

WCP Tube Plugs- User Guide (Rev 1)

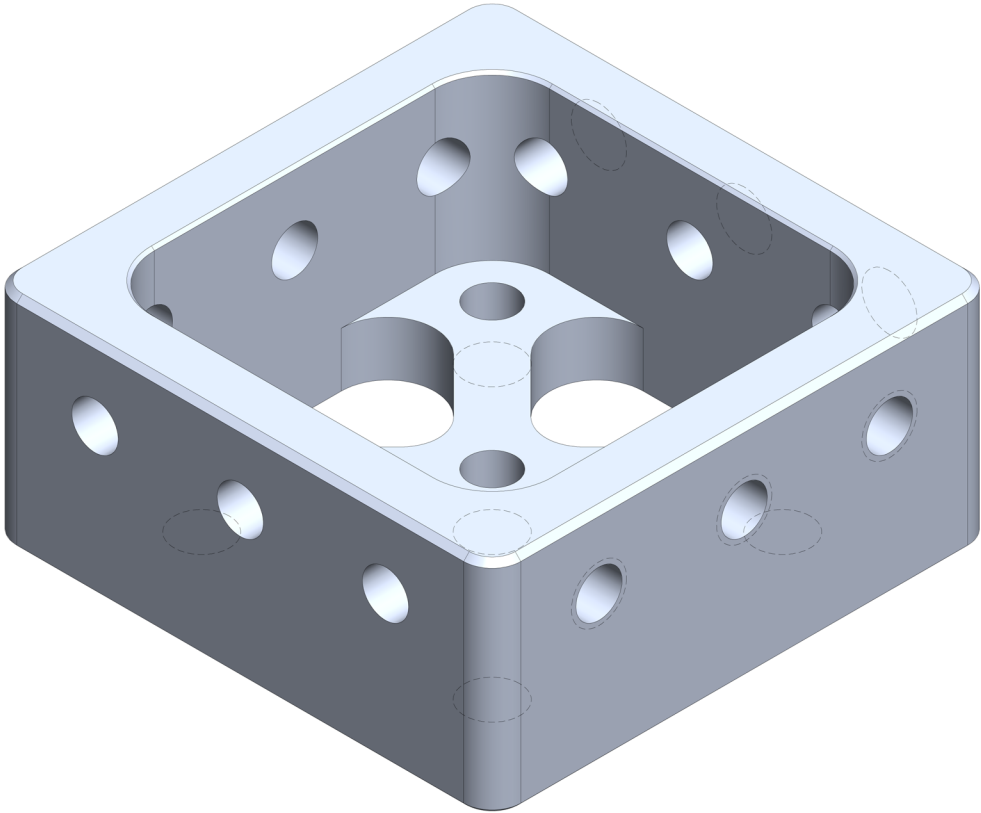




Table of Contents

What are the WCP Tube Plugs?	3
Tube Plug and Sleeve Sizing	4
Installation	5
Hole Drilling	6
Securing Tube Plug	6
Example Connections	7
Example: Corner Connection	8
Example: Middle of Tube	9
Revision Table	11



What are the WCP Tube Plugs?

Square and rectangular metal tubing are among the most commonly used robot construction materials in the FIRST Robotics Competition world. Most of the time, teams will use welding or gussets connected to holes in the tubes to mount parts to tubing, but not every team has access to welding, and sometimes gussets don't easily accomplish teams' design intent. Our solution to this is Tube Plugs!

Tube Plugs are:

- Sized to fit 2"x2", 1.5"x1.5", 1"x1" and 2"x1" tubing
- Sleeves available to account for thinner tube wall thicknesses
 - .1", .06", .05" and .04"
- Tapped #10-32 on all five primary faces
- Designed to support a variety of attachment methods



Tube Plug and Sleeve Sizing

The below chart lists which Tube Plugs and Sleeves are compatible with which common tubing sizes. The Tube Plug with no Sleeves is designed to fit directly into the appropriate tube size in 0.125" wall thickness.

Tube Size	Tube Plug	Tube Plug Sleeve				
		0.125" Wall	0.10" Wall	0.0625" Wall	0.05" Wall	0.04" Wall
2" x 2"	WCP-0373	~	~	WCP-0377	~	~
2"x 1"	WCP-0374	~	WCP-0378	WCP-0379	WCP-0380	~
1.5" x 1.5"	WCP-0375	~	~	WCP-0381	~	~
1" x 1"	WCP-0376	~	WCP-0382	WCP-0383	~	WCP-0384

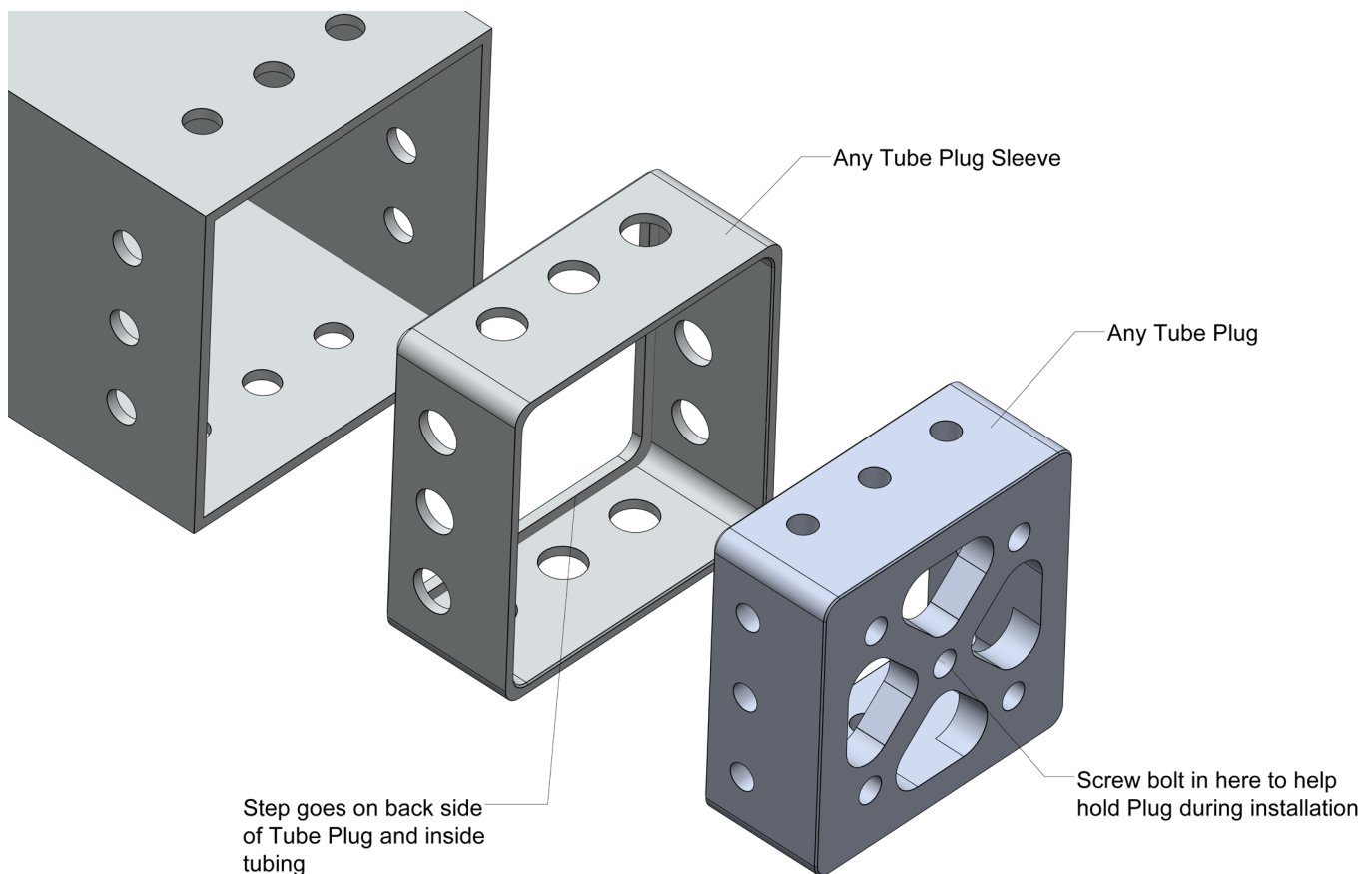


Installation

The Tube Plugs and Sleeves are designed to be a slip to light press fit into most tubing. When using the sleeve, the Plug and Sleeve may not slip directly in. In this case, use a dead blow hammer or soft mallet to tap the Plug and Sleeve into the tube.

We have found that screwing a #10-32 bolt into the large face of the Tube Plug helps during installation as this will prevent the Tube Plug from sliding into the tube. A small amount of super glue can be used to hold the Sleeve to the Tube Plug during intall.

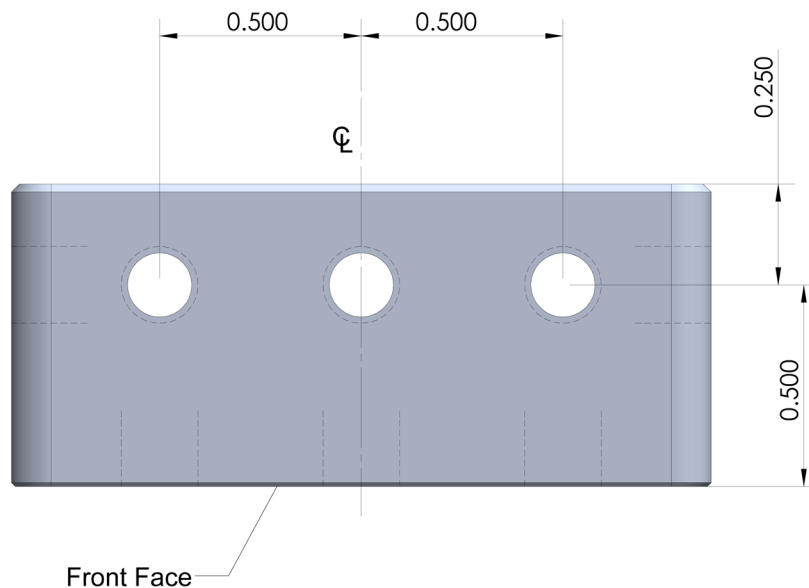
Note: Due to variations and quality in tubing from various suppliers the Tube Plugs may be a bit tighter than expected. If this is the case, a bit of extra force may be needed to install the plugs. The outside can also be sanded down or machined for a slip fit if desired.





Hole Drilling

All holes on the .75" tall sides of the Tube Plugs are .5" from the end of the tube and have .5" spacing between holes. It is recommended to drill these holes using a CNC machine or other hole drilling fixture. If holes are drilled by hand, increase the drilled hole diameter to account for any inaccuracies.



Securing Tube Plug

The Tube Plugs are designed to be secured into tubing using #10-32 x 3/8" L BHCS but these can be substituted for many other fasteners that teams use. A light weight alternative to bolts is to drill the holes out for a 3/16" rivet. Alternately, for a heavy duty connection, the holes can be drilled and tapped to 1/4-20.

All the holes can be used if desired. The recommended minimum is four fasteners in the front face and two fasteners, if possible, on two opposing side faces.



Example Connections

There is unlimited possibilities with the WCP Tube Plugs and Sleeves. Making strong, secure connections has now been made easier. Tube of various sizes can now easily be connected. Common examples can be seen in the following pages.

Examples and benefits:

- Connecting a 1"x1" tube to the middle of the 2" face of a 2"x1" or 2"x2"
- Connecting 3 or more tubes into one corner
- Outside of frames can be gusset from and still strong
- Drive train tubes or other structural tubes can be easily removed and replaced

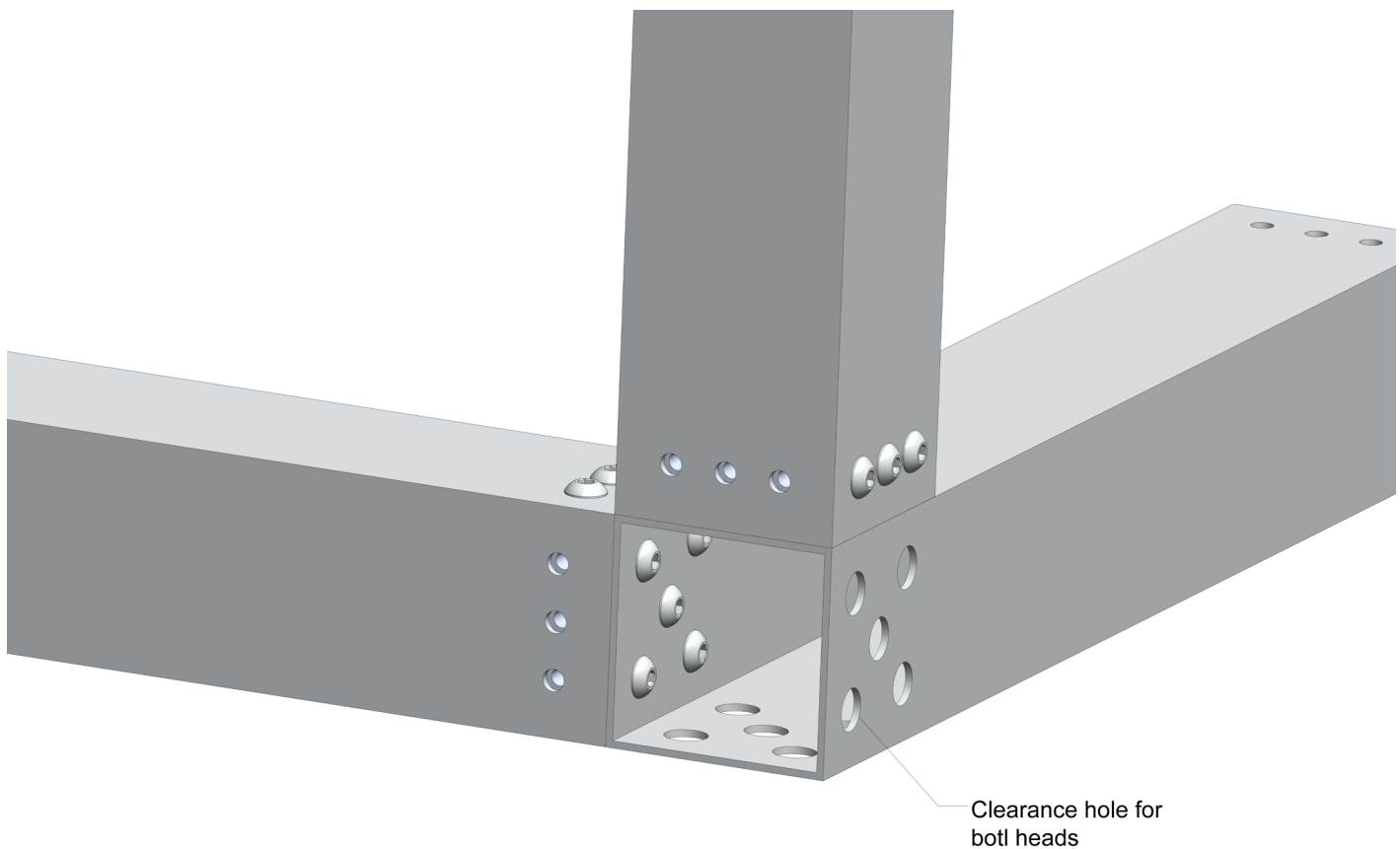


Example: Corner Connection

This is a common connection that teams can utilize the WCP Tube Plugs and Sleeves in. This connection can be seen in a variety of instances in the structures that many teams built. Gussets can now be omitted to keep the outside of a frame flat or to keep other areas free.

When passing a bolt through a tube, it is recommended to make a clearance hole in one side for the head of the bolt rather than passing a longer bolt through the tube.

Note: Any combination of tube sizes can be used in this example.

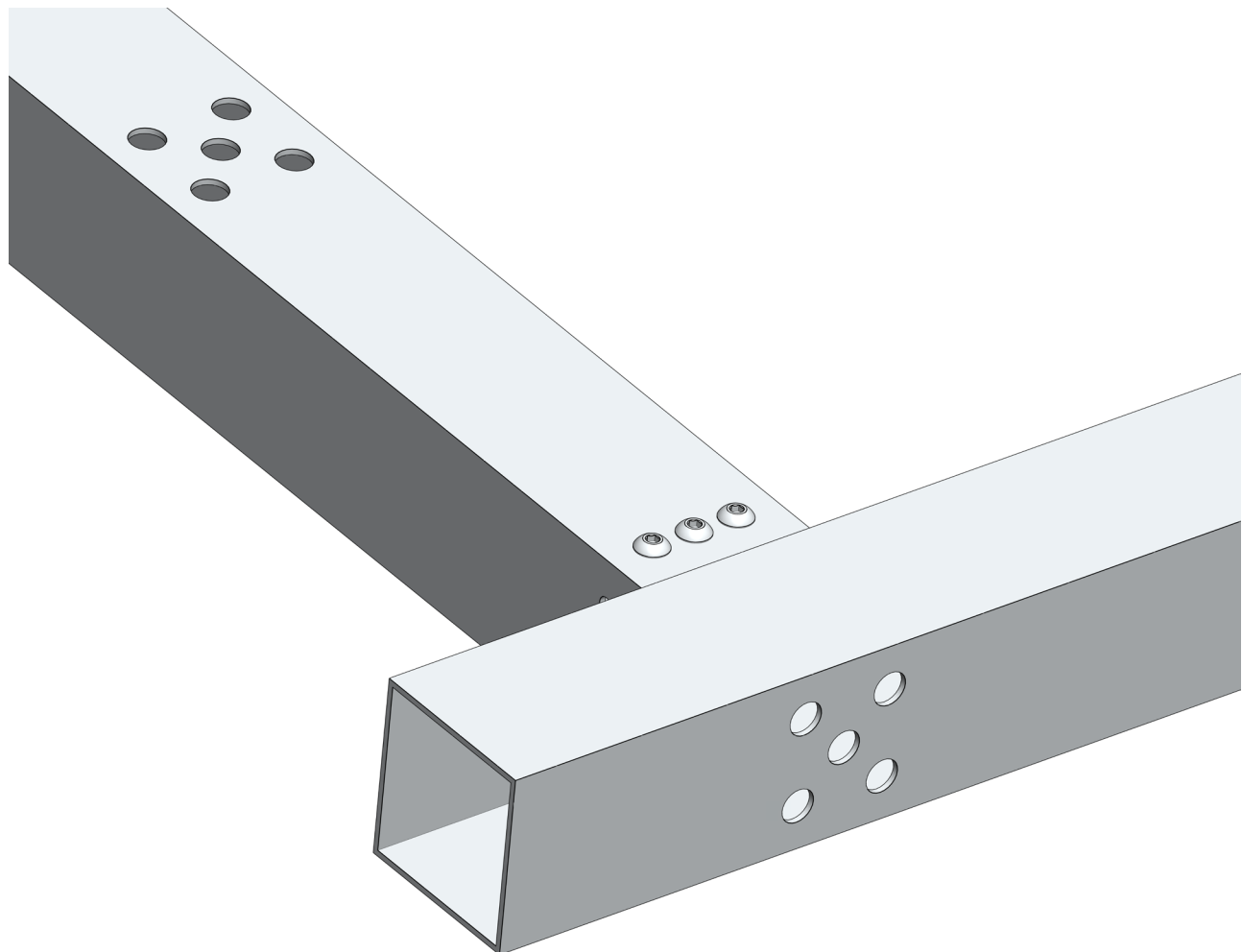




Example: Middle of Tube

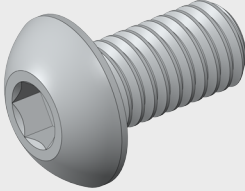
This connection is useful when connection super structure to the main drive train frame. This connection can also be done with multiple tubes going in various directions.

Note: Any combination of tube sizes can be used in this example.





Recommended Parts to Buy

Picture	Name	QTY
	#10-32 x .375" L BHCS (Steel, Black Oxide) (50-Pack) (WCP-0252)	As many as needed



Revision Table

Revision Date	Revision #	Description
8/2/2021	1.0	First revision created.
9/15/2021	1.1	Added 2"x1" and 1.5"x1.5" Tube Plugs and Sleeves.