

Frosty T Burner Build

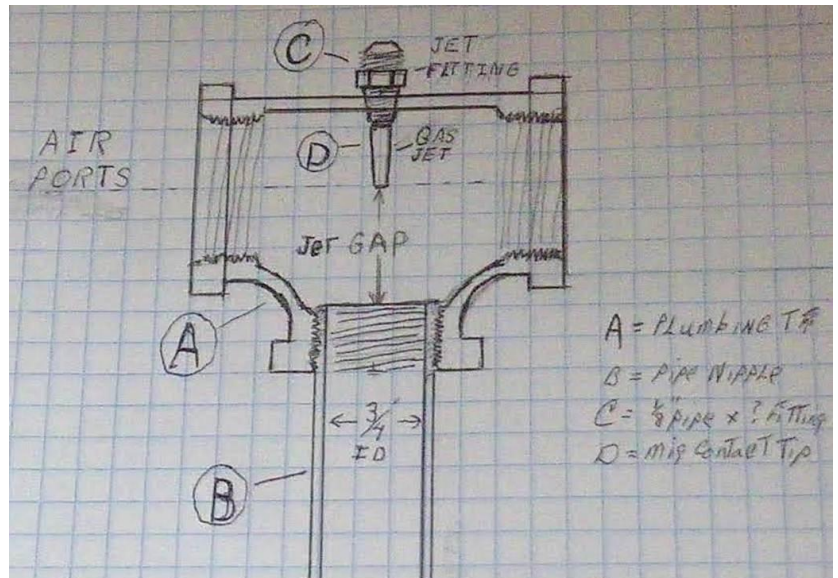
The T burner is a naturally aspirated burner built with plumbing parts, a few tools and some basic skills. The greatest demand is precision, it isn't a watch but the build needs to be done well for it to function well. **I'm using a 3/4" burner as an example in this document.**

There are basic ratios for making them work properly and once you understand them you can apply them to virtually any size induction device (burner). All the ratios are derived from the pipe Diameter.

The ratios are:

- A) Tube Length $L = 8D$ (Pipe Diameter)
- B) Air Intake port area $AI = 2 D$.
- C) Tip Distance from start of burner tube = $.5 D$

(The jet diameter was determined by trial and error so I don't have a ratio to offer.)



THE PARTS LIST:

- **1" x 3/4" black iron plumbing T (1 needed).** The first dimension is the "Run" diameter the second is the "Chase" diameter. Looking at the Letter T the "Run" is the cross bar on the top and the "Chase" the vertical. This bit of jargon is how plumbers designate a T and will help you get what you need.
- **3/4" x 6" black iron nipple (1 needed).**
- **1/8" mpt x 1/4" flare fitting (1 needed).** This needs to be gauged with the correct drill bit so it can be tapped 1/4"-28.
- **0.035" Tweco mig contact tip (1 needed).** When buying a mig tip, be careful you KNOW what threads it uses to mount to the welding handle. Tweco uses 1/4"x28 but other brands use a metric thread, some are available in either. Be SURE of what you buy so you can use the drill and tap to match!
- **Burner flare of your choice (if needed/optional)** Different applications have different needs. For my general shop forge I use "thread protectors." These are similar to a pipe coupler being threaded from both ends but are NOT intended to couple pipe, they are used ONLY to protect the threaded ends of pipe during shipment. They are often throw/give away things in plumbing supplies but you might have to convince them you aren't going to use them as a coupler.

You can buy stainless steel flares I believe Larry Zoeler sells them as do others. Of course you can make your flares if you wish. No, a **bell reducer** does NOT make a good flare, they expand much too abruptly and induce bad turbulence. If you're making one you need to observe a maximum rate of increase of 1:12 or a 12% angle as cut with a lathe. The ratio 1:12 means that the beginning diameter will increase once (double) in 12 times its length. For instance a 1" diameter flare will increase to 2" diameter in 12". 1 in 12.

THE TOOLS LIST:

- **A drill press** is high on my list of most desirable tools for this project. A metal lathe with a 2" spindle pass through is really primo. A hand drill works well with a little different technique.

Bits Needed:

5/16" drill bit

1/8" pipe tap

#3 drill bit

1/4"x28 tap

- **Tap wrench**, the large one in a set is much easier to keep aligned and is more desirable.

BEGINNING THE BUILD

To drill the hole to mount the propane jet requires the greatest precision of the whole build. If you have a drill press, drill vise and experience then this is pretty straight forward.

If you **don't** have a drill vise, here's a trick that works very well:

You'll need a 3/4" "**Floor flange**" and a 3/4" "**Close Nipple.**"

The Floor Flange was designed to anchor pipe to a floor like railing pickets. It works perfectly to anchor the T to the drill table.

- 1) Screw the close nipple into the floor flange and screw the T onto the nipple, make them tight but don't take a pipe wrench to it you just don't want them moving while you're drilling and tapping.
- 2) Measure the center of the top of the T carefully. There may be a die/mold ridge in the center and this will help get the mark as close to perfectly placed as reasonably possible.
- 3) Mark and center punch center on the "T." With the drill bit chucked up in the drill press position the T and floor flange on the drill table and clamp it securely. Be careful not to shift it when clamping, checking it repeatedly is a good thing but keep tweaking till the bit rests dead center in the center punch mark.
- 4) Put a couple drops of oil in the punch mark and with the press on slow speed, drill the hole to be tapped, 5/16" OR as recommended in your tap and die set.



If you **don't** have a drill **press**, here's another trick that works very well:

If you don't have a drill press, find a hole saw that will slip into the T and replace the hole saw's pilot bit with the 5/16" drill bit. The hole saw will then act as a guide to center and align the drill bit straight down the center of the burner tube. You might have to grind the teeth off the hole saw to get it to fit and move freely in the pipe T.

BACK TO THE BUILD:

1) With the hole drilled down the center of the T, **unplug the drill press** and carefully remove the drill bit **without moving the T!** Carefully chuck the 1/8" pipe tap in the drill chuck. Now against every safety rule I know leave the chuck key in the chuck. <SHUDDER> This is to give you a good grip to hand turn the tap. (The drill press is **UNPLUGGED for this**, so it's actually not unsafe).

2) Applying light pressure with two fingers on the feed handle, turn the tap into the Pipe T. **Do NOT tap to full depth**, getting it well started will align everything and you can finish tapping in a bench vise. You want this hole tapped **just** to the point the brass 1/8" mpt brass fitting screws in tightly without bottoming hard on the shoulder.



3) Once the tap is well started, loosen the drill chuck and let the spindle rise off. Now you can remove the T and flange from the drill vise and finish tapping for the brass fitting on the bench. If you used the hole saw alternative to drill the hole go directly to the tap and wrench being careful to tap straight into the T.

4) The next step is tapping the 1/8" MPT end of the brass fitting to accept the mig contact tip. **Very carefully** clamp the fitting by the wrench flats **ONLY** in a smooth jaw vise or use jaw shields - you must NOT damage the threads! Apply the tap to the brass fitting being careful to keep straight down the fitting. The larger tap wrench will hold the tap more securely and being longer will give you a better sight line to keep the tap going straight into the fitting. It's also heavier and enough weight to advance the tap without pressure. There is no depth target with this hole, so don't worry about going too deep just don't get too carried away. Oil, apply steady turn pressure and frequently back the tap out a half turn to break and free cuttings



5) With the brass fitting threaded you can screw the 0.035" mig contact tip in till it bottoms on the shoulder. **JUST finger tight** and be careful not to bend it or you'll have to remove the broken end and try again.

6) Now you're ready to screw the brass fitting into the pipe T, screw the 6" nipple into the T and the thread protector on the other and there's the basic T burner, a little tuning and she's ready to go to work.

- 7) **Oh, you want to supply it with propane?** You'll need a tubing flare tool and cutter and 1/4" copper tubing. Slip the flare nut from brass fitting over the tubing with the threads facing the tube end. Flare the tubing, slip the nut to the end and screw it onto the brass fitting. Determine where you are mounting the 1/4 turn ball valve and using brass adapter from the valve to 1/4" flare you attach the now flared other end of the copper supply line. I put at least one turn in the copper tubing envision a single turn of a coil to provide give and adjustability in the line. Pictured is my shop forge showing how I coil the tubing - the manifold with 1/4 turn ball valves and adapter to fit the propane hose are top right.



ALTERNATIVE: Depending on how you mount your burner, it may never be in a high heat area so a rubber propane hose can be connected directly rather than using the copper piping noted above. This is done using a 1/8" scd. 80 pipe nipple. Scd 80 is much thicker than your usual 1/8" nipple, the ID is almost exactly the correct diameter to tap 1/4"x28. There is a weld bead and a burr on the ends where it was threaded so use the #3 drill bit and hand turn it in the nipple to chase it clean. Using oil and the large tap wrench tap one end 1/4"x28 to receive the mig tip.

The 1/8" nipple will thread into the tapped black iron T and using a 1/8" FPT x 1/4" MPT bushing reducer to adapt to the fitting on the propane hose it's ready to attach to the tank and light up.



RUNNING/TUNING:

6-10 psi should be a good starting point, you can adjust the pressure to suit your work and vagaries in homemade burners.

Tuning the flame is adjusting the air fuel ratio by shortening the mig tip. Out of the baggie the mig tips are a little too long so they don't induce enough combustion air. The closer they are to the throat the less air they will induce.

- To tune the burner you light it and observe the look and sound of the flame. It should have a light blue cone or cylinder in the center with a more transparent darker blue flame surrounding it. Lastly there should be a LITTLE orange feathering on the flames exiting the forge mouth. It should ROAR and loudly.
- It should be a little rich to start with, so remove the brass fitting with mig tip and carefully cut 1/8" off the end and clean it up. Mig tips are fragile and easy to break, be careful. You can cut the mig tips with a: saw, Dremel cut off wheel, etc. a torch tip cleaning file is ideal for cleaning up the burr in the orifice.
- Put it back together light it up and observe. Repeat till it's running clean and hot.

Just a little practice and you can put one together and tune it faster than you can read this . . . almost.