

PVC Pipe Corner Worker Flag Stand

All corner flaggers have worked stations where there was absolutely no place to store or organize the racing flags. The flags are usually propped up against a barrier or strewn about on the ground. The wind is constantly blowing the flags over and the flaggers are constantly stepping on the flags. The flags are continually changing locations so it is hard to find the right flag when that urgent need arises. This article will explain how to make a simple corner station flag stand out of PVC pipe.



I based my design on using a single length of 10 foot PVC pipe that can be obtained from any Home Depot, Lowe's, or other local hardware store. My design will hold eight flags but I will discuss other possible variations at the end of this article.

When purchasing your pipe remember that CPVC pipe comes in smaller diameter sizes and is used for hot water plumbing. This type of pipe is often used for making flag handles. PVC pipe is used for cold water applications and for sprinkler systems. I chose to make my flag stand from PVC-40 pipe even though it has a thinner wall than PVC-80 pipe. PVC-40 pipe has a wall thickness of .133 inch for a 1 inch pipe while PVC-80 pipe has a wall thickness of .179 inch. Schedule 80 PVC pipe is usually much harder to find.

I originally made a flag stand based on 1/2" dowel rod flag handles which is what I was issued at my first SCCA races. Because I live in Austin, Texas, I also flag at the Circuit of the Americas. They use two pieces of CPVC pipe to make a telescoping flag handle that will fit inside their storage lockers at each flag stand and then extends out to support the flag. They also put an end cap on the lower end of the CPVC which further increases the diameter of the flag handle. To accommodate the Circuit of the Americas flags, I had to go to 1 1/4" PVC pipe to accept their flag shafts with endcaps.

My proposed flag stand is made from several lengths of PVC pipe and a number of tees and elbows for that size pipe used. The following table gives the cost for making a flag stand in three different sizes of pipe. My prices were the same at both Home Depot and Lowe's but prices will vary locally.

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Cost of Various Size Flag Stands – Table 1			
	1/2" Dowell	1/2" CPVC with End Cap	3/4" CPVC with End Cap
PVC Pipe Size	3/4"	1"	1 1/4"
Price of 10 Foot Section	\$2.42	\$3.59	\$4.82
Price of 10 Tees	\$4.60	\$9.70	\$19.80
Price of 4 Elbows	\$1.92	\$1.92	\$5.78
Price of Primer	\$5.96	\$5.96	\$5.96
Price of Glue	\$4.94	\$4.94	\$4.94
Total Cost	\$19.84	\$27.11	\$41.28

I calculated the lengths for the various pieces based on using a single 10 foot piece of PVC pipe. The calculations will work for any of the three size pipes noted in Table 1. Before moving on to the actual construction, let me describe the individual pieces. Tees and elbows are standard sized commercially available pieces whose costs are shown in Table 1. I specify a four inch piece between each tee and call these pieces the "piece between flags". To keep the design to 120 inches, 10 feet, I have used three inch pieces on each end of a series of tees. These three inch sections are only used on the ends. Four tees with their accompanying four inch "pieces between flags" and the two three inch end pieces are known as a "flag rail" (Fig 3). There are two "flag rails" in this design. On each end of this design are "end caps" made of two elbows, one tee, and two five inch "end piece separators" (Fig 2). The two flag rails are installed in the "endcaps" but are not glued. The "center connection" is installed in the center of each "end cap" and is glued to each "end cap" to hold the flag stand together. Table 2 below is a summary of the number and lengths of each part.

Length of Various Pieces for a Standard Flag Stand – Table 2			
Cumulative Length	Number of Pieces	Length of Piece	Description
24"	6	4"	Piece between flags
12"	4	3"	End pieces of flag rails
32"	8	4"	Flag shaft holder
20"	4	5	End piece separator
28"	1	28"	Center connection
116"	Total Length		

A few words about cutting the PFC pipe for this project. I bought a ratcheting PVC cutter when I made my second flag stand. This \$12.00 tool lasted all of five cuts before a large chip fell out of the cutting edge of the blade. I made some cuts with a miter box and saw, a band saw, and a table saw. I found the table saw to make the most even cuts. However, I have a cheap band saw which is what I used on most of my parts. Even if

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the ends are not cut at exact angles, they can still be used. A regular hand saw also worked well.



Each length of cut pipe will probably have burrs from the cutting process. I strongly recommend removing these burrs prior to gluing the parts together. A paring knife can be used to scrape the burrs off each part if one doesn't have a deburring tool, available for approximately \$7.00 at Home Depot or Lowe's.

There are two “end caps” in this design. Figure 2 shows the parts of the “end cap” prior to being glued together. This sub assembly consists of an elbow on each end and a tee in the middle. On each side of the tee is a five inch section of PVC. These sections of pipe space the “flag rails” far enough from the center connection so the “flag rails” can fold flat for storage. When gluing these pieces together, I found it helpful to put a short piece of PVC pipe in the each elbow and the tee to align all three parts in the same plane during the gluing phase. If they are not aligned in the same plane, the final flag stand will be twisted. Per the normal gluing instructions for PVC pipe, I applied primer to the inside of each elbow or tee and to the outside of each piece before gluing. I then applied glue to the inside of each elbow or tee, pressed in the appropriate piece of PVC pipe, and then tapped the pipe with a rubber mallet to make sure that it was seated.

Figure 3 shows the pieces of a flag rail prior to assembly. Table 3 gives a breakdown of the parts that are used in this subassembly. I glued the four inch flag shaft holder pieces into the tees first. When I put the individual tees into the rail assembly, I used the flag shaft holders to make sure that the tees were properly aligned so they would lie flat when folded down and so the flags would be in an aligned row when the rail was positioned to hold the flags.




Duplicate this spacing for each flag rail assembly – Table 3								
End Piece	Tee and Flag shaft holder	Piece between flags	Tee and Flag shaft holder	Piece between flags	Tee and Flag shaft holder	Piece between flags	Tee and Flag shaft holder	End Piece
3"	Tee	4"	Tee	4"	Tee	4"	Tee	3"
	4"		4"		4"		4"	

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Once both “flag rails” are made, they are laid side by side to check the length between the two. If the lengths are not similar within ½ inch, one of the three inch end pieces should be cut short until the “flag rails” are approximately the same length. Figure 4 shows the two “flag rails” positioned with the “center connection” between them. A precision straight edge or a spare piece of wood can be used to align all three parts. The “center connection” is then marked to be ¼ inch longer than the longest “flag rail”. The “center connection” is slightly longer than the flag rails so the flag rails will not bind when rotated in the assembled flag stand.

After the “center connection” is glued into one of the two “end caps”, the two “flag rails” are installed but not glued into either “end cap”. At this point, the subassembly should look similar to Figure 5. Primer is now applied to the remaining “end cap” tee and the exposed end of the “center connection”. After glue is applied to the remaining “end cap” tee, the “end cap” is installed over the center connection and both “flag rails”. PVC glue sets fairly quickly so having extra hands to locate the “flag rails” while installing the “center connection” in the “end cap” tee is appreciated. Use the rubber mallet to tap the “end cap” securely onto the flag stand assembly as shown in Figure 6.

Since no glue has been applied to either end of the “flag rails”, they should be free to rotate within the elbows of the “end caps”. If the “flag rails are pushed into the same plane as the “flag stand”, you should have a flat assembly for storage. Each “flag rail” can then be rotated 90 degrees when at the race track to hold the flags. I have been using one of these “flag stands” for two years and the “flag rails” are still tight. I notice that the “flag stands” made of the larger PVC pipe are harder to rotate than the “flag stands” made of the ¾ inch PVC pipe.

		
<p>Figure 4 – Flag rails and center connection. Note that the center connection is ½” longer than the rails.</p>	<p>Figure 5 – Flag rails and center connection prior to gluing.</p>	<p>Figure 6 – Finished flag stand with one flag rail in stored position and one ready for flags.</p>

If you want to customize your “flag stand” you can paint it. I would suggest cleaning the assembly with carburetor cleaner prior to painting. I would also recommend using Krylon Fusion Paint or one of the other plastic paints available today. These paints come in almost any color and are especially designed for use with plastics including

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PVC. Apply the paint in light thin coats and let the assembly dry about 10 minutes between coats.



Flag stand and flags as set up at SCCA Majors in Eagle's Canyon Raceway, Decatur, Texas. Note that only the tips of the flags are visible over the flag stand railing.



Flag stand at the Texas Motor Speedway in College Station, Texas.

It is easy to extend this "flag stand" to hold ten flags by adding an extra tee and an extra four inch piece as a spacer between tees. This will require more than the suggested 10 feet of PVC pipe but most stores sell PVC in two foot sections and only one should be needed for a ten flag holder. If you flag in a particularly windy area you might want to replace the corner elbows with additional tees or crosses so stabilizer feet might be added to keep the stand from blowing over in higher winds. In the two years that I have used my $\frac{3}{4}$ inch PVC flag stand, I have not had an issue with the wind but several people who have seen my design were concerned about the wind.

Two improvements were suggested on my last outing, the MotoGP at Circuit of the Americas. First, add reflective tape so people can see the flag stand when I cross the six lane street on those dark mornings as we are heading out to our stations. Second, we had a lot of rain one day and when I picked up the flag stand I noticed that it had water in it. I have now drilled a hole in each of the elbows so I can easily drain any water.

Have fun building your own "flag stand" now. It should take less than two hours even with a beer or two.