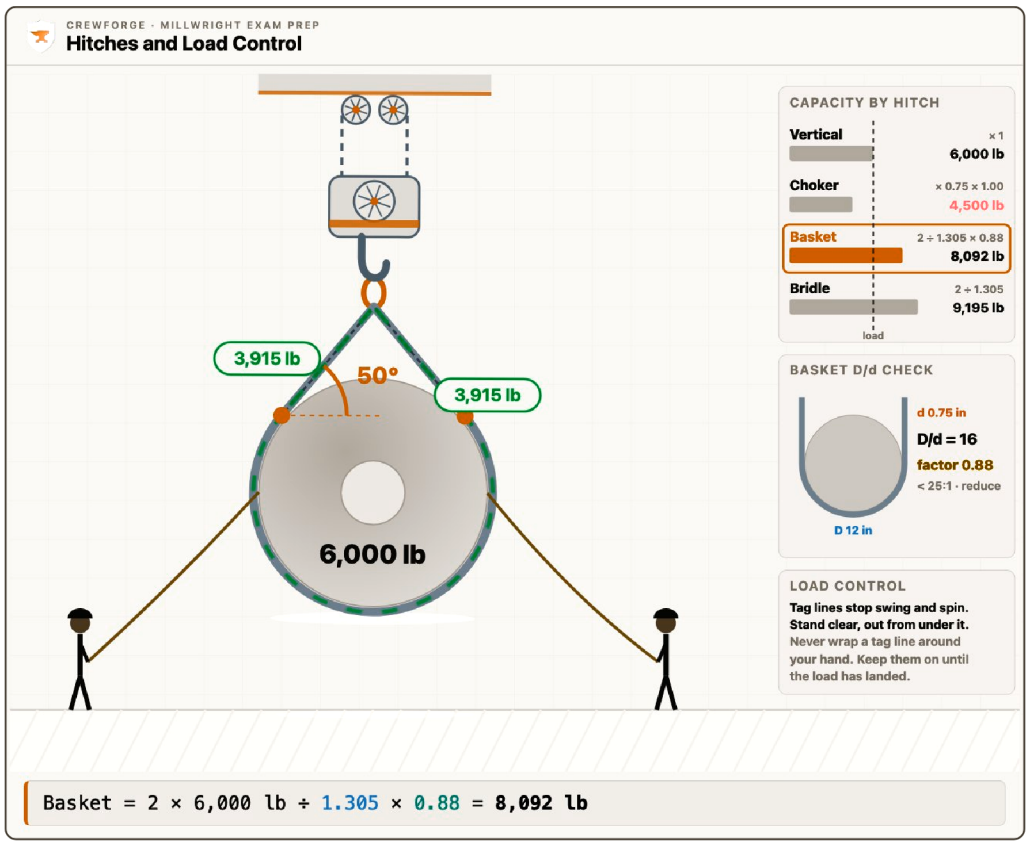
Answer: 9,195 lb

EXAMPLE 3.2 **The same basket around a small pipe**

The same sling and angle, now around a 12 in pipe. What is its capacity?

1. D/d = 12 ÷ 0.75 = 16 : 1. Use the next lower row, 15 : 1: factor 0.88
2. Basket = 2 × 6,000 ÷ 1.305 × 0.88 = 8,092 lb

Answer: 8,092 lb, about 1,103 lb less, from the bend alone



Around a 12 in pipe: D/d 16 : 1, factor 0.88, capacity 8,092 lb.

EXAMPLE 3.3 Metric

A 16 mm wire rope sling rated 2,500 kg vertical is used as a basket around a 168 mm pipe, legs at 60°. What is its capacity?

1. D/d = 168 ÷ 16 = 10.5 : 1 → the 10 : 1 row, factor 0.86
2. Basket = 2 × 2,500 ÷ 1.155 × 0.86 = 3,723 kg

Answer: 3,723 kg

EXAMPLE 3.4 A synthetic basket

A synthetic web sling rated 4,000 lb vertical is used as a basket with its legs at 70°. What is its capacity?

1. No D/d factor from this table for a synthetic sling
2. Basket = 2 × 4,000 ÷ 1.064 = 7,519 lb

Answer: 7,519 lb

SAFETY

Keep the load in the basket

A basket does not grip. A smooth or round load can slide or roll out of it. Use a basket only when the load can't shift, and keep the legs from sliding along it.

CHECK YOUR UNDERSTANDING

1. A ½ in rope is wrapped around a 10 in pin. What is D/d, and which row do you use?
2. A basket's legs are vertical and D/d is 30 : 1. What is it rated at?

Answers at the back of the chapter.

4 Bridles, and picking the hitch

The right hitch depends on the load: its shape, its lifting points, and its edges.

A bridle has two or more legs from one master link down to separate lifting points. The **master link** is the large forged link at the top that sits in the hook and holds every leg, so it carries the whole load and must be rated for it. The lifting points are the lugs or eyes on the load where each leg attaches. Each leg is a sling with its own rating. Its capacity is the number of legs carrying, times the rating per leg, divided by the load angle factor.

```
Bridle = n × WLL ÷ LAF
Three or four legs: n = 2 (two-leg rule)
```

On a rigid load, a three- or four-leg bridle does not share the load evenly. The legs are never exactly equal, so two of them end up with the weight. Plan it as if only two legs carry the load.

EXAMPLE 4.1 **Two-leg chain bridle**

A two-leg alloy chain bridle has 4,000 lb legs at 55°. What can it lift?

1. LAF at 55° = 1.221
2. 2 × 4,000 ÷ 1.221 = 6,552 lb

Answer: 6,552 lb

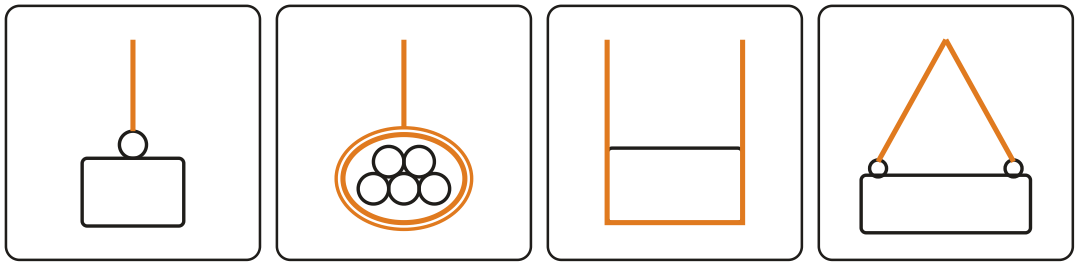
EXAMPLE 4.2 **Four legs, metric**

A four-leg bridle has 2,500 kg legs at 50°. Using the two-leg rule, what can it lift?

1. Plan for two legs
2. 2 × 2,500 ÷ 1.305 = 3,831 kg

Answer: 3,831 kg, not twice that

Picking the hitch



One lifting point	Bundle or long round load	Load that can't slide or roll	Two or more lugs
Vertical	**Double wrap choker**	**Basket**	**Bridle**

Match the hitch to the load: its lifting points, its shape, and whether it can slide.

- **Vertical:** the load has one lifting point and won't turn.
- **Choker:** bundles and long round loads. A double wrap choker grips best and draws a bundle together. On a long load, use two, spread apart.
- **Basket:** only when the load can't slide or roll out.
- **Bridle:** the load has two or more lifting points, such as lugs or eyes.

ON THE JOB

Protect the sling at sharp edges

A sharp edge can cut a fibre or synthetic sling and damage a wire rope. OSHA's sling guidance says to pad every sharp edge that touches a sling with material strong enough to protect it: put a softener or edge guard between them.

CHECK YOUR UNDERSTANDING

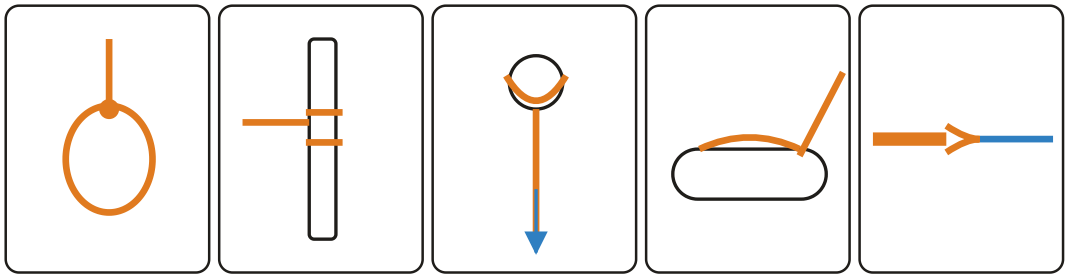
1. A crate has four lifting lugs on top. Which hitch?
2. A bundle of loose pipe must stay together. Which hitch?

Answers at the back of the chapter.

5 Knots riggers use

Riggers tie off tag lines and hand lines every day, and the exam asks which knot does what.

Fibre rope is used for tag lines, hand lines and light lifts, and riggers tie it with a few trusted knots. Each knot has one job it does well. The five below start with the bowline. Learn what each one is for. A qualified person should show you how to tie them.



What each knot is for. These pictures show the job, not how to tie the knot.

KNOT	WHAT IT IS FOR	WATCH FOR
Bowline	A fixed loop that won't slip; unties easily after a load	Leave a long tail
Clove hitch	Tying a line quickly to a pipe or post	Can slip if the pull keeps changing
Round turn and two half hitches	Tying a line off to a ring, bar or post under load	Take the turn first: it holds the strain
Timber hitch	Gripping a log, pole or pipe to drag it	Holds only while it is pulled
Sheet bend	Joining two ropes, even of different sizes	Not for joining slings

Uses from IHSA's rigging chapter (ch. 24) and Animated Knots (animatedknots.com).

A knot holds by friction: the rope pinches itself, the way a hand grips a bar harder the harder the bar is pulled. How each knot pinches decides what it is good for.

- **Bowline:** the loop is locked by the rope's own turn, so it won't slip or jam under load, and it unties easily once the load is off. On the job: a loop to drop over a hook or a post.
- **Clove hitch:** two turns held only by friction. A steady pull locks it, but a pull that keeps changing direction rolls the turns, and it slips. On the job: a quick tie to a pipe, backed up if it must hold.
- **Round turn and two half hitches:** the round turn takes the strain on the post while you tie the hitches, so you can tie off a line that is already pulling. On the job: making off a hand line to a rail.
- **Timber hitch:** the pull pinches the wraps against the pole, and when the pull stops it falls apart. On the job: dragging a pole or a length of pipe; IHSA adds half hitches to hoist a scaffold plank.
- **Sheet bend:** one rope wraps around a bend in the other, so it grips even when the ropes are different sizes. On the job: joining a short hand line to a longer one.

SAFETY

Knots and slings

OSHA's sling guidance says never shorten or lengthen a sling by knotting or twisting it, and a sling with a knot in any part comes out of service. Never join two slings with a knot. Use a sling of the right length, or the right hardware.

CHECK YOUR UNDERSTANDING

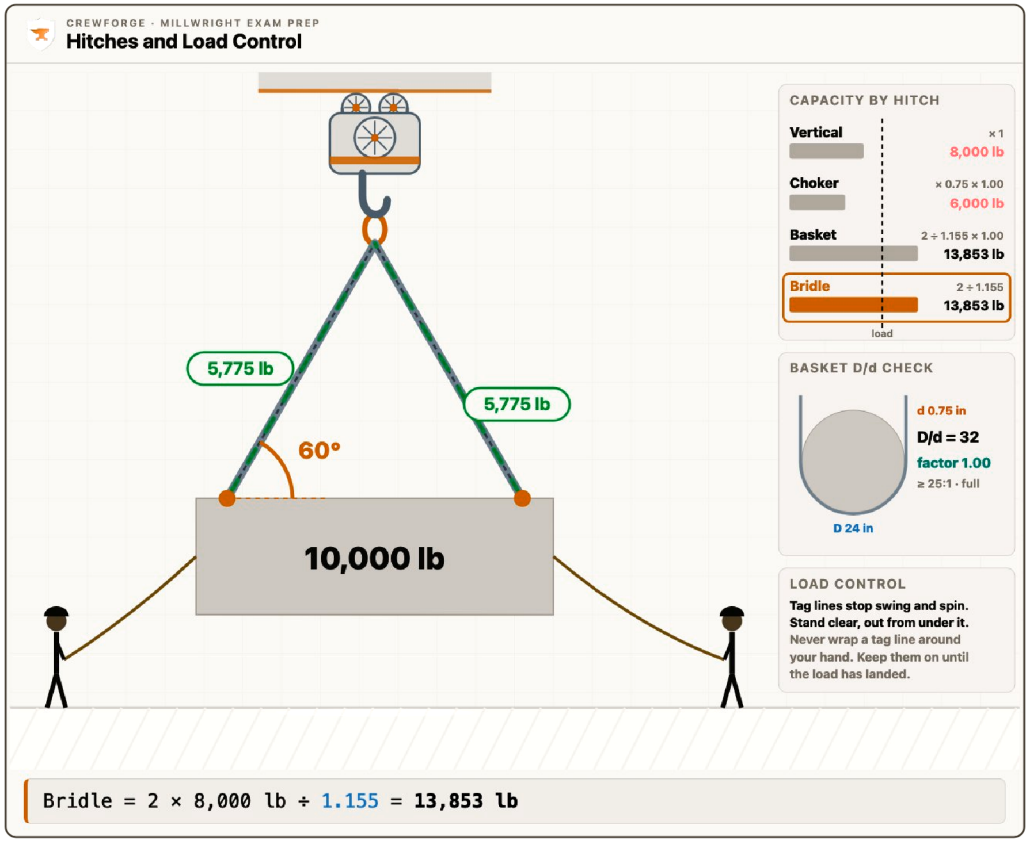
1. Which knot joins two ropes of different sizes?
2. Why is a clove hitch a poor choice where the pull keeps changing?

Answers at the back of the chapter.

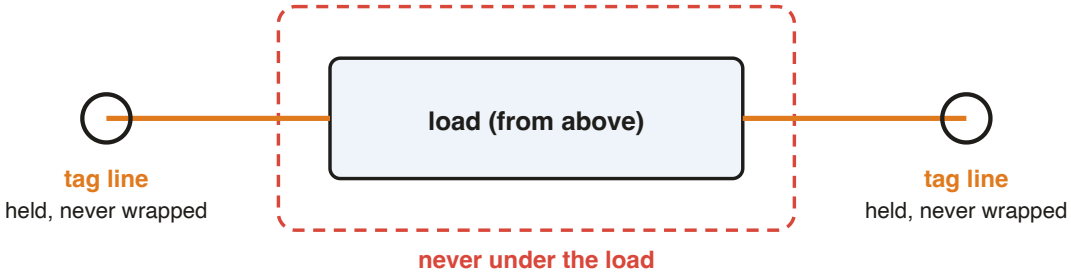
6 Load control and tag lines

A load that swings or turns can pin a worker against a column, or catch a leg on the way past.

A tag line is a rope tied to the load. A worker holds it from a safe distance to stop the load swinging or turning as it moves. Use as many as you need to control the load: on a long load, that is usually one on each end.



A two-leg bridle with a tag line on each end. The two workers keep the load from turning.



Seen from above: workers hold the tag lines from the side, well clear of the load and never under it.

1. Attach the tag lines before the lift.
2. Stand clear of the load, and never go under it, even for a dropped line.

3. Never wrap a tag line around your hand, wrist or body.
4. Keep the tag lines on until the load has landed and is supported.

If the load moves suddenly, don't fight it: never pull harder or move closer to hold it. Let go of the tag line. A line wrapped around a hand can pull a worker in, or off a ledge. These rules come from the lifting gear makers' tag line guides (Hercules SLR; LGH).

SAFETY

Exam preparation, not a procedure

This lesson teaches the rules behind load control. On the job, follow your site's procedures, the lift plan and the signal person.

CHECK YOUR UNDERSTANDING

1. When can the tag lines come off?
2. What do you do if a load swings hard and the tag line pulls?

Answers at the back of the chapter.

7 Putting it together: rig the right hitch

On the job these steps come in one order, and each one needs the one before it.

Here is the order a millwright works through to choose and check a hitch. Your site's lift plan and procedures come first; this is the thinking behind them.

1. Know the load: its weight, its centre of gravity and its shape.
2. Choose the hitch that suits its lifting points and shape.
3. Work out the hitch capacity: choker factors, load angle factor and D/d.
4. Check that the capacity is at least the load each sling carries.
5. Protect the sling at every sharp edge.
6. Attach the tag lines before the lift.
7. Lift a few inches, check the hitch has seated, then carry on.

EXAMPLE 7.1 **Field scenario: chokers or baskets?**

A 9,000 lb roll, 30 in across, must be lifted level. You have two ¾ in wire rope slings rated 6,000 lb vertical. Each sling will take half the load, one near each end. Compare two chokers with natural chokes against two baskets with legs at 60°.

1. `Each sling carries 9,000 ÷ 2 = 4,500 lb`
2. `Choker: 6,000 × 0.75 = 4,500 lb: exactly the load, with no margin`
3. `Basket: D/d = 30 ÷ 0.75 = 40 : 1, factor 1.00`
4. `Basket at 60°: 2 × 6,000 ÷ 1.155 = 10,390 lb, 43 % used`

Answer: Baskets, 10,390 lb each, if the roll is kept from rolling out (cradled or chocked). Chokers would be at 100 % of their rating.

SAFETY

The design factor is not spare capacity

A wire rope sling is made to break at about five times its rating. That margin covers wear, shock loads and small errors. Rate a choker as a choker, never by its vertical rating.

Key formulas

Vertical	`capacity = WLL`
Choker	`WLL × 0.75 (wire rope) × angle-of-choke %; chain and synthetic 0.80, maker's chart below 120°`
Load angle factor	`LAF = 1 ÷ sin θ (θ from horizontal)`
Basket	`2 × WLL ÷ LAF × D/d factor (wire rope)`
D/d	`D ÷ d; 25 : 1 or more = 1.00; between rows, the next lower row`
Bridle	`n × WLL ÷ LAF; three or four legs: n = 2`
Sling rating needed	`load carried ÷ hitch factor`
Tag lines	`on before the lift, off after it lands; never wrapped; never under the load`

Where people lose marks

- **Using the vertical rating for a choker.** A choker is 75 % (wire rope) or 80 % (chain, synthetic) of vertical.
- **Missing the second reduction for a sharp choke.** Below 120°, multiply by the angle-of-choke percentage as well.
- **Doubling the rating for an angled basket.** Twice the rating applies only with vertical legs. Divide by the LAF.
- **Forgetting D/d on a wire rope basket.** Below 25 : 1, multiply by the D/d factor. Use the next lower row.
- **Multiplying by the load angle factor instead of dividing.** Capacity goes down as the angle gets lower. Divide.
- **Dividing by four on a four-leg bridle.** Plan for two legs.
- **Knotting a sling to shorten it.** Never. Use the right length of sling.
- **Taking the tag lines off too early.** Keep them on until the load has landed.

Practice questions

Part A is multiple choice, in the style of the Red Seal exam. Part B asks you to show your working. Answers and full solutions are at the back.

Part A

A1. A wire rope sling is rated 4,000 lb in a vertical hitch. What is its rating in a choker hitch (choke angle 135°)?

A. 2,000 lb
B. 3,000 lb
C. 4,000 lb
D. 8,000 lb

A2. A wire rope sling is rated 6,000 lb vertical. It is used in a choker with a 75° choke angle. Choker = 75 %; 60–89° choke = 74 %. What is its rating?

A. 3,330 lb
B. 4,440 lb
C. 4,500 lb
D. 6,000 lb

A3. A synthetic web sling rated 5,000 lb vertical is used in a basket with both legs at 60° from horizontal (LAF 1.155). What is the basket capacity?

A. 5,000 lb
B. 8,658 lb
C. 10,000 lb
D. 11,550 lb

A4. A 20 mm wire rope sling rated 3,600 kg vertical is used in a basket around a 300 mm pipe, legs at 60° (LAF 1.155). Basket D/d factor at 15 : 1 = 0.88. What is the capacity?

A. 3,600 kg
B. 5,486 kg
C. 6,234 kg
D. 7,200 kg

A5. Three lengths of pipe are lifted together as a bundle. Which hitch holds the bundle best and keeps the pieces from sliding out?

A. Single basket
B. Vertical hitch
C. Double wrap choker
D. Single choker with a sharp choke

A6. Which knot forms a fixed loop that will not slip under load and is easy to untie afterwards?

A. Clove hitch
B. Bowline
C. Sheet bend
D. Timber hitch

A7. Which is correct practice for tag lines?

A. Wrap the line around your hand for a firm hold
B. Remove them once the load is clear of the floor
C. Attach them before the lift and keep them on until the load lands
D. Stand under the load to steady it

A8. A ¾ in wire rope sling rated 8,000 lb vertical is used in a basket around a 6 in pipe, legs at 60° (LAF 1.155). Basket D/d factor at 8 : 1 = 0.84. What is the capacity?

A. 16,000 lb
B. 13,853 lb
C. 11,636 lb
D. 6,000 lb

Part B

B1. A wire rope sling rated 5,000 lb vertical is used as a choker with a 100° choke. What is its capacity?

B2. A wire rope sling rated 4,000 kg vertical is used as a choker with a 70° choke. What is its capacity?

B3. A ½ in wire rope sling rated 7,000 lb vertical is used as a basket with vertical legs around an 8 in pipe. What is its capacity?

B4. A synthetic sling rated 3,000 kg vertical is used as a basket with its legs at 55°. What is its capacity?

B5. A three-leg bridle has 4,000 lb legs at 50°. Using the two-leg rule, what can it lift?

B6. A 2,400 lb load hangs from one synthetic choker with a natural choke. What vertical rating must the sling have?

B7. Which knot would you use to drag a length of pipe along the floor?

B8. A load is still being lowered the last few inches, and the crew wants to take the tag lines off now. Is that right?

Answers and worked solutions

Check your understanding

Section 1.

1. A basket with vertical legs: twice the vertical rating.
2. A quarter of its rating: a wire rope choker is 75 % of vertical.

Section 2.

1. 4,000 × 0.75 = 3,000 lb. 140° is over 120°, so there is no further reduction.
2. The 60°–89° row: 74 %.

Section 3.

1. 10 ÷ 0.5 = 20 : 1, the 20 : 1 row, factor 0.92.
2. Twice the vertical rating.

Section 4.

1. A bridle, planned with the two-leg rule.
2. Double wrap chokers, two of them, spread apart.

Section 5.

1. The sheet bend.
2. It can slip.

Section 6.

1. Once the load has landed.
2. Let go of the line. Never wrap it around your hand.

Part A

A1. B. 3,000 lb

Choker = 4,000 × 0.75 = 3,000 lb (135° ≥ 120°: no further reduction)

A2. A. 3,330 lb

6,000 × 0.75 × 0.74 = 3,330 lb

A3. B. 8,658 lb

Basket = 2 × 5,000 ÷ 1.155 = 8,658 lb (no D/d factor for synthetic)

A4. B. 5,486 kg

D/d = 300 ÷ 20 = 15 → 0.88; 2 × 3,600 ÷ 1.155 × 0.88 = 5,486 kg

A5. C. Double wrap choker

A double wrap choker wraps the bundle twice, holds all the way round and draws the pieces together.

A6. B. Bowline

The bowline: a fixed loop that holds its size and unties easily after loading.

A7. C. Attach them before the lift and keep them on until the load lands

Attach before the lift, stand clear, never wrap, keep them on until the load has landed.

A8. C. 11,636 lb

D/d = 6 ÷ 0.75 = 8 → 0.84; 2 × 8,000 ÷ 1.155 × 0.84 = 11,636 lb

Part B

B1. 3,263 lb

1. Choker: 5,000 × 0.75 = 3,750 lb
2. 100° → 87 %
3. 3,750 × 0.87 = 3,263 lb

B2. 2,220 kg

1. Choker: 4,000 × 0.75 = 3,000 kg
2. 70° → 74 %
3. 3,000 × 0.74 = 2,220 kg

B3. 12,320 lb

1. D/d = 8 ÷ 0.5 = 16 : 1 → the 15 : 1 row, 0.88
2. 2 × 7,000 × 0.88 = 12,320 lb

B4. 4,914 kg

1. LAF at 55° = 1.221
2. 2 × 3,000 ÷ 1.221 = 4,914 kg

B5. 6,130 lb

1. 2 × 4,000 ÷ 1.305 = 6,130 lb

B6. At least 3,000 lb vertical

1. Synthetic choker: 80 % of vertical
2. 2,400 ÷ 0.80 = 3,000 lb

B7. A timber hitch

1. A timber hitch grips a log, pole or pipe so it can be dragged

B8. No. Keep them on until it has landed.

1. Tag lines stay on until the load has landed

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