Simple guidelines for constructing a low tar wood Gasifier for fuel.

I found a lot of information scattered all over the internet and it was confusing due to how some of it was written for engineers by engineers and even though the concept of making a Gasifier is simple the explanations given were not.

From everything I have found and read, you can throw as much rocket science and math at this as you can muster up but the reality is there are many variables such as fuel size, fuel density, fuel moisture, air humidity, elevation, and even where the stars and the moon align in the sky on a given day just to drive that point home.

With that said, there is a lot of good information on the internet on the basic designs of both of these Gasifiers. The imbert construction information is fuzzy so unless you are an engineer or technical, this information can be confusing.

Below is a basic overview of both the FEMA Gasifier and the imbert Gasifier.

The FEMA unit.

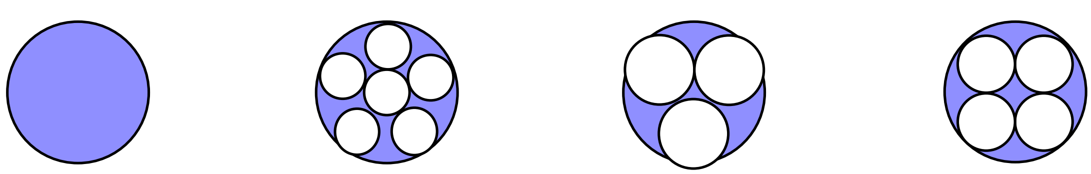
The FEMA unit was designed as an emergency source of gas and it could be built with trash cans and hubcaps along with the most basic materials you could possibly lay your hands on during an emergency if that is all you had to work with and it is very simple to build too but the FEMA unit is a tar producing design. You just dump the fuel into an open top and this too is where it gets it’s oxygen for the reaction. Because it is an open top design it cannot properly regulate it’s ember temperatures and it’s char density needed to keep a stable zone to crack the tar so it needs some serious filtering or you will gum up your engine with tar and that is it’s biggest downfall unless you have a very good filtering setup.

The imbert unit

The imbert is a much more stable design because the fuel hopper is starved of oxygen with a lid that seals it shut once you load it up with fuel and the unit only gets it’s oxygen source from air nozzles placed near the burn/reaction zone. The air jets allow the unit to maintain a stable burn zone with a tight stable char and ember zone and that’s the real magic and the secret to producing clean fuel. It’s biggest downfall is it can get involved in it’s construction because you have to calculate the correct number of nozzles with the correct air hole diameters along with the correct throat diameter (smallest part of the reduction zone) for a given engine size and Hp and if you run an engine too big or too small or too far out of the design specifications it too will produce tar but if you run an engine that falls at least somewhere in the correct range not only will it crack the tar but the efficiently goes up because the cracked tar is converted over into a useable fuel too.

There is way to get a rough calculation on air nozzle sizes and quantities for the imbert design for smaller engines. Let’s look at the air intake or even the muffler pipe diameter of a standard Briggs & Stratton engine rated anywhere from 4 Hp up to 8 Hp. The standard diameter is 3/4 of an inch. Below is a drawing of a 3/4 inch circle and next to that is three more 3/4 inch circles with small circles drawn inside of them You could look at the small circles as air nozzles and for an engine that required a 3/4 inch intake or muffler pipe so you could technically use different combinations of air nozzles in your burn tube as long as their combined openings were equal to or better yet, a bit larger than the intake/exhaust port diameter. What you are really looking for is that the air nozzle’s total combined diameters are equal too or just a bit larger than the air intake or the exhaust port on the engine. This isn’t perfect but this is pretty close and once set up, it’s just a matter of tweaking to get the Gasifier to produce a low tar fuel that can meet the engine’s fuel intake requirements. As primitive as this concept may appear it’s simple and it is valid. See the air intake examples below. Now we are going to do something a bit different here. We are going to use the FEMA pipe diameters combined with the imbert nozzle calculations because the FEMA design will give us the proper restriction zone diameter for a given engine Hp and the imbert design has a clear calculation for the air nozzle hole diameters along with how many must be used for a given engine Hp.

3/4 inch intake diameter (6) - 1/4 Nozzles (3) -3/8 Nozzles (4) -5/16 Nozzles



The gaps highlighted in blue need to be taken into account so some over sizing of the nozzles may be necessary.

There are still a few things that you need to be close with to build a decent tar buster Gasifier and one of them is the ember and the ash zone depth. Below is a basic guideline to go by on the ember and the ash depth. The measurements are in metric but you can convert that over to standard equations if you need to but it roughly comes out to a depth of 20 to 25 cm or better yet 7 inches up to 10 inches deep. This is based off of the downdraft design so it will be valid. One more thing: These measurements are taken below the air nozzles. See the drawing (Fig 5-13) for a better understanding.

You also have to build your fuel hopper size to match your engine Hp because a fuel hopper too small will have you constantly having to reload the unit with fuel. A good rule of thumb would to be to build the fuel hopper too big vs too small.

I gathered this information from different sources and I tried to keep everything simple as possible but you will still need to sit down and read and research this topic and learn as much as you can before attempting to build one of these units.

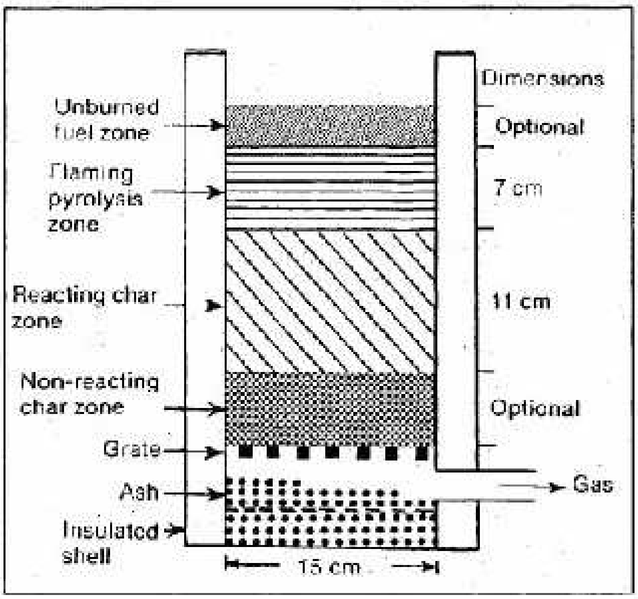


Fig 5-13 stratified downdraft Gasifier design.

!!! Caution Caution Caution !!!

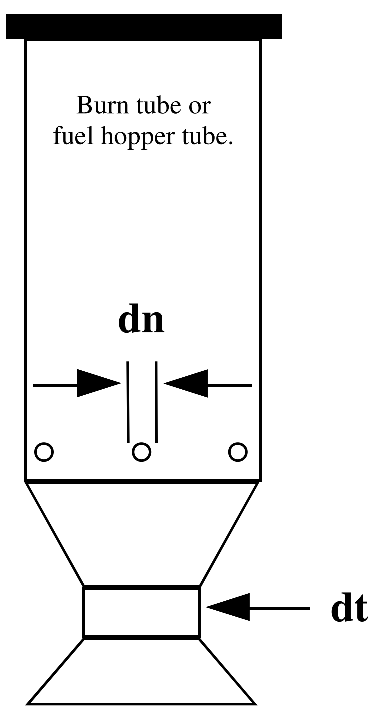
Please keep in mind that you are dealing with dangerous gases along with the possibility of an explosion or a blow back and if you do not have a complete understanding of how this operates or if you build a faulty or a bad design that leaks air into the unit where it shouldn't be you could have an explosion!

With that said, I am not responsible for **ANYTHING** that you decide to construct so it is up to you to read and study up on this topic before you attempt to build one for yourself.

Even the best design can produce tar if the operator does not have an understanding and a feel for the operation of the unit.

dt = diameter of throat at smallest cross-sectional area **(mm)**
dn = nozzle diameter **(mm)**
n = number of nozzles to be installed

dt	dn	n
70	10.5	3
80	9	5
90	10	5
100	11	5
120	12.7	5
130	13.5	5
150	15	5
178	14.3	7
190	16	7
220	18	7
270	22	7
300	24	7



Here are the FEMA tube diameters vs engine Hp

2 Inch pipe diameter at 16 inches length = 5 Hp
4 Inch pipe diameter at 16 inches length = 15 Hp
6 Inch pipe diameter at 16 inches length = 30 Hp
7 Inch pipe diameter at 18 inches length = 40 Hp
8 Inch pipe diameter at 20 inches length = 50 Hp
9 Inch pipe diameter at 22 inches length = 65 Hp
10 Inch pipe diameter at 24 inches length = 80 Hp
11 Inch pipe diameter at 26 inches length = 100 Hp
12 Inch pipe diameter at 28 inches length = 120 Hp
13 Inch pipe diameter at 30 inches length = 140 Hp
14 Inch pipe diameter at 32 inches length = 160 Hp

Important notes below

Use the above numbers to determine the **dt** diameter. You do not want to use a fuel hopper diameter any smaller than 6 inches or it will probably bridge. (clog)