Aluminum Casting Furnace Build 8/10/16 AAC

**Scope**

I intend to build a furnace that is capable of melting aluminum for the purpose of casting. The goal of this project will be to produce 20 one pound billets of aluminum.

**The Components**

1. Furnace
	1. Use old water heater tank (its free)
	2. DIY Refractory cement (Option A)
		1. <http://www.backyardmetalcasting.com/refractories.html>
		2. The refractory mix is composed of Portland cement (1.5 parts), silica sand (2 parts), perlite (1.5 parts) and fireclay (2 parts).
		3. I need 2.6 Cubic Feet but will plan for 4 cubic feet
		4. Cost $101.32
	3. Insulating Fire Brick (Option B)
		1. Common Fire Brick size is 4.5 X 3 X 9 inches
		2. A total of 36 Bricks will be needed to complete the furnace. I will figure for 40 bricks to account for mistakes.
		3. I will still need refractory cement
		4. Cost ?
2. Plinths
	1. Cast with same material as furnace
3. Crucible
	1. Research options
	2. Possible used my old steel scuba tank
4. Tool to remove the Crucible from the furnace
	1. Will build after I decide on the crucible
5. Tool to poor the Crucible
	1. Will build after I decided on the crucible
6. Propane/Oil Burner
	1. Research options
	2. Really like the burner used by Doug from SV Seeker
		1. [http:/svseeker.com/casting\_furnaces.htm](http://svseeker.com/casting_furnaces.htm)
7. Forms for Aluminum Billets
8. Scrap Aluminum
	1. Old lawn mower engine

**The Plan**

1. **Refractory Cement**
	1. I need 2.6 Cubic Feet but will plan for 4 cubic feet.
		1. 1.5+2+1.5+2 = 7parts
		2. 4/7 = 0.57cubic feet per part
		3. Total Cost = $101.27

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| --- |
| Refactory Cement Materials |
| **Description** | **Source** | **Part#** | **Qty Needed** | **QTY Sold In** | **Pice per** | **QTY to Buy** | **Total** |
| Portland Cement | Lowes | 10352 | 161lbs | 94lbs | $10.30 | 188lbs | $20.60 |
| Silica Sand | Lowes | 230025 | 114lbs | 100lbs | $17.35 | 200lbs | $34.75 |
| Perlite | Home Depot | 216847 | .855ft^2 | 2ft^2 | $16.97 | 2ft^2 | $16.97 |
| FireClay | Ceramic Store Inc | n/a | 97.72LBS | 100lbs | $29.00 | 100lbs | $29.00 |
|  |  |  |  |  |  | Total | $101.32 |

* 1. Portland Cement (1.5 Parts)
		1. Can be Purchased at Lowes ($10.30 / 94lbs (.5ft^2)
			1. Part# 10352
			2. 188lbs for $20.60
		2. 1.5 parts\*0.57ft2 = 0.855ft2
		3. 0.86ft2 \* 188lbs = 161lbs
	2. Silica Sand (2 Parts)
		1. Lowes (order) 100 lbs / cubic foot ($17.35 / 100lbs)
			1. Part# 230025
			2. 200lbs for $34.70
		2. 2 parts\*0.57 = 1.14ft2
		3. 1.14ft2 \* 100LBS = 114lbs
	3. Perlite (1.5 Parts)
		1. Home Depot ?lbs / cubic feet ($16.97 / 2 cubic feet)
			1. Sku# 216847
			2. 2ft2 for 16.97
		2. 1.5 parts\*0.57ft2 = 0.855ft2
	4. Fireclay (2 parts)
		1. Ceramic store Inc in Houston
			1. 81.34LBS /cubic feet ()
			2. 100lbs for $29.00
		2. 2 parts\*0.57 = 1.14ft2
		3. 1.14ft2 \* 81.34LBS = 92.72lbs
1. **Insulating Fire Brick**
	1. Common Fire Brick size is 4.5 X 3 X 9 inches
	2. A total of 36 Bricks will be needed to complete the furnace. I will figure for 40 bricks to account for mistakes.
	3. Furnace Dimensions
		1. OD 16inches
		2. ID 10inches
		3. Chamber depth 16 inches
	4. If I take the OD and figure the circumference of the furnace and divide be the width of the brick I should be close to the number of bricks I will need to make one layer.
		1. 16 OD X 3.14 = 50.26 inches around
		2. 50.26inches around / 4 inch brick = 12.56
		3. 13 bricks will be needed per layer
	5. The chamber Depth is 16 inches so I will need two layers of 13 Bricks.
		1. 26 Bricks to complete the walls
	6. The Chamber bottom will need one layer of bricks
		1. 4.5 inches \* 9 inches = 40.5 inches square per brick
		2. 16 inch OD / 2 = 8 Outer Radius
		3. 8 OR \* 8 OR \*3.14 = 201.06 inches square
		4. 201.06 in^2 / 40.5 in^2 = 4.96
		5. Five Bricks will be needed for the bottom
	7. I will plan to use the same count for the lid as I do for the bottom.
		1. I will need 5 Bricks for the lid
	8. The Furnace will need a total of 31 Bricks To complete
		1. (13 \* 2) + (5 \* 2) = 36 Bricks

**Propane/ Oil Burner**

1. <http://svseeker.com/casting_furnaces.htm>
	1. Parts Patriot Supply
		1. Nozzle Adapter ($24.00)
			1. Manufacturer: DELAVAN
			2. Product Code: 17147



* + 1. Nozzle ($24.00)
			1. Manufacturer: DELAVAN
			2. Product Code: 30609-8

1. I assembled a parts list with part numbers and quantities from Mcmaster-Carr. It is quite pricy so I will look at other sources and cheaper options for materials and connectors. This First list is sort of an Ideal build list.
	1. Parts List

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Feed line | Quantity  | Description | Part# | Price | Extended |
| Air | 1 | Industrial-Shape Hose Coupling, Size 1/4 Zinc-Plated Steel Plug, 1/4 NPTF Female End | 6534K56 | $1.32 | $1.32 |
| All | 4 | Steel 37 Degree Flared Tube Fitting, Adapter for 1/4" Tube OD x 1/4 NPTF Male Pipe | 50695K162 | $1.46 | $5.84 |
| All | 1 | Smooth-Bore Seamless Steel Tubing, 1/4" OD, 0.049" Wall Thickness, 6 Feet Long | 9220K321 | $10.46 | $10.46 |
| Null | 1 |  Standard-Wall Steel Pipe, 2 Pipe Size, 3' Length, Unthreaded | 7750K196 | $46.45 | $46.45 |
| Oil | 1 | Compact Extreme-Pressure Steel Threaded Fitting, 1/8 Pipe Size, 90 Degree Male Elbow | 50925K117 | $3.83 | $3.83 |
| Oil | 1 | Steel 37 Degree Flared Tube Fitting, Straight Adapter for 1/4" Tube OD x 1/8 NPTF Female | 50695K171 | $1.95 | $1.95 |
| Oil | 1 | ISO-A Hose Coupling, Zinc-Plated Sleeve-Lock Socket, 1/4 Coupling, 1/4" NPTF Female | 51335K51 | $21.94 | $21.94 |
| Oil | 1 | ISO-A Hose Coupling, Zinc-Plated Plug, 1/4 Coupling Size, 1/4" NPTF Female | 51335K61 | $8.38 | $8.38 |
| Oil | 1 | PVC Tubing for Fuels and Lubricants, 1/4" ID, 3/8" OD, 25 ft. Length | 5187K63 | $16.25 | $16.25 |
| Oil, LP | 2 | Compact Extreme-Pressure Steel Threaded Fitting, 3/8 Male x 1/4 Female Pipe Size, Hex Head Bushing | 50925K345 | $1.50 | $3.00 |
| Propane | 1 | Hose Coupling for Natural and LP GAS, Socket, 3/8" NPT Female, 3/8" Coupler | 6053T11 | $23.25 | $23.25 |
| Propane | 1 | Hose Coupling for Natural and LP GAS, Plug, 3/8" NPTF Female, 3/8" Coupler | 6053T12 | $11.18 | $11.18 |
| Propane | 1 | Gas Regulator for Propane, CGA #510 Male Inlet, Standard Duty, 1-Stage | 7897A66 | $141.09 | $141.09 |
| Propane | 1 | 12 Feet Long Hose for Torch-to-Propane Tank Adapter  | 7976A34 | $41.46 | $41.46 |
| Propane | 1 | Brass Barbed Tube Fitting for Vacuum, Straight for 1/4" Tube ID x 1/4 Male Pipe Size | 44555K132 | $3.03 | $3.03 |
|  |  |  |  | Total | $339.43 |