

AN ECONOMICAL APPROACH TO BUILDING A TANK OVERFLOW WATER CHANGING SYSTEM

My name is Frank Schulterbrandt and I will present to you the basic instructions on how to construct an economical overflow water changing system for your aquariums that will house your fancy guppies.

After you have determined how many tanks you want to fit into your fish room or fish area, you can now start to estimate how much this is going to cost you. I will first give you the materials needed, then the tools needed and finally the assembly of such a system. This plan is based on the assumption that you will be using 10 gallon tanks. This plan can be tailored to any size aquariums that can be drilled by you.

I am not discussing how to set up a fish Rack for your aquariums the quick way by using cinder block, but to save space by not using cinder block and by investing more time and saving more space for additional fish tanks by using 2 x 4 lumber. By using lumber it becomes easier to create your water changing system (you have surface area that screws can be imbedded in easier). My first system like this I used cinder block, I did not like working with this. I had to use ty-straps, etc.

I will use my fish room setup as a guide in this article. I have constructed three fish racks using 2 X 4 plywood. First of all you have to know the dimensions of the area that you will have your fish tanks to work with. Then you will need to know the dimensions of your fish tanks. In this case I am using ten gallon fish tanks which measure in inches 20.3 X 10.5 X 12.6 (L X W X H).

If you were to build a fish rack using 8 or 10 foot lengths of lumber you could fit 8 tanks on each level (4 tanks, center brace, 4 tanks). If you were using 10 foot length, you could fit 9 tanks on each level (3 tanks, center brace, 3 tanks, center brace 3 tanks) etc. You have to measure your room size and determine the length of each rack. This will be a lengthy article so I have divided it into 7 parts. The itemized cost for this project will be presented at the end in part VII of "PUTTING IT ALL TOGETHER".

- Part I : Construction of a fish tank rack
- Part II: Air line system assembly
- Part III: Assembling the overflow waste system
- Part IV: Assembling the water line
- Part V: Drilling your aquariums and tank overflow assembly
- Part VI: Air exchange system
- Part VII: Putting it all together

It may seem like it , but in no way am I endorsing any of the stores or the tools needed to create this project.

The general tools needed for this project:

- 1: Chop Saw (can be rented)



2: Variable Speed Drill (3/8) and Drill Bit Set



3: Tape Measure



4: Aluminum Rafter Square



5: Standard Level



6: Screw Drivers (Phillips and flat head) 7: hammer



8: Bungee Cords

or 2 4 Inch Quick Release Clamp



The general materials needed for this project:

1: #8 X 2-1/2 inch Bugle-Head Coarse Thread Sharp Point Drywall Screws (5 lb-Pack)

2: #8 X 1-1/4 inch Bugle-Head Coarse Thread Sharp Point Drywall Screws (1 lb-Pack)



Corner "L" Brackets



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Part I : Construction of a fish tank rack

What you will need to have is the materials needed list. Don't try to remember the list like I have done so many times before and end up with additional trips for the forgotten items. Write everything down on paper or make the notes on your phone, etc. If you don't make a note of the required materials I guarantee that you will be making multiple trips to HomeDepot, Lowes, or your local hardware/lumber store. In my case I needed 2x4 8 footers. So my first trip to the Home Depot was to get as many 8 footers that I could fit into my Subaru Forester, enough to construct my first rack. I also purchased all of the smaller items at this time (screws, "L" braces, etc). Below I am showing to a four level rack and a three level rack. The choice is yours as to how your construct your rack. I am just laying out the foundation guidelines to the construction of your rack. **In the diagrams below the 2 X 4 are to be laid flat not upright.**

Diagram 1

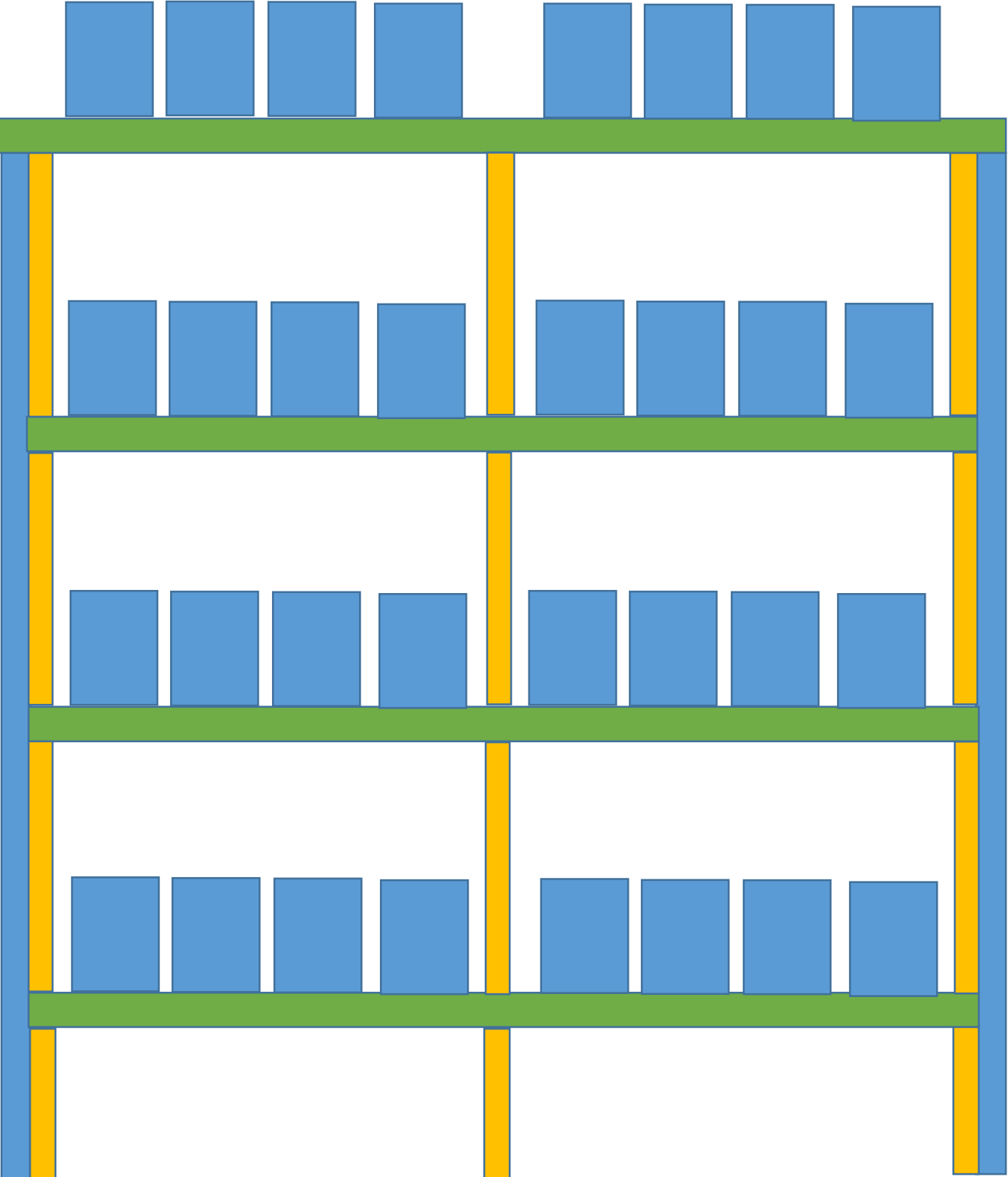
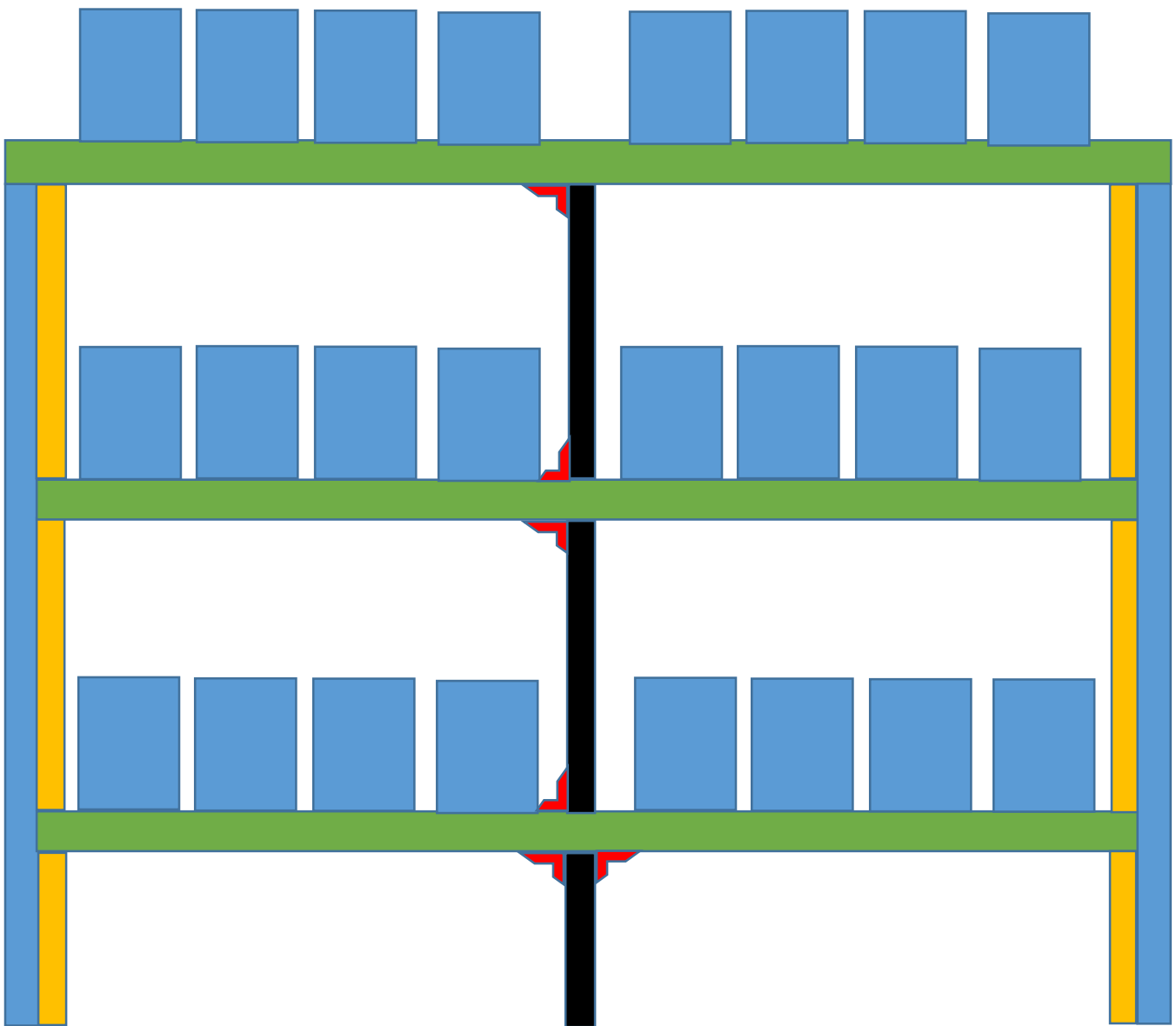


Diagram 2



BLUE 2 X 4 **GREEN** 2 X 4 **ORANGE** 2 X 4 **BLACK** 1 X 3

The front and back are to constructed the same way. Use 2 ¼ inch Dry Wall Screws to fasten. Use Metal Corner **L brackets** on the center brace noted in **BLACK**. You determine what the length of the **ORANGE** section will be. But remember you need height over the tank to work with your hands and to put filters into the tank.

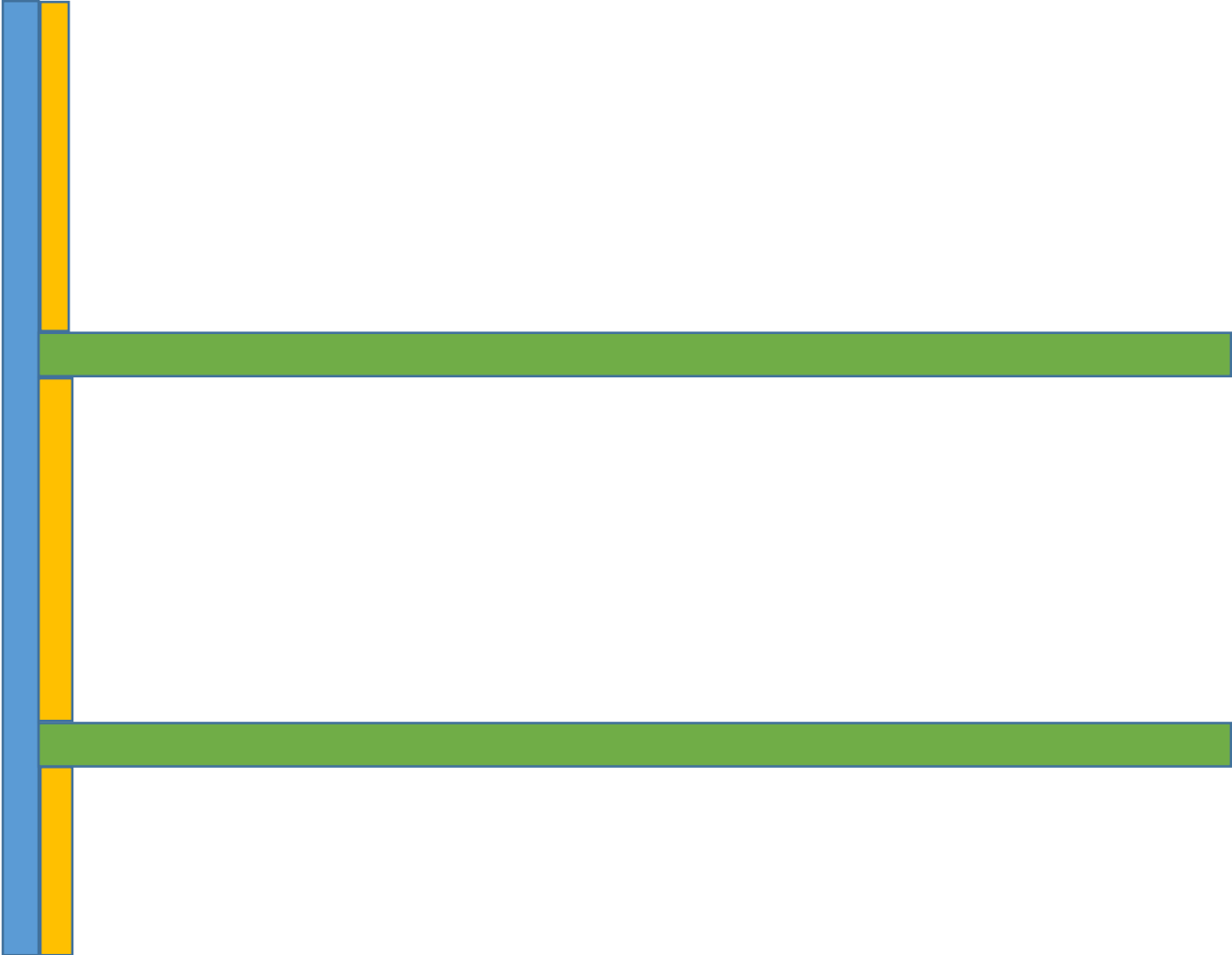
Construct 4 sections like below and use screws to join together:

Diagram 3



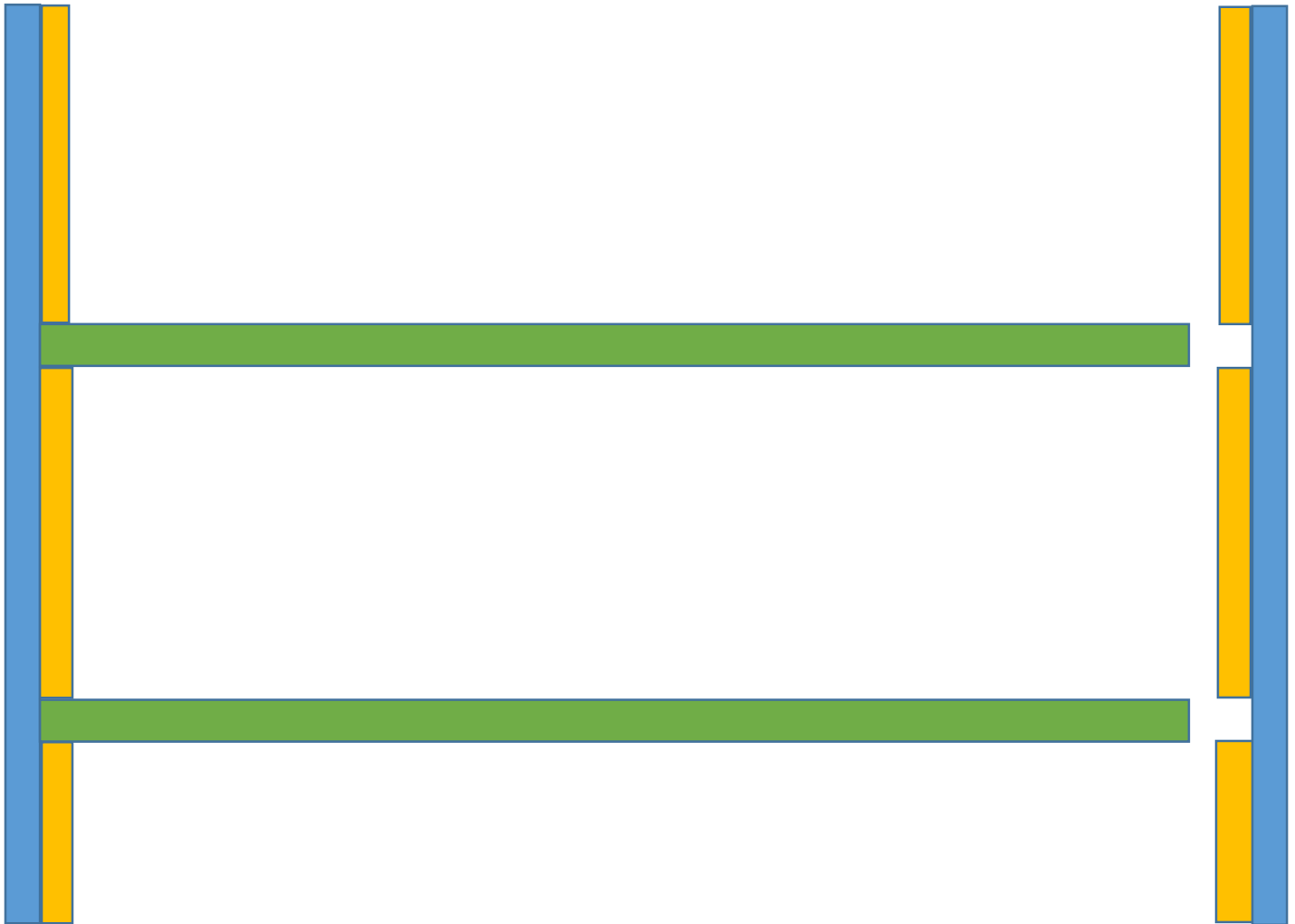
Then add the **GREEN** section and use screws to join together: (lay the frame flat on the floor then screw from the blue area, I drill a hole for the screws first).

Diagram 4



Then add the **BLUE** add **ORANGE** section and then use screws to join together:

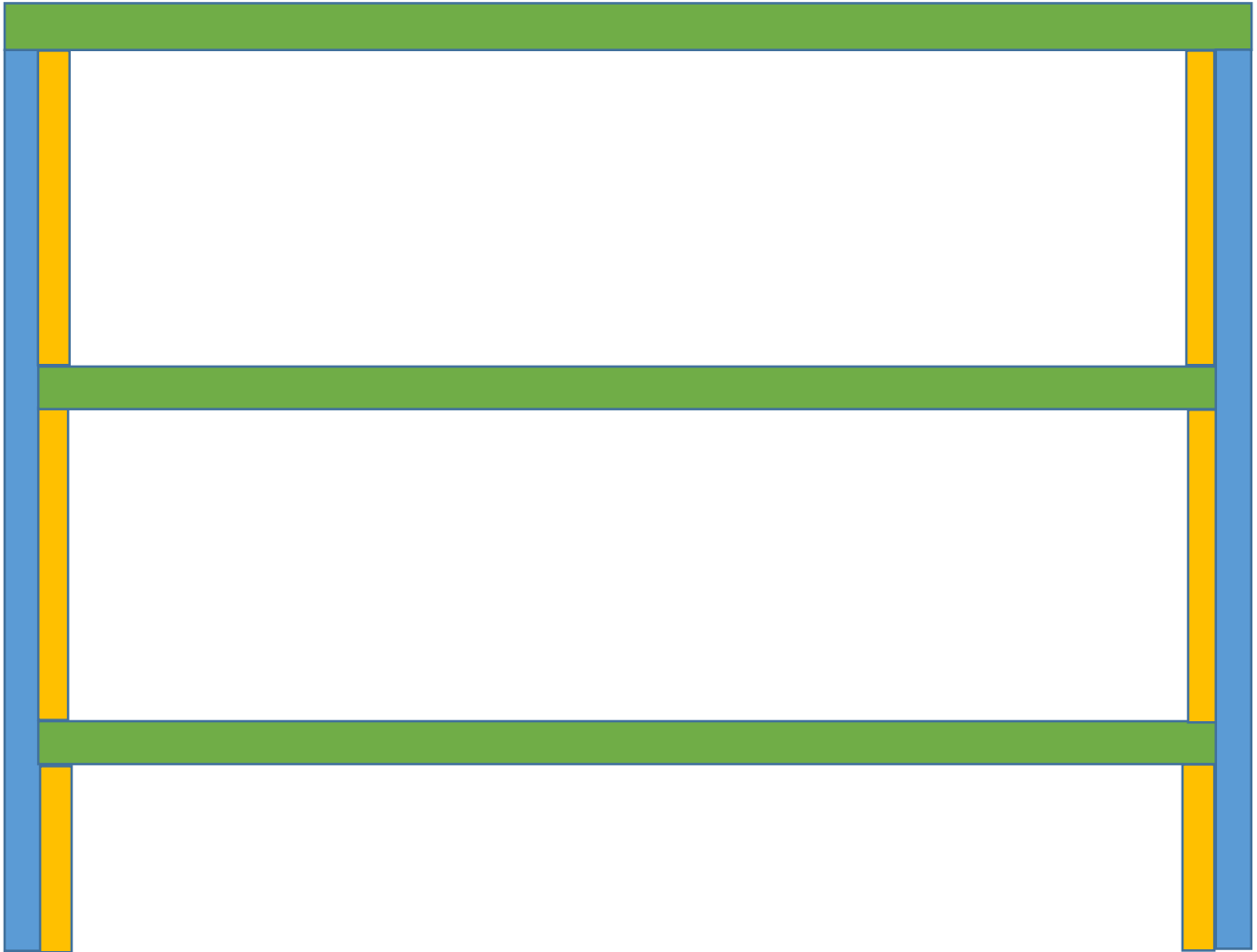
Diagram 5



Make sure that the right angles are square by using the Rafter Square.

Then add the top **GREEN** section and use screws to join together:

Diagram 6



Add the **BLACK** sections to the existing frame as seen in Diagram 2. Then add L brackets as indicated in **RED** also from Diagram 2.

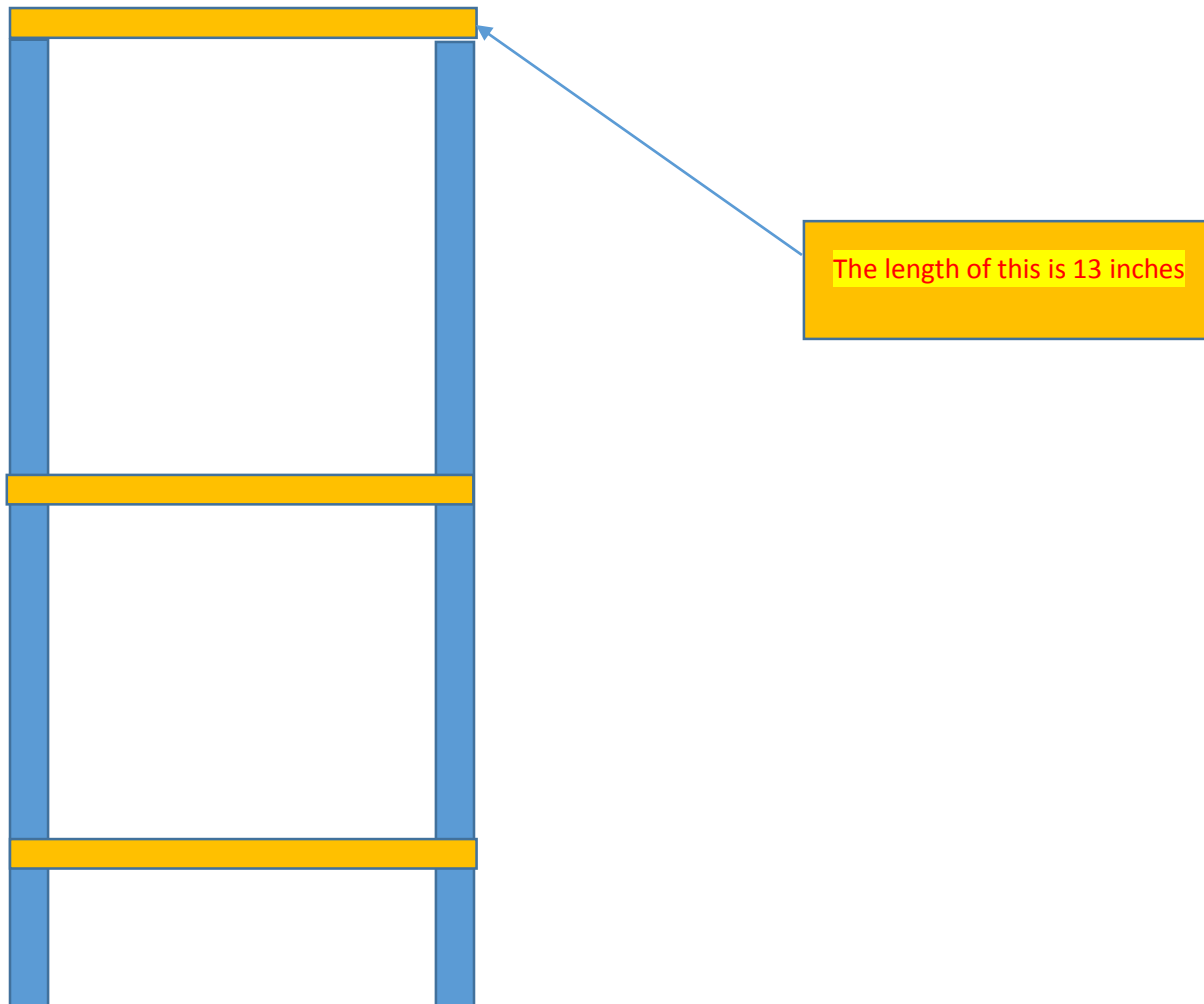
Two sections will be created like this, FRONT and the BACK.

When both section have been completed then they must be joined together.

Make sure that the right angles are square by using the Rafter Square.

Side view of the two sections being joined together (FRONT AND BACK).
This is to be done for both sides...Your ten gallon tanks will hang over both BLUE sections of the rack.

Diagram 7



Congratulations, You have just finished building your rack.
Now a nice coat of Enamel Rustoleum paint would really look nice...
I also use this paint to paint the bottom and backs of my aquariums.
Green , light Blue or black are nice colors, there are a whole range of colors to choose from.
Make sure that the right angles are square by using the Rafter Square.
You have just completed Part I .

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Part II : Air Line System Assembly

The tools needed for this project are a Tape measure, drill , drill bits and a Chop Saw.

The parts needed for this project are as follows.

I would suggest that your airline system be constructed with 1 inch PVC piping. Buy the PRO PACK (consisting of 10 pieces) of PVC you can save by buying the PRO PACK at Lowes. I will not go into detail but the parts needed for this project are.

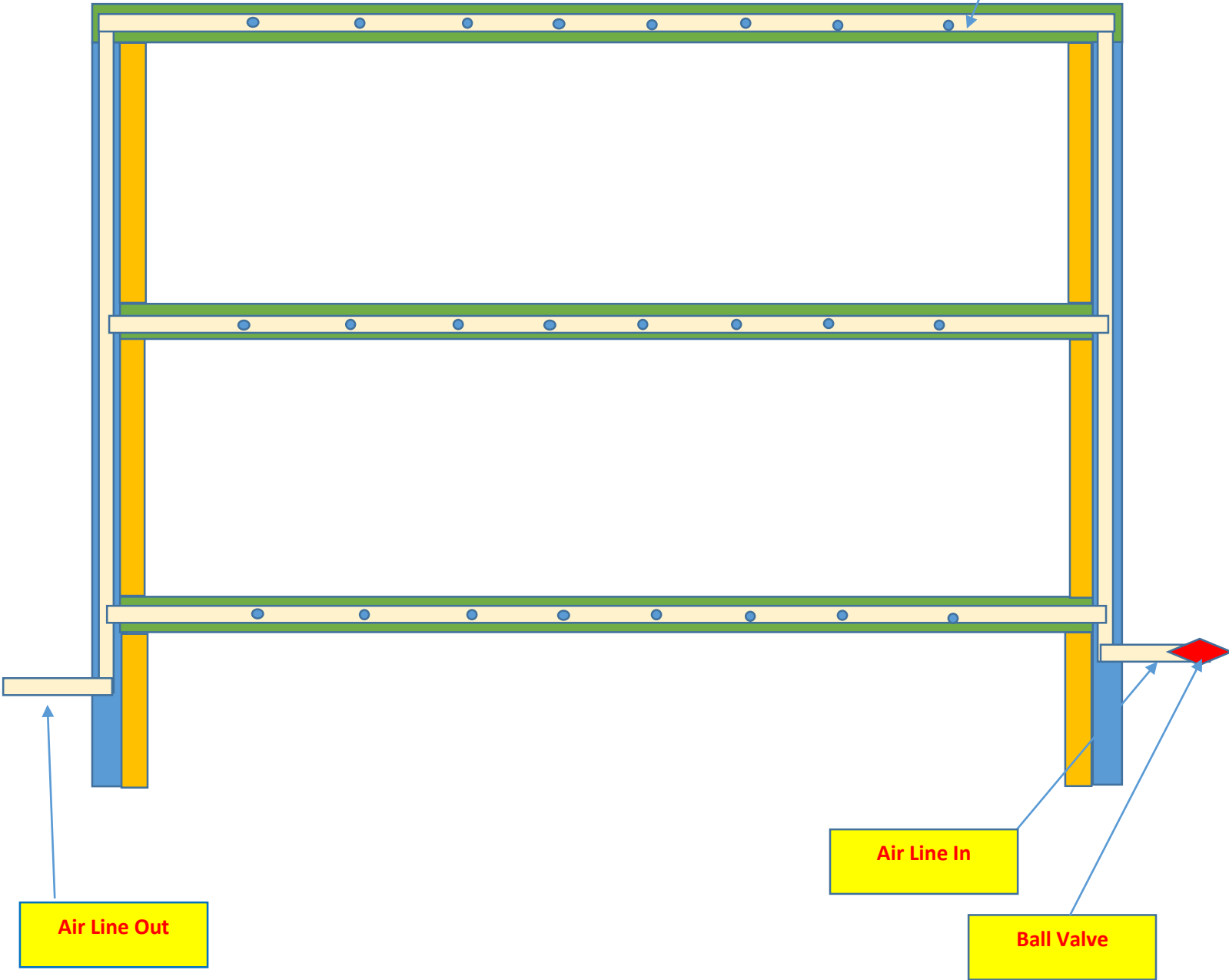
1 inch PVC piping you can get away with using $\frac{3}{4}$ PCV which cost less and is easier to work with. You will also need 90 degree PVC Elbows & PVC "T"s along with PVC End Caps, perhaps even PVC couplers. Lees 2 Way Air Control Plastic Valves. A flexible (Ribbed) plastic hose to connect to your Air Supply Source, $\frac{3}{4}$ inch 2 Hole Conduit Straps and two clamps for the flexible air line hose(one clamping the hose to the PVC and the other clamping the hose to your source of air. Use the clamp or bungee cord to hold one end of the PVC while you work on the other end. You will use the metal "U" straps to attach the PVC to your frame rack. Once the horizontal lengths of PVC are placed on each level, you can start using the PVC Elbows and "T" while installing the vertical PVC lengths. You will also need a ball valve to bleed off the extra air from your air supply system as not to put any back pressure on you air supply source. The ball valve can be at the beginning or at the end of your PVC air line system. Once again do not cement these parts.





Drilled Air Line Holes

Diagram 8



From three photos below you can get a good idea as how to assemble your air line system. When making the holes for the plastic air valves, use a smaller bit to start the hole then the larger one. Test to see which is the best larger drill bit to use. Use a scrap piece of PVC piping to make your hole is the correct size, then push the blue plastic air control valve into the hole. If this is done right, just a little force is needed to insert the plastic air valve. No expensive Brass Valves needed. Do not use any PVC Cement as this is not necessary when constructing the air line system. When we construct the water line system the PVC Cement is a must.







You have just completed Part II

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Part III: Assembling the overflow waste system

The tools needed for this project are a Tape measure, drill and a Chop Saw, 1 inch round holesaw bit set which cost about 20.00 home Depot or Lowes.



The parts needed for this project are as follows.

Screw the vinyl rain gutter to the back of the rack as seen below. The gutters should be at a slant/pitched of $\frac{1}{2}$ inch. Attach the rain gutter end caps and then glue with aquarium cement.


RED indicates the use of the Amerimax Home Products 10 ft. White Traditional Vinyl Gutter (3.98 for a 10 foot section)



BLACK indicates the use of the White Vinyl K-Style End Cap Set (Used at each end of the vinyl gutter (7.64 for a 2 piece set)



1 inch Bulkhead only slip inlet X slip outlet from JHEMCO (3 pieces indicated as **DARK ORANGE** in Diagram 9)

BF1		1" Bulkhead only slip inlet x slip outlet	1 3/4"	SALE \$3.50	
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1/2 in. x 10 ft. PVC Sch. 40 Plain-End Pipe (you do the math as to how many pieces you will need) (2.43 per 10 foot section)

1 in. x 10 ft. PVC Sch. 40 Plain-End Pipe (1 section used as the down spouts **PURPLE** in Diagram 10) (4.50 per 10 foot section)



Diagram 9



The next step is to drill a 1 inch hole on the bottom at the end of each vinyl rain gutter so that you can insert a 1 inch bulk head fitting.

After inserting the 1 inch bulk head fitting, insert a length of 1 inch PVC piping into the 1 inch bulk head fitting to extend to the next rain gutter below. Indicated in **PURPLE** below

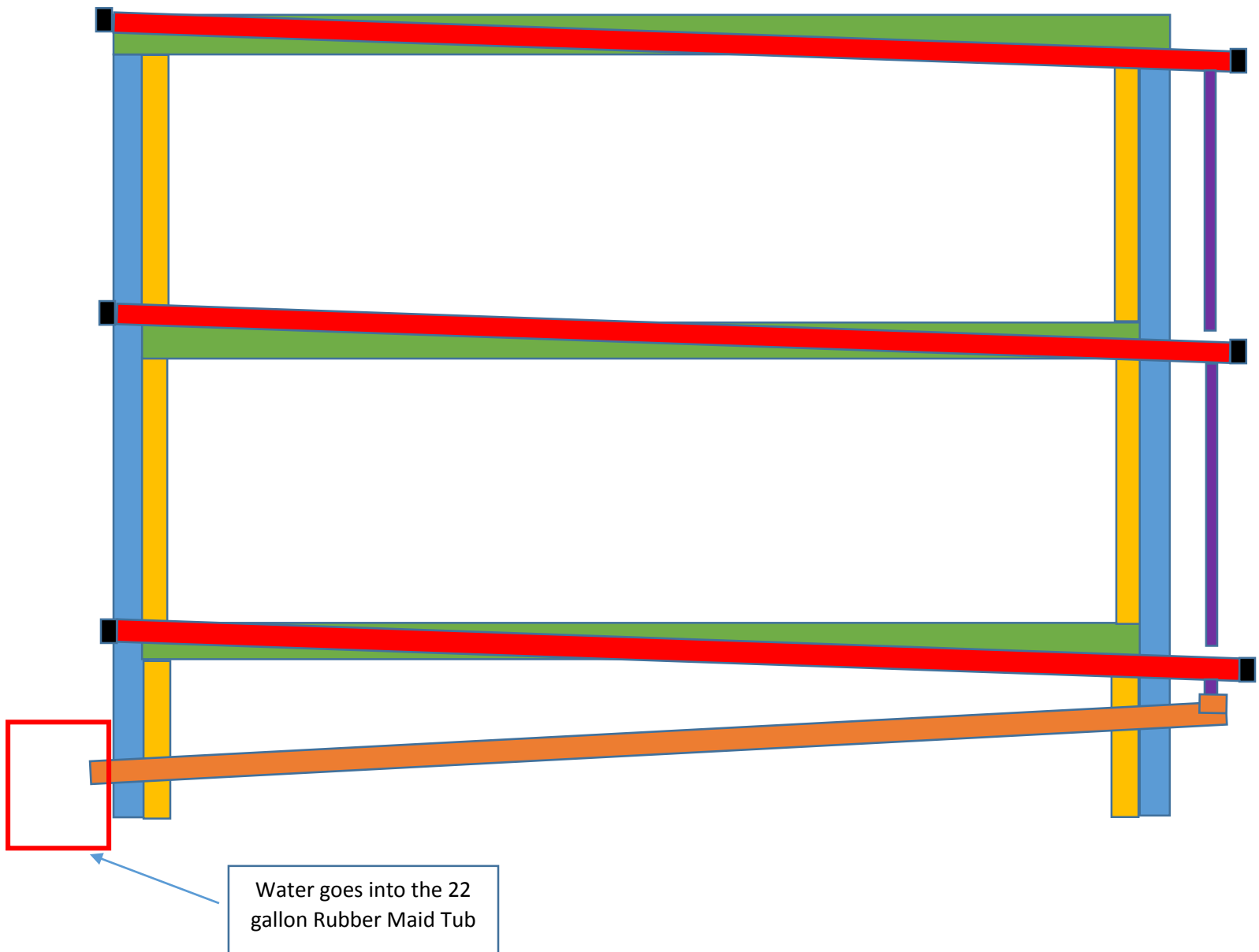
Diagram 10



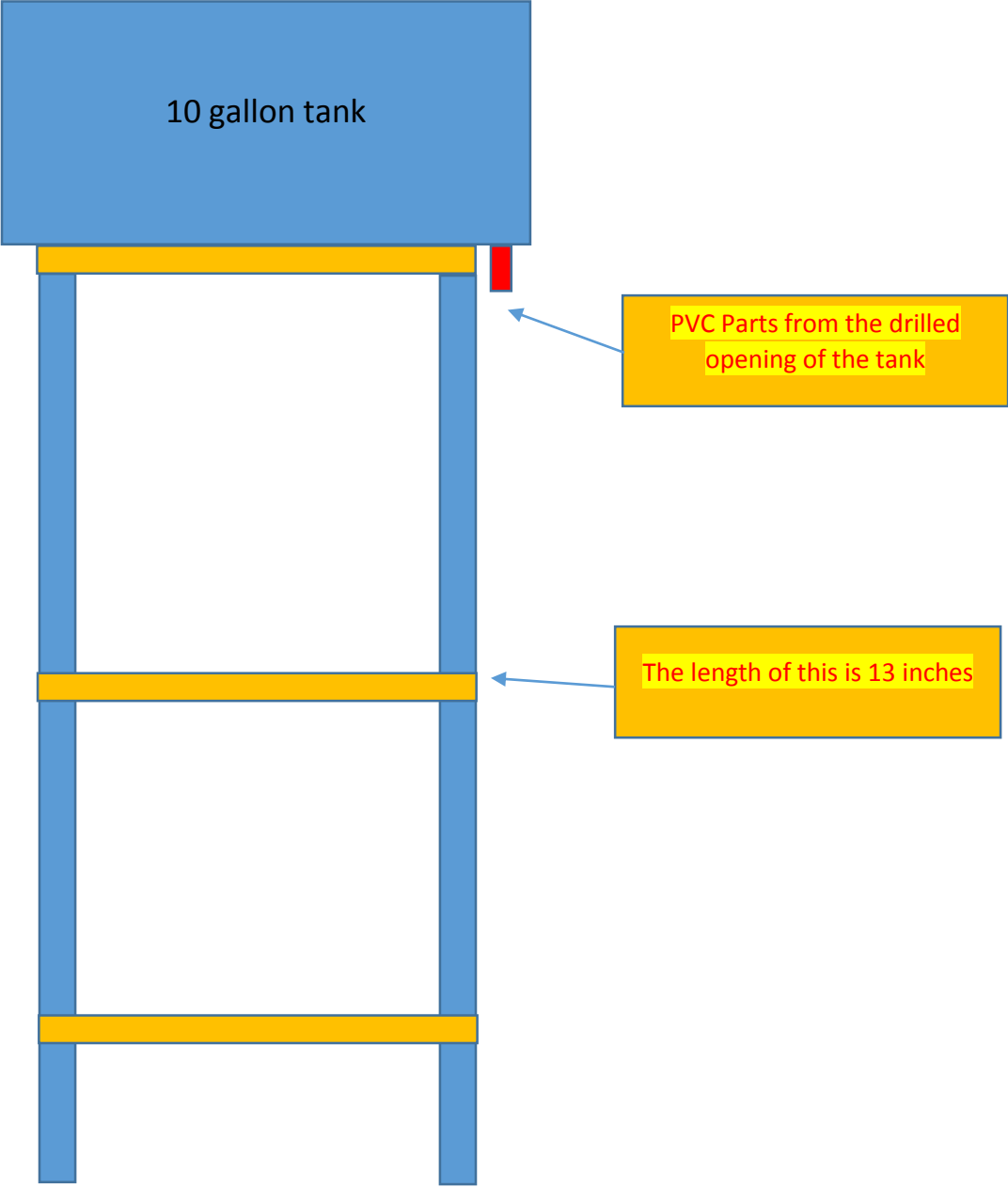
The waste line is the next step in this process.

I would suggest that you use a 3 inch PVC pipe as a waste line (indicated by **BURNT ORANGE**). You will need a 3 inch "T" and a 3 inch end cap. The waste line will be pitched all around the room to be emptied into a Rubber Maid 22 gallon tub which has a sump pump to pump the water to a slop sink or out of the room, etc.(this part requires no explanation except the cutting out of a hole into the Rubber Maid tub to allow the waste line PVC pipe to deposit the waste water.

Diagram 11



Notice the **RED OVERFLOW STEM** hangs over your rack. The stem will be over the vinyl rain gutter. This can be seen in the photo below.



Notice how the end of the tank is over the vinyl rain gutter waste line.
The overflow PVC pipe from the tank pours water into the rain gutter.









Congratulation you just completed Part III

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Part IV: Assembling the water line system

The tools needed for this project are a Tape measure, drill and a Chop Saw.

The parts needed for this project are as follows.

1/2 in. x 10 ft. PVC Sch. 40 Plain-End Pipe in YELLOW, 90 degree elbows, "T", end caps, connectors and **1/2 inch ball valves**, **Plastic air/water valves from JHEMCO**, **wall storage hooks(Bike storage hooks)**, **3/4 inch 2 hole Conduit Straps**. Also needed PVC Primer and Cement Kit.

This will be the only time that you will glue PVC parts together.



AWV1TB		Plastic Air / Water Valve 10-32 thread x airline barb	\$0.75	25 @ \$0.65
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Once you have drilled a hole in the PVC, the threaded end of the valve can be screwed in snugly. If there is a leak on some of them, you can use a small application of aquarium cement. Out of 87 ten gallon tanks only 6 valves had minor leaks, so small I never bothered to seal them.

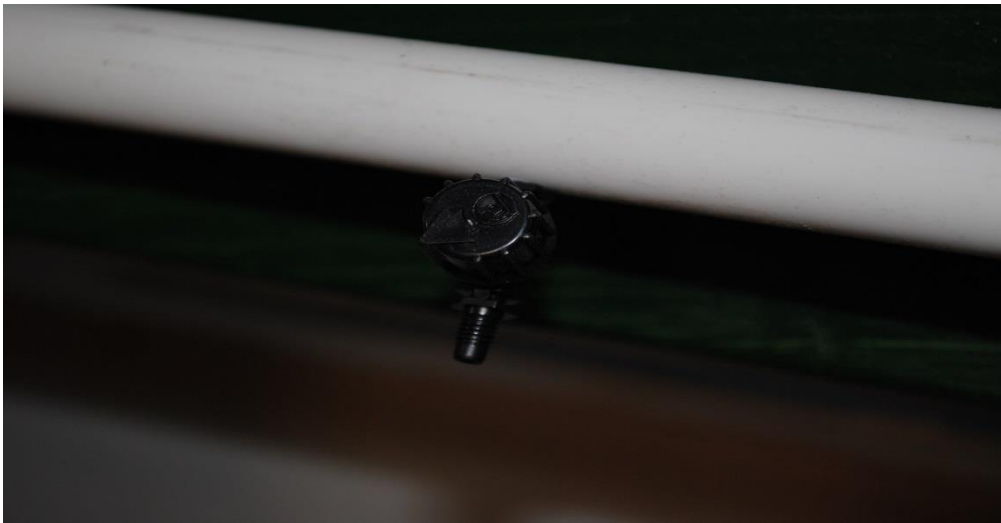
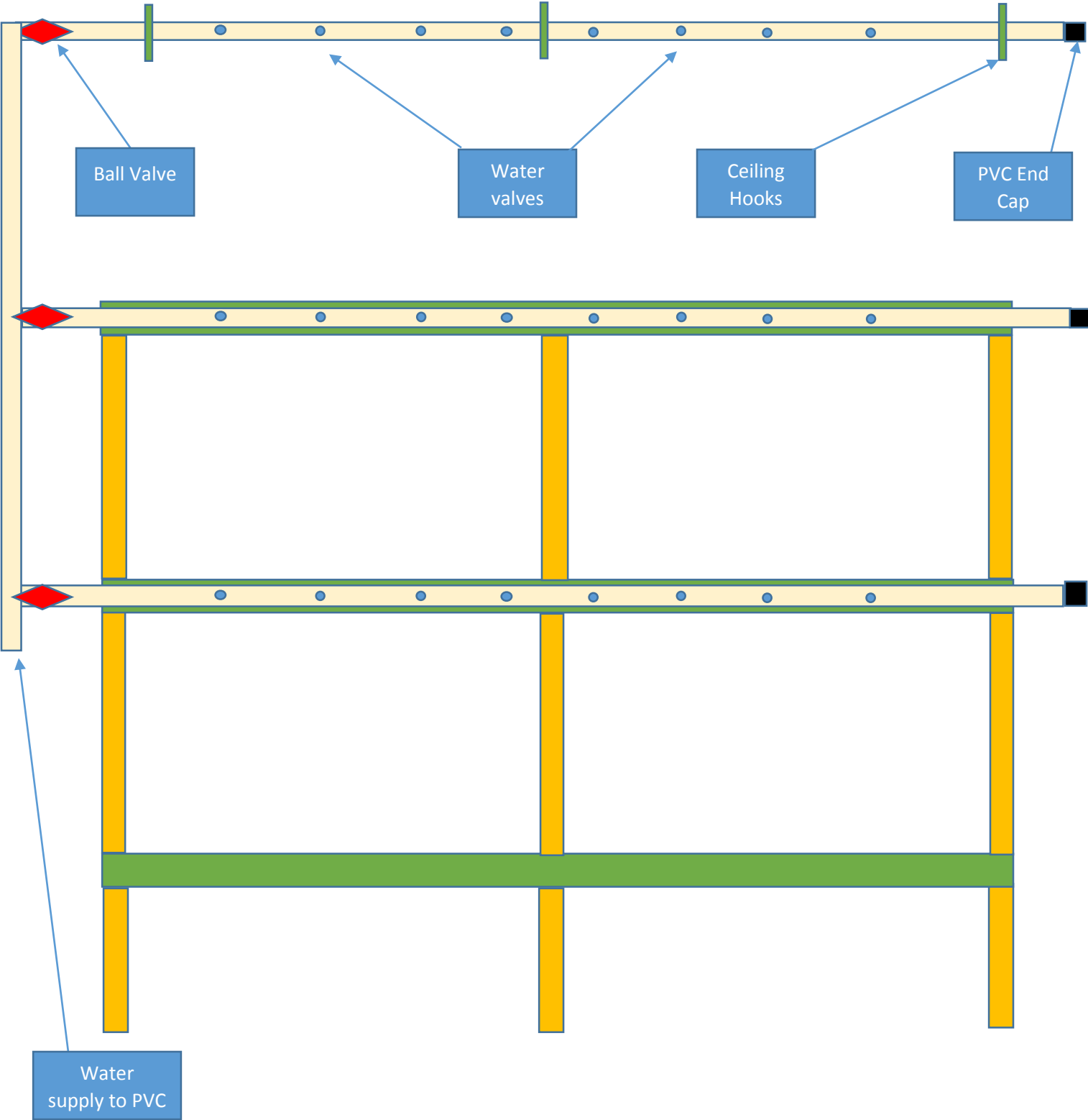


Diagram 12



PVC Cement and Primer Solvents

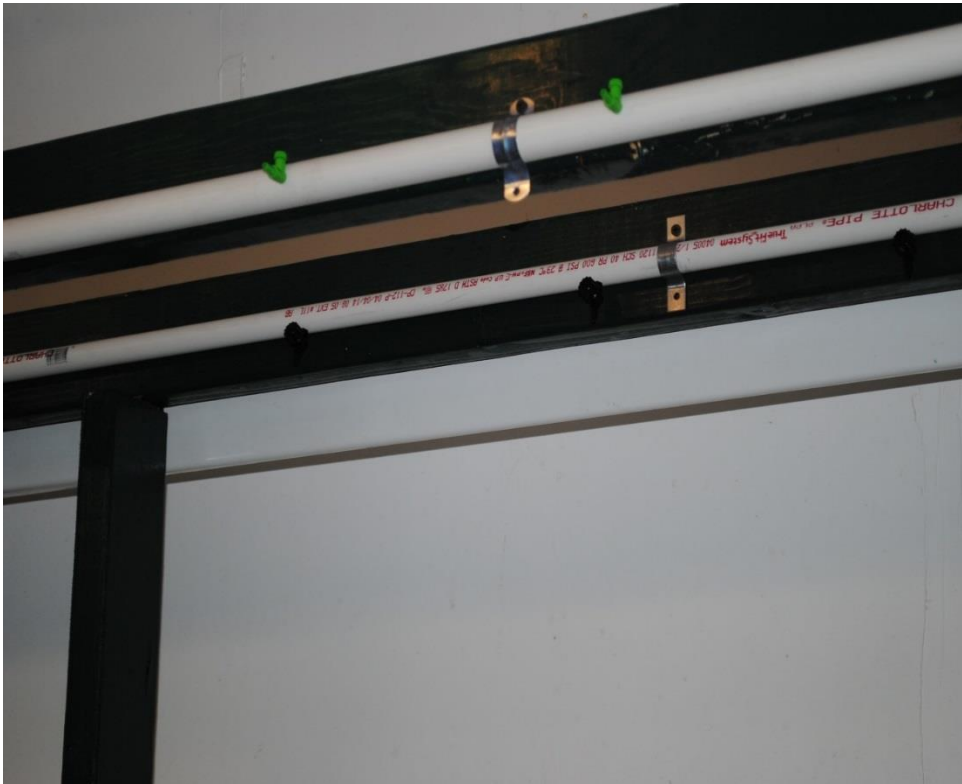


"J" Hooks to hold the water line over the top tanks





Water line put in place with Metal “U” Straps (back inside part of the rack).



Notice the Ball Valve in the upper left (with RED handle)



Ball Valve at each level to control where the water will be dispersed by the level the tanks are on.



PVC water line runs from the slop sink, below the shelf and to the area of the ball valves.



Water line continued



Below are the water lines from one rack section to another with ball valves.



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Part V : Drilling your aquariums and tank overflow assembly

OK this sounds like the scary part of the project, trust me on this, it is very easy if done correctly. My first attempt with drilling ten gallon tanks was 73 tanks drilled, casualties of war was 3 cracked tanks. Not too bad for a novice... Take an old unwanted leaker tank and practice drilling 3 or 4 holes into it... until you feel comfortable working on a good tank. If you crack a tank or two, that is the cost of drilling glass.... The tools needed for this project are a drill, a drill bit, an empty plastic squeeze bottle like Dawn Dish Detergent or Palmolive Dish Detergent. You will also need about 16 ounces of Car Anti Freeze. You will need a drill guide that can be purchased online from Home Depot or a drill press from Harbor Freight. You will need a drill ring (from JHEMCO) to pour the Half Water and half Anti freeze car coolant mix into. Most importantly you will need a pair of safety goggles while drilling into glass.



Standard Grade Diamond Plated Bits		
<i>drills have life expectancy of about 30-60 holes depending on thickness and technique</i>		
GDB.875	Glass Drill Bit, 7/8" OD	\$51.75
GDB1.125	Glass Drill, 1 1/8" OD (for 1/2" Schd. 40 Bulkheads)	\$56.00
GDB1.5	Glass Drill, 1 1/2" OD (for 3/4" Schd. 40 Bulkheads)	\$68.00
GDB1.75	Glass Drill, 1 3/4" OD (for 1" Schd. 40 Bulkheads)	\$78.50
GDB2.375	Glass Drill Bit, 2 3/8" OD (for 1 1/2" Schd 40 Bulkheads)	\$130.00
GDB3	Glass Drill Bit, 3" OD (for 2" Schd. 40 Bulkheads)	\$155.00



Drill Rings (for coolant containment)		
GDRBR-1.5	Rubber base ring for up to 1 1/2" drill bits	\$13.50
GDRBR-3	Rubber base ring for up to 3" drill bits	\$16.95



General Tools Drill Guide and Chuck

Model # 36/37 Internet # 100349264



★★★★☆ 2.2/5 28 Reviews

\$31.46 / each

Product Sold : Online Only
Item cannot be shipped to the following state(s): GU,PR,VI

Description:
Since 1910, General Tools has grown to become the recognized industry leader for specialty hand tools and instruments. The General Tools Drill Guide and Chuck can be adjusted in 5-degree increments from 0 - 45 degrees, left and right. V-guides on the base permit drilling through dowel or other rounded stock. Slide lock for sanding and buffing applications. Use with 3/8 in. and 1/2 in. portable electric drills. Portable and lightweight, it folds flat for toolbox storage.

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8 in. Bench Mount Drill Press, 5 Speed

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Bench drill press has 5 speeds and a built-in swivel lamp

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This item may be available at your local Harbor Freight Tools Store

FIND STORE

You now need to make a stand to place your tank on for drilling. I take two sections of cinder block and stand one upright and the other placed on top to make a "T".

I then cut a piece of plywood that can fit into the tank dimensions about 7 inches in width and 15 inches in length. The plywood protects the tank from the cinder block and also disperses the pressure from drilling onto the glass. If you have not painted the bottom of your tanks you can take a piece of plywood and make a circle in the area that you are going to drill. I use a 3 inches from the side and 3 inches from the back. Now you place the fish tank over the plywood that is resting on the cinder block. Now you will be able to see the circle, that is the area where each tank will be drilled. Now place the drill on the fish tank around the circle. The next step is to pour a little of the Half and half mixture of your water and anti freeze into the drill ring. This mixture will keep the drill bit and the glass from getting too hot. Once the drill has been attached to the drill guide and the drill bit has been attached to the drill. You are now ready to actually start the drilling process.

Start the drill and gently lower the drill into the reservoir of coolant and onto the glass tank. Apply only a moderate amount of pressure, just let the drill do the work.

It usually takes me a little over a minute to drill each tank. I drill for about 20 seconds then stop for about 5 seconds. I repeat this 3 times. I never lift the drill from the grooves that are being created from the drill bit cutting into the glass. By stopping after 20 seconds of drilling and waiting for 5 seconds, you allow the bit to cool just a little and for some of the coolant to seep back into the grooves. You will know when the glass has been cut because the drilling sound will be different when the drill bit starts to cut into the wood. Lift the drill ,lift the drill ring. Wipe off the coolant , remove the circular piece of glass that has been cut. You are now ready to set up for the next tank.

Don't rush this process you will get the hang of it after drilling 2 or 3 tanks. There are also videos on "YOUTUBE" on how to drill aquariums.

Once your tanks have been drilled you can now paint your tanks.

Now it is time to assemble the overflow stem. The materials needed for this part of the project are as follows. You will be using ½ inch PVC piping and ½ inch PCV parts. No PVC Cement is to be used in this step. You will also need a large tube of aquarium cement and a caulking gun (dispenser). Each tank will require one female adapter, one MPT X FPT Riser , two black "O" rings as seen below and a 8 inch section of ½ inch PVC piping.

1/2 in. Schedule 40 PVC Female Adapter

and Charlotte Pipe 1/2 in. x 1/2 in. PVC Sch. 40
MPT x FPT Riser



Hose Washer and O-Ring Combo Pack from the garden department.

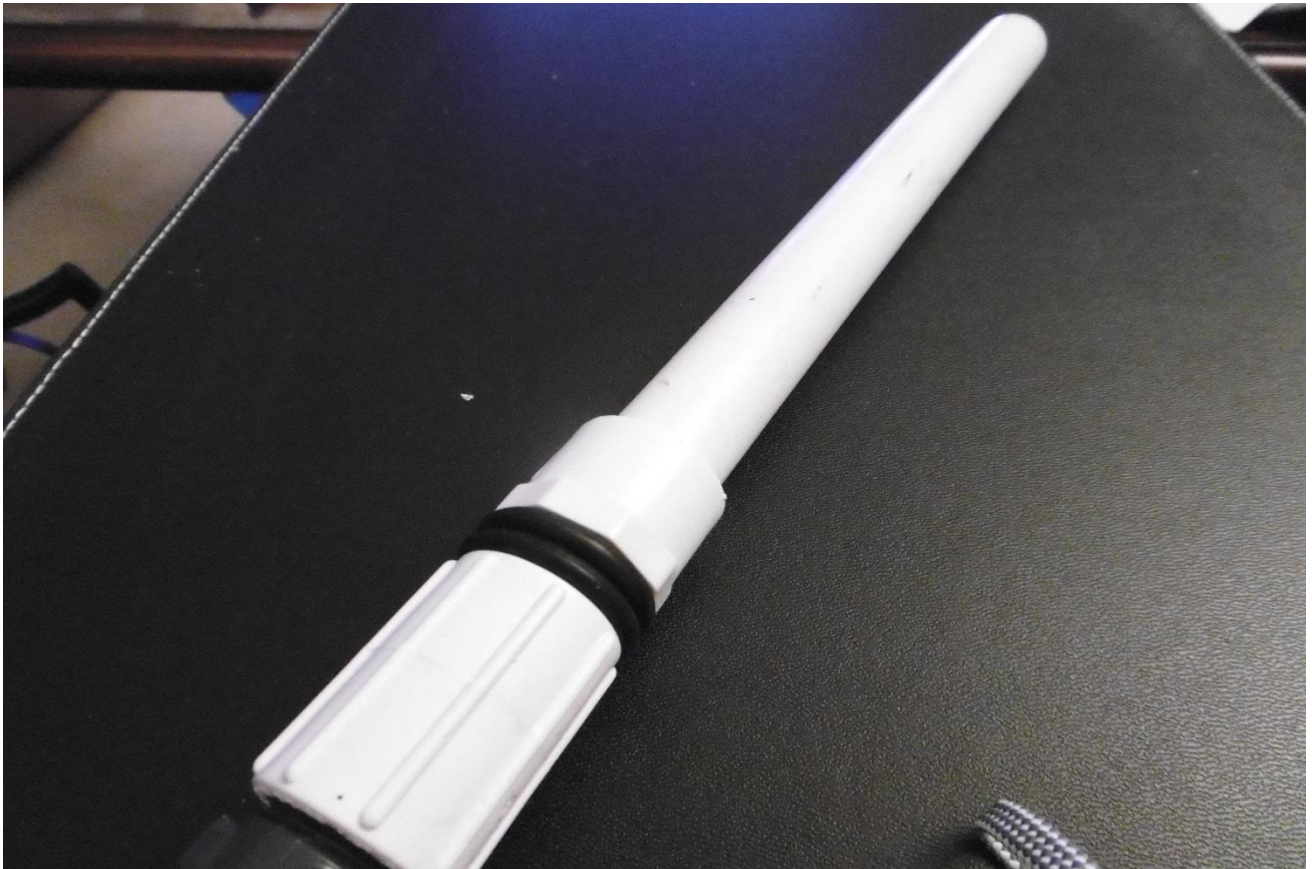


1/2 in. x 10 ft. PVC Sch. 40 Plain-End Pipe (to be used as the overflow pipe 8-9 inches, based on the height you chose for the water to start overflowing in your tank)

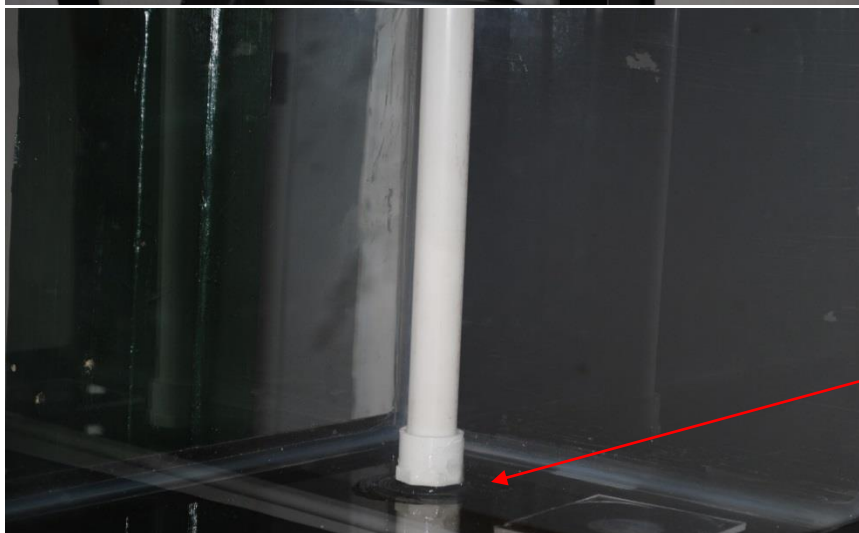




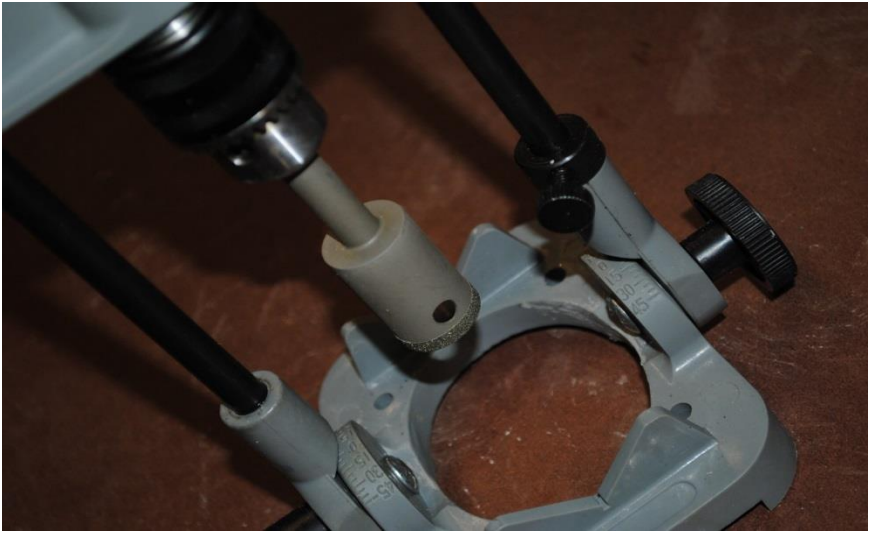




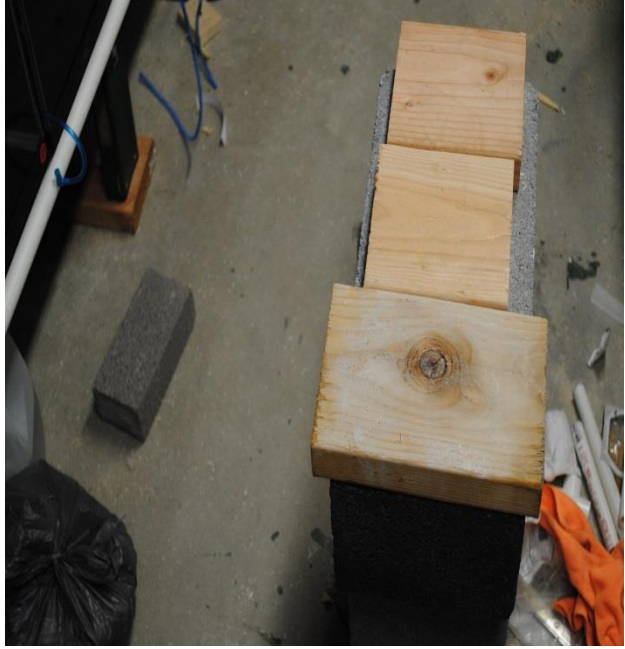
Notice that the MPT x FPT Riser part and one "O" ring goes inside the tank (seen in the third photo below). Now apply aquarium cement on both sides of the fittings and the aquarium. Now take a length of ½ inch PVC (8-10 inches) , insert into the Riser part.



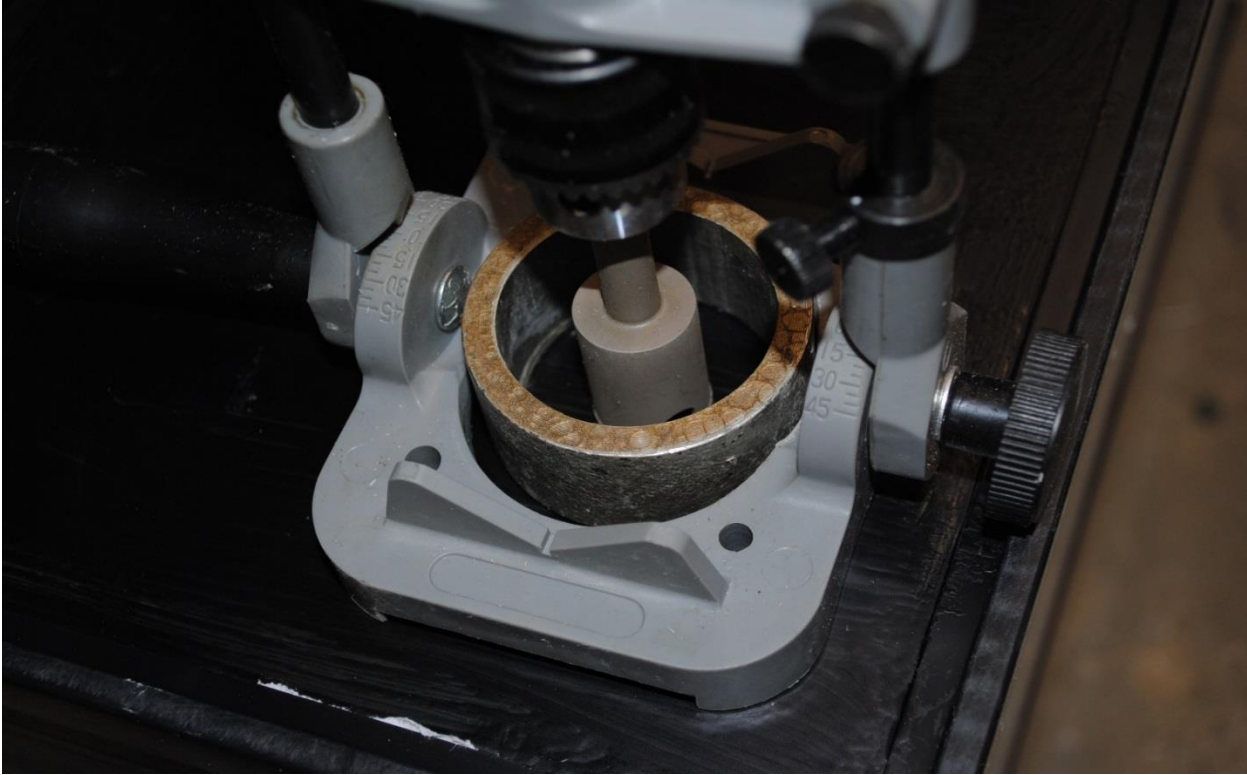
Apply aquarium cement around PVC fittings on both sides of the aquarium, to insure the seal.

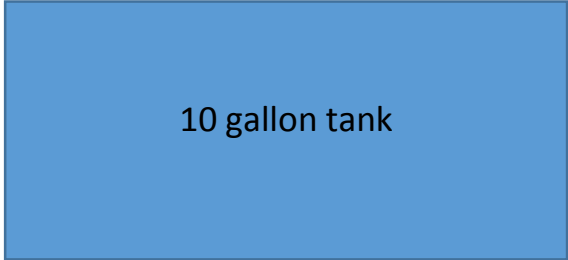




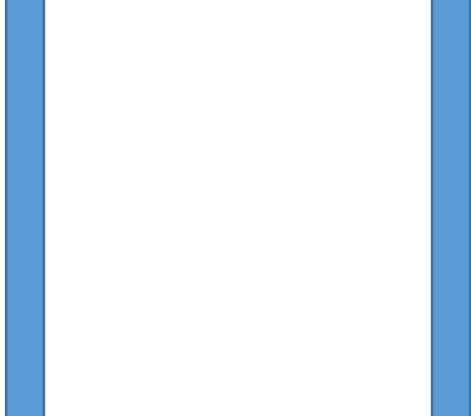








PVC Parts from the drilled opening of the tank



The length of this is 13 inches



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Part VI : Air Exchange System

For around \$125.00 you can make your own air exchange system. You can do this in one of two ways. 1: Use an IN-LINE Duct fan and flexible duct piping and blow the heated air outside the house. You will also need vents to the fish room to allow new air into the room. 2: Use the following items. The blower should be mounted near the ceiling of your fish room. The rectangular section of the Aluminum Register Box should be fitted over the rectangular section of the blower. Use duct tape to secure the Register Box to the blower. You will need to cut a 4 ½ inch hole in the wall to slip the flexible heating duct piping through. As in the above step you will need vents to allow new air to enter the room. Part VI was added because tanks without tops is but one part of the equation for a fish room that has become humid. You have added a dehumidifier to eliminate the humidity, but in the summer time that is unwanted heat. To combat the heat issue I have introduced this section to remove unwanted heat from the fish room.

PRO-PERFORMANCE High Velocity Pivoting Blower Fan (\$79.96)



Flexible Heating Duct Piping (\$10.99)



Duct Tape (\$6.99)



4 inch X 10 inch Steel Register floor vents (8.99) You will more than likely need two of these.



10 inch X 4 inch to 6 inch 90 degree Register Box (\$6.98)





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Part VII : Putting it all together

Now that you have read parts 1 thru 6 of this article. You now have the knowhow of how to proceed with these projects. Below is a way to get an estimate on what it will cost you. I have tried to itemize some of the tools and or products needed. So now it's time to get to work...

The cost of these items are based on 2015 US Dollars prices at the major home improvement centers and or your local hardware store. Some of the tools used in this project can be rented.

If you don't already possess the major tools, I suggest you borrow the major tools from a friend. I want to remind you that this guideline project can be tailored to your specific needs. Have fun and good luck... I hope that I was a help to at least someone...

YEAR 2015	Part Descriptions	Part #	Cost	Qty	Total	Purchased At	Comments	Proj Part
	Bungee Cords (pack of 8)		2.47		2.47	Harbor Freight /Lowe's/Home Depot		1
	4 Inch Quick Release Clamp		1.88	2	3.76	Home Depot		1
	Lees Plastic Air line Control Valves (air Control Kit)		1.95			Internet or Kens Fish		2
	Flexible Ribbed Hose (improvise)					Lowe's/Home Depot/ Hardware Store	use to connect Air Source to PVC	1
	Corner "L" Brackets (pack of 4)		2.88	2	5.76	Lowe's/Home Depot/ Hardware Store		1
	#8 X 1-1/4 inch Coarse Thread Dry Wall Screws 1 lb pack		6.47		6.47	Lowe's/Home Depot/ Hardware Store		1,2,3,4
	#8 X 2-1/2 inch Coarse Thread Dry Wall Screws 5 lb pack		21.97		21.97	Lowe's/Home Depot/ Hardware Store		1,2,3,4
	1/2 inch Metal Clamps (10 pack)		1.84			Lowe's/Home Depot/ Hardware Store		2
	PVC 1 inch or 3/4 inch Socket Ball Valve (Air System)		5.50 / 3.35			Lowe's/Home Depot/ Hardware Store		2
	3/4 inch 90 degree PVC Elbow		.53			Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	2
	3/4 inch End Caps		.41			Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	2
	3/4 inch "T"		.53			Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	2
	3/4 X 10 feet Plain End Pipe		3.09			Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	2,3
	White Vinyl K-Style Gutter End Cap (Set of 2)		7.64			Home Depot	one set for each rain gutter	3
	Amerimax 10 ft White Vinyl Gutter		3.98			Home Depot		3
	PVC Primer and Cement Solvent kit		9.23		9.23	Lowe's/Home Depot/ Hardware Store		3
	3 inch PVC "T"		3.99		3.99	Lowe's/Home Depot/ Hardware Store		3
	3 inch PVC End Cap		1.48		1.48	Lowe's/Home Depot/ Hardware Store		3
	3 inch X 10 feet pipe		5.96			Lowe's/Home Depot/ Hardware Store		3
	1 inch BulkHead only slip inlet X Slip Out slip	BF1	3.50			JHEMCO		3
	Rubber Maid Tub 22 gallon		7.99		7.99	Lowe's/Home Depot/ Hardware Store		3

Submersible Sump Pump		50.00	50.00	Harbor Freight /Lowe's/Home Depot/ HS	online 20 % discount coupon @ HF	3
Hole Saw Kit		20.00	20.00	Lowe's/Home Depot/ Hardware Store		3
3/4 or 1 inch Metal Clamps (10 pack)		2.15		Lowe's/Home Depot/ Hardware Store		4
1/2 PVC 90 Degree Elbows		.26		Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	4
1/2 inch PVC Tee		.58		Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	4
1/2 inch PVC End Cap		.38		Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	4
1/2 inch PVC couplers(connectors)		.38		Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	4
PVC Solvent Socket Ball Valve 1/2 inch		4.00		Lowe's/Home Depot/ Hardware Store	one for each level	4
Bike Storage Hooks "J" Hooks		.90		Lowe's/Home Depot/ Hardware Store		4
Plastic Air / Water Valve (Thread X Barb) (25 @.65)	AWV1TB	.75		JHEMCO		4
1/2 inch X 10 Feet Plain End Pipe		2.22		Lowe's/Home Depot/ Hardware Store	Buy the Pro PACK of 10 @ Lowe's	4,5
Hose Washer and "O" Ring Combo Pack (6 "O" rings per pk)		1.19		Lowe's/Home Depot/ Hardware Store	Garden Department	5
1/2 inch PVC Female Adapter (treaded X treaded)		.58		Lowe's/Home Depot/ Hardware Store		5
1/2 inch X 1/2 inch PVC MPT X FPT Riser		.68		Lowe's/Home Depot/ Hardware Store		5
Glass Drill Bit	GDB1.125	56.00	56.00	JHEMCO		5
Rubber Base Ring for up to 1 1/2 drill bits	GDRBR-1.5	13.50	13.50	JHEMCO		5
Drill Guide and Chuck (model 36/37)	100349264	31.46	31.46	Home Depot		5
8 inch Bench Mount Drill Press 5 Speed		62.99	62.99	Harbor Freight Stores	online 20 % discount coupon @ HF	5
Safety Goggles		3.00	3.00	Harbor Freight /Lowe's/Home Depot/ HS		5
Perfecto Aquarium Cement 10.3 oz. need caulking gun		8.55	8.55	Kens Fish		5
PRO-Performance High Velocity Pivoting Blower Fan		79.96	79.96	Home Depot		6

Flexible Heating Duct Piping		10.99		10.99	Lowes/Home Depot/ Hardware Store	6
4 inch X 10 inch Steel Register Floor Vents		8.99	2	18	Lowes/Home Depot/ Hardware Store	6
Duct Tape		6.99		6.99	Lowes/Home Depot/ Hardware Store	6
10 inch X 4 inch to 6 inch 90 degree Register Box		6.98		6.98	Lowes/Home Depot/ Hardware Store	6

