Scout Knot Relay Device

Attribution

Thanks to the original designer and builder, Bryan Mecham from Troop 173 in Meridian, Idaho. Also, thanks to Joseph "Joey" Kozlowski from Troop 119 in Meridian, Idaho for sharing his device for copying.

Description

This knot relay device has the seven required knots for the Boy Scout "Trail To First Class" ranks. It can be assembled quickly and transported easily. The scouts will enjoy doing one-on-one relays or team relay competitions. It is a good device to maintain knot tying skills that are often lost after the knot requirement is learned.

Drawing

Labeled pipe segments and connectors

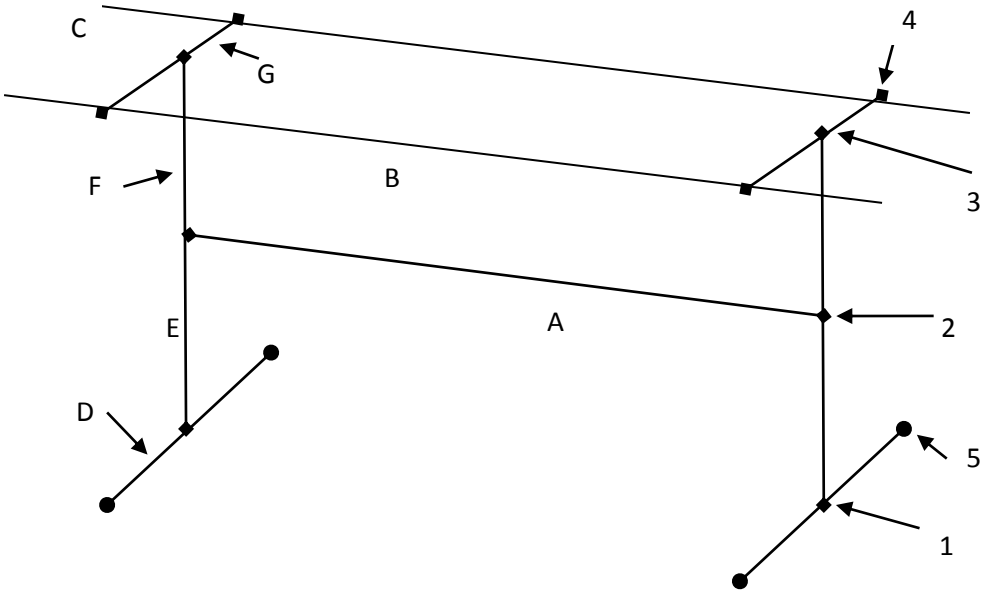


Figure 1: Labeled pipe segments and connectors. Assembled device with parts labeled. Lines are pipe pieces, diamonds are "T" connectors, and round dots are end connectors. See write-up for descriptions.

Material List

Approximate cost is less than $50.

1. 4 each: 1 inch x 10' PVC pipe (450 psi)
2. 10 each: 1 inch "T" PVC (450 psi)
3. 4 each: 1 inch cap
4. 50' of 5/16" rope (flexible nylon)

5. 3’ piece of thin rope (e.g. paracord)
6. (Optional) 2 each: 4’ rebar or pipe that can fit inside pipe for additional base weight.

Tools List

1. Hacksaw or Miter box for cutting plastic pipe
2. Sandpaper (e.g. 100 grit) for sanding plastic burrs after drilling and cutting
3. Scissors for cutting rope
4. Lighter for fusing rope
5. 3/8” drill and electric drill (can be a wood drill bit)
6. Vise for holding pipe while drilling
7. Nail for starting drill hole in pipe
8. Packing tape to tape knot diagrams to the pipe
9. Safety goggles or glasses
10. Dustpan and brush for cleanup
11. Mallet for constructing device

Cutting pipes

Cut each pipe in the following lengths. Cut the 1-foot segments on the end of the pipes (as shown) in order to have the factory cut be the visible cut (the factory cut is the cut at the ends already made before purchasing the pipe). This will allow the smooth ends to be visible during construction of the relay device. All lengths are in feet. Sand off any burrs.

1. Pipe 1: 6, 2, ½, ½, 1
2. Pipe 2: 6, 2, ½, ½, 1
3. Pipe 3: 1, 6, 2, 1
4. Pipe 4: 2, 2, 2, 2, 2

When you are done you will have the following lengths:

1. 3 each of 6 feet (Labeled “A” and “B” in Figure 1)
2. 4 each of 1 foot (“C” in Figure 1)
3. 8 each of 2 feet (“D”, “E” and “F” in Figure 1)
4. 4 each of ½ foot (“G” in Figure 1)

You will also have:

1. Ten “T” pieces (Labeled “1”, “2”, “3”, “4” in Figure 1)
2. Four End Caps (Labeled “5” in Figure 1)

Drilling holes

When drilling holes, secure the pipe in a vise so it won’t slip or rotate while drilling. Use a nail or sharp object to carefully start a pilot hole. If no vise is available construct a “V” shape with two pieces of wood.

For a more pleasing appearance have the writing on the pipe be down. You will be drilling through both the top and bottom of the pipe to try to keep the drill bit centered in the pipe and held vertical.

See Figure 2 for a diagram of the drill locations.

For the 1-foot segments (“C”) drill a hole at 5-1/2” from the factory finish end.

For two (2) of the 6-foot segments (“B”) drill holes at the following distances from one end: 6-1/2”, 21”, 36”, 51”, and 65-1/2”. The 3rd 6-foot segment (“A”) has no holes in it.

Sand the holes carefully to remove burrs. The smoother the holes are, the easier it is to get the rope through the holes. You may want to wrap the sandpaper around a pencil or something similar to get to the inside of the holes.

Diagram of drill and knot locations

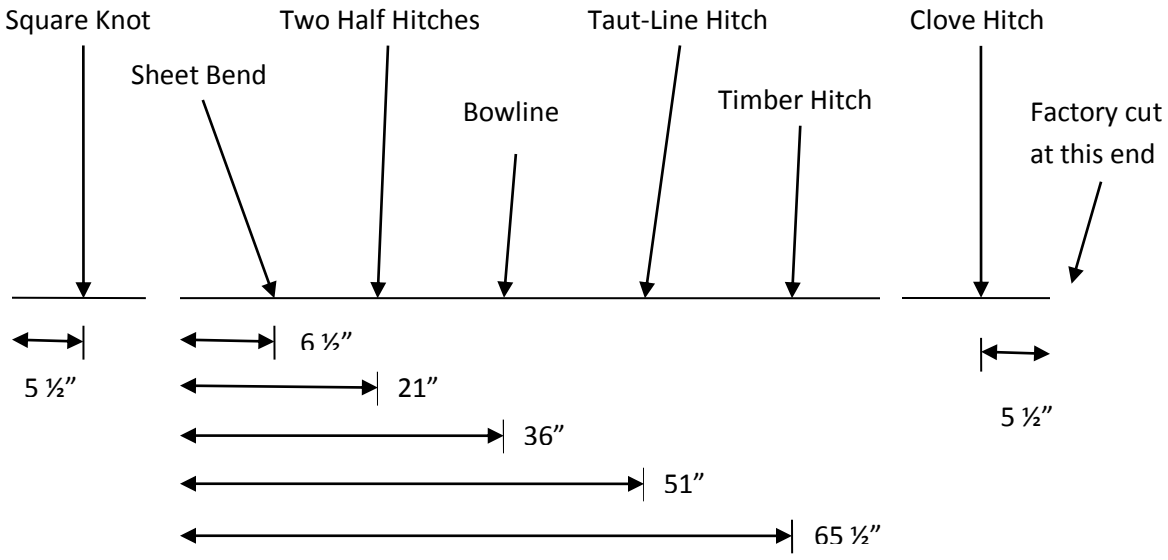


Figure 2: Drill and knot locations. Drill holes at the following locations measured from the ends of the respective pieces. The ropes for the knots are labeled. Repeat this for both sides, starting from the same end. See the following sections for the procedures. The long pipe is a segment “B” piece and the two small pipes are segment “C” pieces.

Cutting Rope

When cutting the rope use a lighter to fuse the end to prevent the rope from fraying. When fusing it is very important to have the fused portion be smaller than the 3/8” hole that was drilled so the rope can be threaded through the holes. It is possible to wait a short time after the nylon has cooled from the flame and then squeeze the fused end from four sides to squish it into a narrower end than the rope.

With the 50’ 5/16” nylon rope, cut two (2) pieces that are 30” long and cut twelve (12) pieces that are 45” long.

Construction

There is no need to use glue or pipe cement. For a more pleasing appearance have writing on the pipe pieces facing down with the pieces that are parallel to the ground, and facing inward on the vertical pieces.

Note: The following instructions reference Figure 1. For example, **End Cap (“5”) -> 2’ segment (“D”) -> “T” (“1”)** means attach End Cap labeled “5” on the end of the 2-foot segment labeled “D” which is attached into the “T” connector labeled “1”.

Pipes

1. Base: Attach End Cap (“5”) -> 2’ segment (“D”) -> “T” (“1”) -> 2’ segment (“D”) -> End Cap (“5”). If using optional rebar or pipe for extra weight, insert it before attaching the last End Cap. Use mallet where necessary to secure parts.
2. Repeat for 2nd base.
3. Into the “T” (“1”) of the base insert 2’ segment (“E”) -> “T” (“2”) -> 2’ segment (“F”) -> “T” (“3”). The lower “T” has the opening on the side; the upper “T” has the bottom of the “T” on the 2’ segment (“F”). The openings of the upper “T” is parallel to the base.
4. Repeat for 2nd base.
5. To the upper “T” of step 3, attach a ½’ segment (“G”) and a “T” (“4”), where the “T” is parallel to the ground when the piece is upright. Do this for both sides of the upper “T”.
6. Repeat for 2nd base.
7. Attach the two bases together using the single 6’ segment (“A”) without holes and the “T” (“2”) that is halfway up the side.
8. Attach the two 6’ segments (“B”) with holes between the upper “T” connectors (“4”) that are open. The 6’ segments will all be parallel to each other. Make sure the holes are vertical so the ropes will hang down.
9. Attach the 1-foot segments (“C”) to the last open “T” connectors (“4”). The drilled holes should be closer to the “T” connector. The smooth, factory cut should be facing out.

Rope

For all knots, thread the rope segment through the two holes that are vertical to each other. It might be easier to thread from the bottom up, depending on how the holes were drilled.

NOTE: This is a relay device so each knot on one side is across from the same knot on the other side.

For the square knot, thread the 30” piece of rope halfway through the holes. Tie a simple overhand knot next to the plastic pipe so the rope is centered and cannot slide. A square knot can be tied with the two ends of the single piece.

For all other knots, thread the 45” piece of rope through the holes. Tie a simple overhand knot at the top and pull the rope down through the hole until the knot is resting on top of the pipe. Tie another overhand knot so that it is tight against the bottom of the pipe so the rope will not slide.

Tie the 30” smaller cord to the pipe, between the Sheet Bend rope and the Two Half Hitches rope. Use two half hitches to attach it. Slide it next to the Sheet Bend rope as it is the second rope for the Sheet Bend knot.

Visual Aids

Print, cut out and tape each knot diagram on piece “A”. The Square Knot diagram goes right next to the “T” connector on the appropriate side and the Clove Hitch diagram goes right next to the “T” connector on its side. All other diagrams line up with the drilled hole for the respective knot.

Use clear packing tape to attach the knot diagram to the pipe.

How to Use

As a relay device have two scouts start across from each other at the square knot. As soon as a knot is tied the scout moves to the next knot. The first scout to finish all the knots (in order) wins.

As a team relay, start as above. Once a scout has finished with the square knot and moved to the sheet bend knot, the next scout on the team can start the square knot. The following scout must completely untie the knot before starting.

Under one minute for all knots is a good time. Some scouts or leaders raise the bar by tying knots facing away from the relay device with their hands behind their back.

Note: There are different ways to tie each knot and some knots can be tied rapidly or traditionally. Set any rules you want to make sure scouts learn a variety of ways to tie each knot.

Transportation

To transport the device it can be taken apart in the following steps:

1. Remove the pipe segments “B” from the “T” connectors. The ”T” connectors can be twisted so the 1-foot segments with the square knot and clove hitch ropes are pointed down.
2. Remove the pipe segment “A” from the “T” connectors. Lay segment “A” down with the “B” segments.
3. Remove pipe segments “E” from the base. Lay the base pieces and vertical sides down with the “A” and “B” segments.
4. Using the two of the ropes (e.g. Bowline and Timber Hitch) from segments “B”, wrap the ropes in opposite directions around all the pieces one or two times and tie with a square knot. This show hold the pieces together securely.
5. Optional – Find a 10-foot segment of rope and tie around top and bottom of the pipe bundle (e.g. using a two half hitch) to create a strap to carry the bundle over a shoulder.

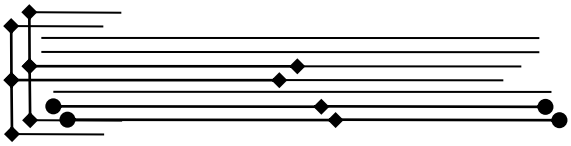


Figure 3: Pipe segments laid out for transportation. Use the ropes from the knots to tie all the segments together.

Knot Descriptions

Square Knot

The **square knot** can be used to join two ropes together. Generally, it works best with two ropes of the same diameter, and should not be used to hold a heavy load.

Sheet Bend

The **sheet bend** won't slip when ropes of dissimilar material and size are entwined. When tying the knot, be sure that the working ends are on the same side; otherwise, the knot might be unreliable. If you tie a thick and thin rope together, use the thick rope to form the "stationary loop" and the thin rope as the "working line."

Bowline

This knot is popular among mountaineers, climbers, sailors and others. Use the **bowline** when you need a non-slip loop at the end of a line. The knot won't slip, regardless of the load applied.

Two half hitches

Use two half hitches to tie a rope to a tree, ring or dock. If you need more security, take a second turn around the tree, or just add more half-hitches.

Taut-line hitch

To create an adjustable loop that stays in place, use the **taut-line hitch**. This is the knot to use for staking out the guy lines of your tent.

Timber hitch

The **timber hitch** is often used to drag a log across the ground or to start a diagonal lashing.

Clove hitch

The **clove hitch** is a versatile knot that is often used in Scouting activities, including servings as the start or finish to many lashings.

About the Author

This document was created by Mike Lydon, Meridian Troop 62, Ore-Ida Council, for the benefit of all scouts. It is one of his Wood Badge (W1-106-16 – Owl Patrol) ticket items. Any errors are solely mine.

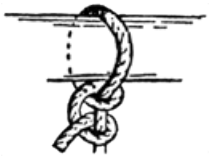
Knot Diagrams

Print out this page and cut out the diagrams to tape to the lower pipe cross-segment, labeled “A” in Figure 1. You can tape the square knot and clove hitch diagrams near the correct side connectors and the rest can line up with the rope for that particular knot.

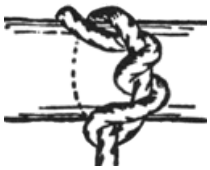
Square Knot

Sheet Bend

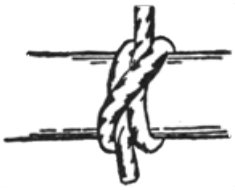
Bowline



Two Half-Hitches



Timber Hitch



Clove Hitch

Taut-line Hitch